Einführung und Recherche-Übung: natürliche Nahrung

Marcus Clauss

mclauss@vetclinics.uzh.ch

Montag, 18.10.2021, 15:15-17:00

Gliederung meines Blockes

- Charakterisierung von Tierarten: natürliche Nahrung und Verhalten
- Verdauungsphysiologie
- Futtermittel
- mit der Fütterung zusammenhängende Probleme
    - Heimsäuger ‘Journal Club’
    - Reptilien & Ziervögel

- Lösungen für die Haltung und Fütterung von Heimtieren

Gliederung dieser Einheit

- gesetzliche Grundlagen
- wissenschaftliche Herangehensweise: Literturrecherche
    - natürliche Nahrung
    - natürliches Verhalten
- Besprechung der Ergebnisse und Probleme
    - Kaninchen
    - Meerschweinchen & Chinchilla
    - Degu
    - Landschildkröten
    - Wellensittich
    - Igel

Was muss man bei der Tierhaltung beachten?

Was muss man bei der Tierhaltung beachten?

1. Gesetze

Was muss man bei der Tierhaltung beachten?

1. Gesetze
2. Verordnungen

Tierschutzverordnung

Ist

- ein Kaninchen
- ein Meerschweinchen
- ein Wellensittich
- eine Landschildkröte

ein Haustier?

Tierschutzverordnung

Ist

- ein Kaninchen
- ein Meerschweinchen
- ein Wellensittich
- eine Landschildkröte

ein Haustier?

Go to **www.menti.com** and use the code **3475 1647**

Tierschutzverordnung

Art. 2 Begriffe

[1] Es werden folgende Tierkategorien nach Domestikationsstatus unterschieden:

a. *Haustiere:* domestizierte Tiere der Pferde-, Rinder-, Schweine-, Schaf- und Ziegengattung, ausgenommen der exotischen Arten; domestizierte Yaks und Wasserbüffel; Lamas und Alpakas; Hauskaninchen, Haushunde und Hauskatzen; Haustauben sowie Hausgeflügel wie Haushühner, Truthühner, Perlhühner, Hausgänse und Hausenten;

b. *Wildtiere:* Wirbeltiere, ausser den Haustieren, sowie Kopffüsser und Panzerkrebse.

Tierschutzverordnung

Art. 2 Begriffe

[1] Es werden folgende Tierkategorien nach Domestikationsstatus unterschieden:

a. *Haustiere:* domestizierte Tiere der Pferde-, Rinder-, Schweine-, Schaf- und Ziegengattung, ausgenommen der exotischen Arten; domestizierte Yaks und Wasserbüffel; Lamas und Alpakas; Hauskaninchen, Haushunde und Hauskatzen; Haustauben sowie Hausgeflügel wie Haushühner, Truthühner, Perlhühner, Hausgänse und Hausenten;

b. *Wildtiere:* Wirbeltiere, ausser den Haustieren, sowie Kopffüsser und Panzerkrebse.

Was ist das Ziel von “Ernährung” ?

Was ist das Ziel von “Ernährung” ?

Go to **www.menti.com** and use the code **8339 9889**

Tierschutzverordnung

Art. 3 Grundsätze[8]

[1] Tiere sind so zu halten und mit ihnen ist so umzugehen, dass ihre Körperfunktionen und ihr Verhalten nicht gestört werden und ihre Anpassungsfähigkeit nicht überfordert wird.[9]

[2] Unterkünfte und Gehege müssen mit geeigneten Futter-, Tränke-, Kot- und Harnplätzen, Ruhe- und Rückzugsorten mit Deckung, Beschäftigungsmöglichkeiten, Körperpflegeeinrichtungen und Klimabereichen versehen sein.

[3] Fütterung und Pflege sind angemessen, wenn sie nach dem Stand der Erfahrung und den Erkenntnissen der Physiologie, Verhaltenskunde und Hygiene den Bedürfnissen der Tiere entsprechen.

Tierschutzverordnung

Art. 3 Grundsätze[8]

[1] Tiere sind so zu halten und mit ihnen ist so umzugehen, dass ihre Körperfunktionen und ihr Verhalten nicht gestört werden und ihre Anpassungsfähigkeit nicht überfordert wird.[9]

[2] Unterkünfte und Gehege müssen mit geeigneten Futter-, Tränke-, Kot- und Harnplätzen, Ruhe- und Rückzugsorten mit Deckung, Beschäftigungsmöglichkeiten, Körperpflegeeinrichtungen und Klimabereichen versehen sein.

[3] Fütterung und Pflege sind angemessen, wenn sie nach dem Stand der Erfahrung und den Erkenntnissen der Physiologie, Verhaltenskunde und Hygiene den Bedürfnissen der Tiere entsprechen.

Tierschutzverordnung

Art. 3 Grundsätze[8]

[1] Tiere sind so zu halten und mit ihnen ist so umzugehen, dass ihre Körperfunktionen und ihr Verhalten nicht gestört werden und ihre Anpassungsfähigkeit nicht überfordert wird.[9]

[2] Unterkünfte und Gehege müssen mit geeigneten Futter-, Tränke-, Kot- und Harnplätzen, Ruhe- und Rückzugsorten mit Deckung, Beschäftigungsmöglichkeiten, Körperpflegeeinrichtungen und Klimabereichen versehen sein.

[3] Fütterung und Pflege sind angemessen, wenn sie nach dem Stand der Erfahrung und den Erkenntnissen der Physiologie, Verhaltenskunde und Hygiene den Bedürfnissen der Tiere entsprechen.

Tierschutzverordnung

Art. 3 Grundsätze[8]

[1] Tiere sind so zu halten und mit ihnen ist so umzugehen, dass ihre Körperfunktionen und ihr Verhalten nicht gestört werden und ihre Anpassungsfähigkeit nicht überfordert wird.[9]

[2] Unterkünfte und Gehege müssen mit geeigneten Futter-, Tränke-, Kot- und Harnplätzen, Ruhe- und Rückzugsorten mit Deckung, Beschäftigungsmöglichkeiten, Körperpflegeeinrichtungen und Klimabereichen versehen sein.

[3] Fütterung und Pflege sind angemessen, wenn sie nach dem Stand der Erfahrung und den Erkenntnissen der Physiologie, Verhaltenskunde und Hygiene den Bedürfnissen der Tiere entsprechen.

Was ist das ?

Tierschutzverordnung

Art. 4 Fütterung

[1] Tiere sind regelmässig und ausreichend mit geeignetem Futter und mit Wasser zu versorgen. Werden Tiere in Gruppen gehalten, so muss die Tierhalterin oder der Tierhalter dafür sorgen, dass jedes Tier genügend Futter und Wasser erhält.

Tierschutzverordnung

Art. 4 Fütterung

[1] Tiere sind regelmässig und ausreichend mit geeignetem Futter und mit Wasser zu versorgen. Werden Tiere in Gruppen gehalten, so muss die Tierhalterin oder der Tierhalter dafür sorgen, dass jedes Tier genügend Futter und Wasser erhält.

Tierschutzverordnung

Art. 4 Fütterung

[1] Tiere sind regelmässig und ausreichend mit geeignetem Futter und mit Wasser zu versorgen. Werden Tiere in Gruppen gehalten, so muss die Tierhalterin oder der Tierhalter dafür sorgen, dass jedes Tier genügend Futter und Wasser erhält.

[2] Den Tieren ist die mit der Nahrungsaufnahme verbundene arttypische Beschäftigung zu ermöglichen.

Tierschutzverordnung

Art. 4 Fütterung

[1] Tiere sind regelmässig und ausreichend mit geeignetem Futter und mit Wasser zu versorgen. Werden Tiere in Gruppen gehalten, so muss die Tierhalterin oder der Tierhalter dafür sorgen, dass jedes Tier genügend Futter und Wasser erhält.

[2] Den Tieren ist die mit der Nahrungsaufnahme verbundene arttypische Beschäftigung zu ermöglichen.

Tierschutzverordnung

Art. 4 Fütterung

[1] Tiere sind regelmässig und ausreichend mit geeignetem Futter und mit Wasser zu versorgen. Werden Tiere in Gruppen gehalten, so muss die Tierhalterin oder der Tierhalter dafür sorgen, dass jedes Tier genügend Futter und Wasser erhält.

[2] Den Tieren ist die mit der Nahrungsaufnahme verbundene arttypische Beschäftigung zu ermöglichen.

Tierschutzverordnung

8. Abschnitt: Hauskaninchen

Art. 64 Beschäftigung sowie Gruppenhaltung für Jungtiere

[1] Kaninchen müssen täglich mit grob strukturiertem Futter wie Heu oder Stroh versorgt werden sowie ständig Objekte zum Benagen zur Verfügung haben.

[2] Jungtiere dürfen in den ersten acht Wochen nicht einzeln gehalten werden.

Tierschutzverordnung

Gehege für Säugetiere			Für Gruppen bis zu n Tieren					Für jedes weitere Tier[a]		Besondere Anforderungen
			Anzahl	Aussengehege[a]		Innengehege[a]		Aussen	Innen	
Tierarten			(n)	Fläche[b] m²	Volumen m³	Fläche[b] m²	Volumen m³	m²	m²	
40	Meerschweinchen, *Cavia porcellus*	d)f)g)	2	–	–	0,5	–	–	0,2	39) 41) 45) 47) 54)
41	Hamster, Mesocricetus sp.	d)	1	–	–	0,18	–	–	0,05	2) 40) 41) 42) 44) 45) 48)
42	Maus, Mus musculus	d)	2	–	–	0,18	–	–	0,05	2) 39) 41) 42) 44) 45) 47)
43	Mongolische Rennmaus (Gerbil)	d)	5	–	–	0,5	–	–	0,05	40) 41) 42) 44) 45) 46) 47)
44	Ratte, Rattus norvegicus	d)	5	–	–	0,5	0,35	–	0,05	39) 41) 42) 44) 45) 47)
45	Degu		5	–	–	0,5	0,35	–	0,2	40) 41) 45) 46) 47)
46	Chinchilla	d)	2	–	–	0,5	0,75	–	0,2	39) 41) 42) 43) 45) 46) 47)

Tierschutzverordnung

Gehege für Säugetiere			Für Gruppen bis zu n Tieren					Für jedes weitere Tier[a]		Besondere Anforderungen
			Anzahl	Aussengehege[a]		Innengehege[a]		Aussen	Innen	
Tierarten			(n)	Fläche[b] m²	Volumen m³	Fläche[b] m²	Volumen m³	m²	m²	
40	Meerschweinchen, *Cavia porcellus*	d)f)g)	2	–	–	0,5	–	–	0,2	39) 41) 45) 47) 54)
41	Hamster, Mesocricetus sp.	d)	1	–	–	0,18	–	–	0,05	2) 40) 41) 42) 44) 45) 48)
42	Maus, Mus musculus	d)	2	–	–	0,18	–	–	0,05	2) 39) 41) 42) 44) 45) 47)
43	Mongolische Rennmaus (Gerbil)	d)	5	–	–	0,5	–	–	0,05	40) 41) 42) 44) 45) 46) 47)
44	Ratte, Rattus norvegicus	d)	5	–	–	0,5	0,35	–	0,05	39) 41) 42) 44) 45) 47)
45	Degu		5	–	–	0,5	0,35	–	0,2	40) 41) 45) 46) 47)
46	Chinchilla	d)	2	–	–	0,5	0,75	–	0,2	39) 41) 42) 43) 45) 46) 47)

d) Werden die Tiere in bewilligten Versuchstierhaltungen gehalten, so müssen sie mindestens nach den Anforderungen nach Anhang 3 gehalten werden.

e) Diese Mindestmasse gelten für am 1. September 2008 bestehende Haltungen. Bei neu eingerichteten Anlagen sind vorliegende neue Erkenntnisse bei der Festlegung der Mindestmasse einzubeziehen.

f) Von den Tieren begehbare erhöhte Flächen können bis zu 1/3 der geforderten Minimalfläche angerechnet werden.

g) Für junge Meerschweinchen (<700 g) beträgt die zusätzliche Fläche ab dem 3. Tier für jedes Tier 0,1 m².

Tierschutzverordnung

Gehege für Säugetiere			Für Gruppen bis zu n Tieren					Für jedes weitere Tier[a]		Besondere Anforderungen
			Anzahl	Aussengehege[a]		Innengehege[a]		Aussen	Innen	
Tierarten			(n)	Fläche[b] m^2	Volumen m^3	Fläche[b] m^2	Volumen m^3	m^2	m^2	
40	Meerschweinchen, *Cavia porcellus*	d)f)g)	2	–	–	0,5	–	–	0,2	39) 41) 45) 47) 54)
41	Hamster, Mesocricetus sp.	d)	1	–	–	0,18	–	–	0,05	2) 40) 41) 42) 44) 45) 48)
42	Maus, Mus musculus	d)	2	–	–	0,18	–	–	0,05	2) 39) 41) 42) 44) 45) 47)
43	Mongolische Rennmaus (Gerbil)	d)	5	–	–	0,5	–	–	0,05	40) 41) 42) 44) 45) 46) 47)
44	Ratte, Rattus norvegicus	d)	5	–	–	0,5	0,35	–	0,05	39) 41) 42) 44) 45) 47)
45	Degu		5	–	–	0,5	0,35	–	0,2	40) 41) 45) 46) 47)
46	Chinchilla	d)	2	–	–	0,5	0,75	–	0,2	39) 41) 42) 43) 45) 46) 47)

1) Grabgelegenheit.
2) Klettermöglichkeiten, je nach Art Äste oder Kletterfelsen. Die Astdicke hat den Greiforganen der Tiere zu entsprechen.

Tierschutzverordnung 2015

Gehege für Säugetiere			Für Gruppen bis zu n Tieren					Für jedes weitere Tier[a]		Besondere Anforderungen
			Anzahl	Aussengehege[a]		Innengehege[a]		Aussen	Innen	
Tierarten			(n)	Fläche[b] m²	Volumen m³	Fläche[b] m²	Volumen m³	m²	m²	
40	Meerschweinchen, *Cavia porcellus*	d)f)g)	2	–	–	0,5	–	–	0,2	39) 41) 45) 47) 54)
41	Hamster, Mesocricetus sp.	d)	1	–	–	0,18	–	–	0,05	2) 40) 41) 42) 44) 45) 48)
42	Maus, Mus musculus	d)	2	–	–	0,18	–	–	0,05	2) 39) 41) 42) 44) 45) 47)
43	Mongolische Rennmaus (Gerbil)	d)	5	–	–	0,5	–	–	0,05	40) 41) 42) 44) 45) 46) 47)
44	Ratte, Rattus norvegicus	d)	5	–	–	0,5	0,35	–	0,05	39) 41) 42) 44) 45) 47)
45	Degu		5	–	–	0,5	0,35	–	0,2	40) 41) 45) 46) 47)
46	Chinchilla	d)	2	–	–	0,5	0,75	–	0,2	39) 41) 42) 43) 45) 46) 47)

39) Geeignete Einstreu.
40) Geeignete Einstreu zum Graben: für Hamster 15 cm tief; für Mongolische Rennmaus 25 cm tief; für Degu 30 cm tief.
41) Eine oder mehrere Rückzugsmöglichkeiten, in denen alle Tiere Platz finden. Für Chinchilla erhöhte Rückzugsmöglichkeiten.
42) Geeignetes Nestmaterial.
43) Sitzbretter auf verschiedenen Höhen.
44) Grob strukturiertes Futter, wie Heu oder Stroh; für Hamster und Mäuse Körnerbeimischungen; für Meerschweinchen Vitamin-C-haltiges Futter.
45) Nageobjekte, wie Weichholz oder frische Äste.
46) Sandbad.
47) Die Tiere sind in Gruppen von mindestens 2 Tieren zu halten.
48) Es darf ein einzelnes Tier in einem Gehege gehalten werden. Davon ausgenommen sind Tiere soziallebender Arten.
54) Grob strukturiertes Futter, wie Heu oder Stroh, und Vitamin-C-haltiges Futter.

Tierschutzverordnung 2015

Gehege für Säugetiere			Für Gruppen bis zu n Tieren					Für jedes weitere Tier[a]		Besondere Anforderungen
			Anzahl	Aussengehege[a]		Innengehege[a]		Aussen	Innen	
Tierarten			(n)	Fläche[b] m²	Volumen m³	Fläche[b] m²	Volumen m³	m²	m²	
40	Meerschweinchen, *Cavia porcellus*	d)f)g)	2	–	–	0,5	–	–	0,2	39) 41) 45) 47) 54)
41	Hamster, Mesocricetus sp.	d)	1	–	–	0,18	–	–	0,05	2) 40) 41) 42) 44) 45) 48)
42	Maus, Mus musculus	d)	2	–	–	0,18	–	–	0,05	2) 39) 41) 42) 44) 45) 47)
43	Mongolische Rennmaus (Gerbil)	d)	5	–	–	0,5	–	–	0,05	40) 41) 42) 44) 45) 46) 47)
44	Ratte, Rattus norvegicus	d)	5	–	–	0,5	0,35	–	0,05	39) 41) 42) 44) 45) 47)
45	Degu		5	–	–	0,5	0,35	–	0,2	40) 41) 45) 46) 47)
46	Chinchilla	d)	2	–	–	0,5	0,75	–	0,2	39) 41) 42) 43) 45) 46) 47)

44) Grob strukturiertes Futter, wie Heu oder Stroh; für Hamster und Mäuse Körnerbeimischungen;

54) Grob strukturiertes Futter, wie Heu oder Stroh, und Vitamin-C-haltiges Futter.

Warum brauchen Degu und Chinchilla kein ‘grob strukturiertes Futter’ ?

Go to **www.menti.com** and use the code **3147 2176**

Tierschutzverordnung 2015

Gehege für Säugetiere			Für Gruppen bis zu n Tieren					Für jedes weitere Tier[a]		Besondere Anforderungen
			Anzahl	Aussengehege[a]		Innengehege[a]		Aussen	Innen	
Tierarten			(n)	Fläche[b] m²	Volumen m³	Fläche[b] m²	Volumen m³	m²	m²	
40	Meerschweinchen, *Cavia porcellus*	d)f)g)	2	–	–	0,5	–	–	0,2	39) 41) 45) 47) 54)
41	Hamster, Mesocricetus sp.	d)	1	–	–	0,18	–	–	0,05	2) 40) 41) 42) 44) 45) 48)
42	Maus, Mus musculus	d)	2	–	–	0,18	–	–	0,05	2) 39) 41) 42) 44) 45) 47)
43	Mongolische Rennmaus (Gerbil)	d)	5	–	–	0,5	–	–	0,05	40) 41) 42) 44) 45) 46) 47)
44	Ratte, Rattus norvegicus	d)	5	–	–	0,5	0,35	–	0,05	39) 41) 42) 44) 45) 47)
45	Degu		5	–	–	0,5	0,35	–	0,2	40) 41) 45) 46) 47)
46	Chinchilla	d)	2	–	–	0,5	0,75	–	0,2	39) 41) 42) 43) 45) 46) 47)

44) Grob strukturiertes Futter, wie Heu oder Stroh; für Hamster und Mäuse Körnerbeimischungen;

54) Grob strukturiertes Futter, wie Heu oder Stroh, und Vitamin-C-haltiges Futter.

Tierschutzverordnung 2018

Gehege für Säugetiere			Für Gruppen bis zu n Tieren					Für jedes weitere Tier[a]		Besondere Anforderungen
			Anzahl	Aussengehege[a]		Innengehege[a]		Aussen	Innen	
Tierarten			(n)	Fläche[b] m²	Volumen m³	Fläche[b] m²	Volumen m³	m²	m²	
40	Meerschweinchen, *Cavia porcellus*	d)f)g)	2	–	–	0,5	–	–	0,2	39) 41) 45) 47) 54)
41	Hamster, Mesocricetus sp.	d)	1	–	–	0,18	–	–	0,05	2) 40) 41) 42) 44) 45) 48)
42	Maus, Mus musculus	d)	2	–	–	0,18	–	–	0,05	2) 39) 41) 42) 44) 45) 47)
43	Mongolische Rennmaus (Gerbil)	d)	5	–	–	0,5	–	–	0,05	40) 41) 42) 44) 45) 46) 47)
44	Ratte, Rattus norvegicus	d)	5	–	–	0,5	0,35	–	0,05	39) 41) 42) 44) 45) 47)
45	Degu		5	–	–	0,5	0,35	–	0,2	40) 41) 44) 45) 46) 47)
46	Chinchilla	d)	2	–	–	0,5	0,75	–	0,2	39) 41) 42) 43) 44) 45) 46) 47)

44) Grob strukturiertes Futter, wie Heu oder Stroh; für Hamster und Mäuse Körnerbeimischungen;

54) Grob strukturiertes Futter, wie Heu oder Stroh, und Vitamin-C-haltiges Futter.

Was muss man bei der Tierhaltung beachten?

1. Gesetze
2. Verordnungen
3. Empfehlungen

BLV-Informationen

Der Bundesrat › EDI › BLV

Kontakt Medien Extranet DE FR IT EN

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Lebensmittelsicherheit und Veterinärwesen

Suchen ...

Lebensmittel und Ernährung | Gebrauchs- und Bedarfsartikel | Tiere | Import und Export | Das BLV

Startseite BLV › Tiere › Tierschutz › Heim- und Wildtierhaltung › Kaninchen

‹ Tierschutz

Heim- und Wildtierhaltung

- Hunde
- Katzen
- Frettchen
- Pferde
- Kaninchen
- Meerschweinchen
- Ratten
- Rennmäuse

Kaninchen

Kaninchen brauchen grosse, gut gestaltete Gehege, in denen sie sich frei bewegen können und die zugleich aber auch Rückzugsmöglichkeiten bieten. Als soziale Tiere benötigen sie Kontakt zu Artgenossen. Kaninchen sind sowohl Heimtiere wie Nutztiere.

Als Heimtiere sind Kaninchen vor allem für Kinder sehr attraktiv. Aber sie mögen es nicht, herumgetragen und geknuddelt zu werden. Sie erstarren dabei vor Schreck oder kratzen und beissen. Leben Kaninchen mit ihrer Gruppe in einem artgerecht gestalteten Gehege, so können sich Erwachsene und Kinder an ihrem natürlichen Verhalten erfreuen, ohne dass die Tiere festgehalten oder aus dem Gehege herausgenommen werden müssen.

Die Rassenkaninchenhaltung gilt als Hobby, bei der spezielle Rassen gezüchtet und Tiere ausgestellt werden.

BLV-Informationen

Der Bundesrat › EDI › BLV

Kontakt Medien Extranet DE FR IT EN

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Lebensmittelsicherheit und Veterinärwesen

Suchen ...

Lebensmittel und Ernährung | Gebrauchs- und Bedarfsartikel | Tiere | Import und Export | Das BLV

Startseite BLV › Tiere › Tierschutz › Heim- und Wildtierhaltung › Kaninchen

‹ Tierschutz

Heim- und Wildtierhaltung

- Hunde
- Katzen
- Frettchen
- Pferde
- Kaninchen
- Meerschweinchen
- Ratten
- Rennmäuse

Kaninchen

Kaninchen brauchen grosse, gut gestaltete Gehege, in denen sie sich frei bewegen können und die zugleich aber auch Rückzugsmöglichkeiten bieten. Als soziale Tiere benötigen sie Kontakt zu Artgenossen. Kaninchen sind sowohl Heimtiere wie Nutztiere.

Als Heimtiere sind Kaninchen vor allem für Kinder sehr attraktiv. Aber sie mögen es nicht, herumgetragen und geknuddelt zu werden. Sie erstarren dabei vor Schreck oder kratzen und beissen. Leben Kaninchen mit ihrer Gruppe in einem artgerecht gestalteten Gehege, so können sich Erwachsene und Kinder an ihrem natürlichen Verhalten erfreuen, ohne dass die Tiere festgehalten oder aus dem Gehege herausgenommen werden müssen.

Die Rassenkaninchenhaltung gilt als Hobby, bei der spezielle Rassen gezüchtet und Tiere ausgestellt werden.

- › Haltung und Pflege
- › Sozialkontakte
- › Bewegung und Beschäftigung
- › Futter und Wasser
- › Zucht
- › Kaninchen als Nutztiere
- › Fachgerechtes Töten
- › Ausbildung für die Haltung von Kaninchen

University of Zurich[UZH]

Clinic for Zoo Animals, Exotic Pets and Wildlife

‘Evidence-based’ Herangehensweise an die Fütterung von Tieren

Welche Art von Evidenz lasse ich gelten ?

Welche Art von Evidenz lasse ich gelten ?

– Natürliche Nahrung von freilebenden Tieren ?

Welche Art von Evidenz lasse ich gelten ?

- Natürliche Nahrung von freilebenden Tieren ?
- Verdauungs-Anatomie und -physiologie ?

Welche Art von Evidenz lasse ich gelten ?

- Natürliche Nahrung von freilebenden Tieren ?
- Verdauungs-Anatomie und -physiologie ?
- Experimentelles oder empirisches Ausloten von Grenzen ?

Welche Art von Evidenz lasse ich gelten ?

- Natürliche Nahrung von freilebenden Tieren ?
- Verdauungs-Anatomie und -physiologie ?
- Experimentelles oder empirisches Ausloten von Grenzen ?

“Erfahrungen und Erkenntnisse”

Welche Art von Evidenz lasse ich gelten ?

- Natürliche Nahrung von freilebenden Tieren ?
- Verdauungs-Anatomie und -physiologie ?
- Experimentelles oder empirisches Ausloten von Grenzen ?

"Erfahrungen und Erkenntnisse"

Fütterung in Menschenobhut beinhaltet in der Regel eine Abweichung von der Ernährung im natürlichen Habitat.

Welche Art von Evidenz lasse ich gelten ?

- Natürliche Nahrung von freilebenden Tieren ?
- Verdauungs-Anatomie und -physiologie ?
- Experimentelles oder empirisches Ausloten von Grenzen ?

"Erfahrungen und Erkenntnisse"

Fütterung in Menschenobhut beinhaltet in der Regel eine Abweichung von der Ernährung im natürlichen Habitat. Wie weit will ich das zulassen?

Welche Art von Evidenz lasse ich gelten ?

- Natürliche Nahrung von freilebenden Tieren ?
- Verdauungs-Anatomie und -physiologie ?
- Experimentelles oder empirisches Ausloten von Grenzen ?

"Erfahrungen und Erkenntnisse"

Fütterung in Menschenobhut beinhaltet in der Regel eine Abweichung von der Ernährung im natürlichen Habitat. Wie weit will ich das zulassen?

- soweit, dass es für BesitzerInnen bequem und billig ist (und den freien Markt nicht einschränkt) ?

Welche Art von Evidenz lasse ich gelten ?

- Natürliche Nahrung von freilebenden Tieren ?
- Verdauungs-Anatomie und -physiologie ?
- Experimentelles oder empirisches Ausloten von Grenzen ?

"Erfahrungen und Erkenntnisse"

Fütterung in Menschenobhut beinhaltet in der Regel eine Abweichung von der Ernährung im natürlichen Habitat. Wie weit will ich das zulassen?

- soweit, dass es für BesitzerInnen bequem und billig ist (und den freien Markt nicht einschränkt) ?
- soweit es keine nicht rechtfertigbare Belastung hervorruft ?

Welche Art von Evidenz lasse ich gelten ?

- Natürliche Nahrung von freilebenden Tieren ?
- Verdauungs-Anatomie und -physiologie ?
- Experimentelles oder empirisches Ausloten von Grenzen ?

"Erfahrungen und Erkenntnisse"

Fütterung in Menschenobhut beinhaltet in der Regel eine Abweichung von der Ernährung im natürlichen Habitat. Wie weit will ich das zulassen?

- soweit, dass es für BesitzerInnen bequem und billig ist (und den freien Markt nicht einschränkt) ?
- soweit es keine nicht rechtfertigbare Belastung hervorruft ?
- so dass die Lebenserwartung nicht eingeschränkt wird ?

Welche Art von Evidenz lasse ich gelten ?

- Natürliche Nahrung von freilebenden Tieren ?
- Verdauungs-Anatomie und -physiologie ?
- Experimentelles oder empirisches Ausloten von Grenzen ?

"Erfahrungen und Erkenntnisse"

Fütterung in Menschenobhut beinhaltet in der Regel eine Abweichung von der Ernährung im natürlichen Habitat. Wie weit will ich das zulassen?

- soweit, dass es für BesitzerInnen bequem und billig ist (und den freien Markt nicht einschränkt) ?
- soweit es keine nicht rechtfertigbare Belastung hervorruft ?
- so dass die Lebenserwartung nicht eingeschränkt wird ?
- gemäss den Regeln der Tierschutzverordnung für Wildtiere ?

Welche Art von Evidenz lasse ich gelten ?

- Natürliche Nahrung von freilebenden Tieren ?
- Verdauungs-Anatomie und -physiologie ?
- Experimentelles oder empirisches Ausloten von Grenzen ?

"Erfahrungen und Erkenntnisse"

Fütterung in Menschenobhut beinhaltet in der Regel eine Abweichung von der Ernährung im natürlichen Habitat. Wie weit will ich das zulassen?

- soweit, dass es für BesitzerInnen bequem und billig ist (und den freien Markt nicht einschränkt) ?
- soweit es keine nicht rechtfertigbare Belastung hervorruft ?
- so dass die Lebenserwartung nicht eingeschränkt wird ?
- gemäss den Regeln der Tierschutzverordnung für Wildtiere ?

L.	Mit der Fütterung sind die arttypischen Merkmale der Nahrungsaufnahme (räumlich und zeitlich variierendes Futterangebot, Futterbeschaffung, Futterbearbeitung und Dauer der Futteraufnahme) zu simulieren.

Welche Art von Evidenz lasse ich gelten ?

- Natürliche Nahrung von freilebenden Tieren ?
- Verdauungs-Anatomie und -physiologie ?
- Experimentelles oder empirisches Ausloten von Grenzen ?

"Erfahrungen und Erkenntnisse"

Fütterung in Menschenobhut beinhaltet in der Regel eine Abweichung von der Ernährung im natürlichen Habitat. Wie weit will ich das zulassen?

- soweit, dass es für BesitzerInnen bequem und billig ist (und den freien Markt nicht einschränkt) ?
- soweit es keine nicht rechtfertigbare Belastung hervorruft ?
- so dass die Lebenserwartung nicht eingeschränkt wird ?
- gemäss den Regeln der Tierschutzverordnung für Wildtiere ?

L. Mit der Fütterung sind die arttypischen Merkmale der Nahrungsaufnahme (räumlich und zeitlich variierendes Futterangebot, Futterbeschaffung, Futterbearbeitung und Dauer der Futteraufnahme) zu simulieren.

Was ‘wissen’ wir ?

Wie recherchiere ich ‘Wissen’ ?

Wissens-Anhäufung im Zuge der Naturwissenschaften?

Daten werden in Publikationen präsentiert.

Wissens-Anhäufung im Zuge der Naturwissenschaften?

Daten werden in Publikationen präsentiert.

Bei Aussagen, die sich auf diese Daten beziehen, werden die entsprechenden Publikationen zitiert.

Wissens-Anhäufung im Zuge der Naturwissenschaften?

Daten werden in Publikationen präsentiert.

Bei Aussagen, die sich auf diese Daten beziehen, werden die entsprechenden Publikationen zitiert.

It is a herbivorous diurnal rodent, with a diet composed mainly of herbs, seeds and leaves (Meserve 1981; Meserve et al. 1983).

Wissens-Anhäufung im Zuge der Naturwissenschaften?

Daten werden in Publikationen präsentiert.

Bei Aussagen, die sich auf diese Daten beziehen, werden die entsprechenden Publikationen zitiert.

It is a herbivorous diurnal rodent, with a diet composed mainly of herbs, seeds and leaves (Meserve 1981; Meserve et al. 1983).

Meserve, P. L. 1981: Trophic relationships among small mammals in a Chilean semiarid thorn shrub community. J. Mammal. **62**, 304—317.

Meserve, P. L., Martin, R. E. & Rodriguez, J. 1983: Feeding ecology of two Chilean caviomorphs in a central Mediterranean savanna. J. Mammal. **64**, 322—325.

Wissens-Anhäufung im Zuge der Naturwissenschaften?

Daten werden in Publikationen präsentiert.

Bei Aussagen, die sich auf diese Daten beziehen, werden die entsprechenden Publikationen zitiert.

Octodon degus are semifossorial, diurnal, and live in colonial or familial groups of 5 to 10 animals.[2,5]

Wissens-Anhäufung im Zuge der Naturwissenschaften?

Daten werden in Publikationen präsentiert.

Bei Aussagen, die sich auf diese Daten beziehen, werden die entsprechenden Publikationen zitiert.

Octodon degus are semifossorial, diurnal, and live in colonial or familial groups of 5 to 10 animals.[2,5]

2. Fulk GW. Notes of the activity, reproduction, and social behavior of *Octodon degus*. J Mammal 1976;57:495–505.

Wissens-Anhäufung im Zuge der Naturwissenschaften?

Daten werden in Publikationen präsentiert.

Bei Aussagen, die sich auf diese Daten beziehen, werden die entsprechenden Publikationen zitiert.

Octodon degus are semifossorial, diurnal, and live in colonial or familial groups of 5 to 10 animals.[2,5]

2. Fulk GW. Notes of the activity, reproduction, and social behavior of *Octodon degus*. J Mammal 1976;57:495–505.

5. Veloso C, Bozinovic F. Effect of food quality on the energetics of reproduction in a precocial rodent, *Octodon degus*. J Mamm 2000;81(4):971–8.

Wissens-Anhäufung im Zuge der Naturwissenschaften?

Daten werden in Publikationen präsentiert.

Bei Aussagen, die sich auf diese Daten beziehen, werden die entsprechenden Publikationen zitiert.

Es ist ein Zeichen schlechter wissenschaftlicher Qualität, wenn ein Zitat nicht das liefert, wofür es zitiert wird … also in der Regel: keine Daten für die Behauptung liefert, für die es zitiert wird.

Wissens-Anhäufung im Zuge der Naturwissenschaften?

Daten werden in Publikationen präsentiert.

Bei Aussagen, die sich auf diese Daten beziehen, werden die entsprechenden Publikationen zitiert.

Es ist ein Zeichen schlechter wissenschaftlicher Qualität, wenn ein Zitat nicht das liefert, wofür es zitiert wird … also in der Regel: keine Daten für die Behauptung liefert, für die es zitiert wird.

D.h. man zitiert nicht für eine Behauptung, die irgendwo in der Einleitung oder Diskussion steht, sondern man zitiert für die Daten, die eine Publikation liefert.

Den Unterschied zu kennen macht gute vs. einen schlampig-schlechte wissenschaftliche Praxis aus.

Nicht alles braucht ein Zitat …

Nicht alles braucht ein Zitat …

Journal of Animal Husbandry and Dairy Science
Volume 5, Issue 1, 2021, PP 1-9
ISSN 2637-5354
DOI: https://doi.org/10.22259/2637-5354.0501001

Effects of Allium Sativum Powder on in Vitro Digestibility of Maize Stover in Cattle

Lemoufouet Jules[1*], Kana Jean Raphael[1], Taboumda Evariste[1], Mube Kuitche Hervé[1], Mekuiko Watsop Hippolyte[2], Miégoué Emile[1], Tendonkeng Fernand[1], Mouchili Mama[1], Matumuini Ndzani Essie Ference[3] et Pamo Tedonkeng Etienne[1]

According to Meyer et *al*. (2010), animals ingest food to meet their energy needs.

Meyer K and Hummel J, Clauss M: 2010. The relationship between forage cell wall content and voluntary food intake in mammalian herbivores. *Mammal Review* 40: 221-245.

… aber jedes Zitat sollte stimmen !

… aber jedes Zitat sollte stimmen !

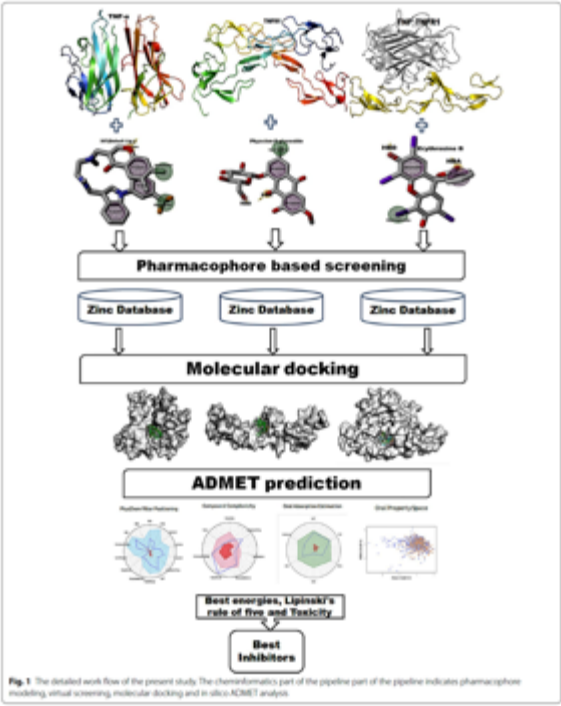
Saddala and Huang *J Transl Med* (2019) 17:215
https://doi.org/10.1186/s12967-019-1965-5

Journal of Translational Medicine

RESEARCH Open Access

Identification of novel inhibitors for TNFα, TNFR1 and TNFα-TNFR1 complex using pharmacophore-based approaches

Madhu Sudhana Saddala and Hu Huang*



interest. Docking was performed using the AutoDock in PyRx Virtual Screening tool [28, 29]. The hit molecules

28. Schwarm A, Ortmann S, Wolf C, Streich WJ, Clauss M. More efficient mastication allows increasing intake without compromising digestibility or necessitating a larger gut: comparative feeding trials in banteng (Bos javanicus) and pygmy hippopotamus (Hexaprotodon liberiensis). Comp Biochem Physiol A. 2009;152(4):504–12.

Welche Quellen akzeptiere ich ?

Die sogenannte ‘peer-reviewed literature’ – also Publikationen, die in Fachzeitschriften mit Gutachterprozess erschienen sind …

… wenn darin korrekt gearbeitet wurde.

Es gibt keinen Freibrief, der eigenes Nachdenken überflüssig macht.

Andere Quellen (Bücher ohne Quellenangaben, Webseiten, Erfahrungsberichte) nur mit grosser Vorsicht.

Denken hilft

Eur J Wildl Res (2016) 62:143–145
DOI 10.1007/s10344-015-0980-y

SHORT COMMUNICATION

Carcass consumption by domestic rabbits (*Oryctolagus cuniculus*)

Marcus Clauss[1] · Andreas Lischke[2] · Heike Botha[1] · Jean-Michel Hatt[1]

Received: 21 September 2015 / Revised: 18 November 2015 / Accepted: 2 December 2015 / Published online: 11 December 2015
© Springer-Verlag Berlin Heidelberg 2015

Abstract Conventional concepts about trophic niches in mammals are often linked to adaptations of digestive physiology, and so carnivory by herbivorous animals is often considered a physiological impossibility. However, numerous reports on events of carnivory in herbivores without apparent harmful consequences exist. Here, we report the habitual daily consumption of animal prey (day-old chicks and rodents) by two rabbits kept in a mixed-species exhibit with raptors over a period of 9 months. While not requiring a change of the classification of rabbits as strict herbivores, anecdotes like this one suggest that some trophic niches might be better explained by other factors than digestive physiology, such as ecological opportunity, behavioural adaptations and biomechanical limits to ingestion.

Keywords Herbivory · Carnivory · Placentophagy · Cannibalism · Scavenging · Coprophagy

In a philosophical paper on logical possibility, Seddon (1972) asks '*Are carnivorous rabbits possible*, *anywhere*?' and answers the question with '*No*, *this is a theoretical absurdity*.', giving various reasons such as a herbivore dentition, a digestive tract not suited to digest meat, and—interestingly—an incompatibility of meat eating with the strategy of coprophagy. This tendency to think in clear, exclusive categories is not only typical for lay audiences but occurs in natural sciences as well. Most people would react in disbelief on hearing a story of a cow or a deer stalking a bird and then subsequently devouring it, as described repeatedly (Allan 1978; Pietz and Granfors 2000; Nack and Ribic 2005). We prefer to rely on predictable patterns, and to a certain extent sentimentalized concepts in regard to animals. Yet observers confronted with an unexpected aberrant, curious or bizarre behaviour document their observation in the hope of adding to a growing body of anecdotes that may, over time, change our concepts of what is normal. For example, a collection of anecdotal evidence of carnivory in the common hippopotamus (*Hippopotamus amphibius*)—typically considered a strict herbivore—provides an explanation for the observation that this species is, amongst all herbivores considered, particularly affected by anthrax epidemics (Dudley et al. 2015).

Here, we report a case of habitual carnivory in rabbits. The natural diet of rabbits usually consists of a variety of plants (e.g. Martins et al. 2002; Martin et al. 2007). Carnivory has been reported in rabbits under certain conditions. Placentophagia—the consumption of the afterbirth by the female that just gave birth—is common in mammals (Kristal 1980), and rabbits are no exception (Sawin and Carry 1953; Melo and González-Mariscal 2003). Accidental ingestion of neonates has sporadically been associated with placentophagia (Sawin and Carry 1953), but also ingestion of deceased neonates, or the deliberate killing and ingestion of neonates have been reported (González-Redondo and Zamora-Lozano 2008). Such latter cases differ from incidents of sheer 'infanticide' insofar as not only killing, but also devouring of the neonate is part of the behaviour ('cannibalism'; Kristal 2009). Similar observations were reported for cottontail rabbits (*Sylvilagus floridanus*) (Smith 1974), and reviewed as a general strategy in rodents irrespective of their

✉ Marcus Clauss
mclauss@vetclinics.uzh.ch

[1] Clinic for Zoo Animals, Exotic Pets and Wildlife, Vetsuisse Faculty, University of Zurich, Winterthurerstr. 260, 8057 Zurich, Switzerland

[2] Bird of Prey Sanctuary Berg am Irchel, PanEco, Foundation for Sustainable Development and Intercultural Exchange, Chileweg 5, 8415 Berg am Irchel, Switzerland

Drei Schritte der Literaturrecherche

1. Quelle lokalisieren (Suchmaschine, z.B. Pubmed, google scholar oder via Web-Lexika, z.B. Wikipedia – die Web-Lexika selber sind keine Quelle, aber ggf. eine Quellensammlung)

Drei Schritte der Literaturrecherche

1. Quelle lokalisieren (Suchmaschine, z.B. Pubmed, google scholar oder via Web-Lexika, z.B. Wikipedia – die Web-Lexika selber sind keine Quelle, aber ggf. eine Quellensammlung)
2. In der Quelle zitierte Literatur (insbesondere in Einleitung und Diskussion)

Drei Schritte der Literaturrecherche

1. Quelle lokalisieren (Suchmaschine, z.B. Pubmed, google scholar oder via Web-Lexika, z.B. Wikipedia – die Web-Lexika selber sind keine Quelle, aber ggf. eine Quellensammlung)
2. In der Quelle zitierte Literatur (insbesondere in Einleitung und Diskussion)

It is a herbivorous diurnal rodent, with a diet composed mainly of herbs, seeds and leaves (Meserve 1981; Meserve et al. 1983). Degus

Meserve, P. L. 1981: Trophic relationships among small mammals in a Chilean semiarid thorn shrub community. J. Mammal. **62**, 304—317.

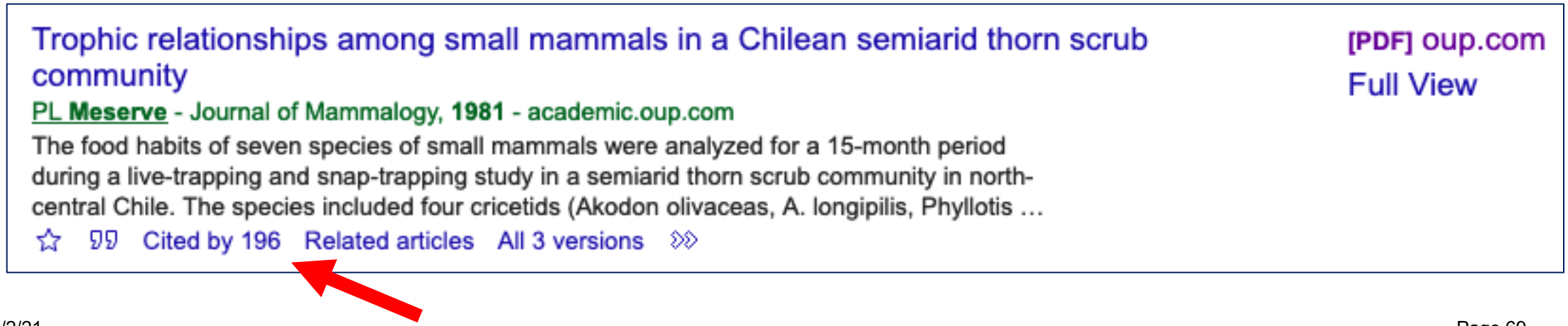
Meserve, P. L., Martin, R. E. & Rodriguez, J. 1983: Feeding ecology of two Chilean caviomorphs in a central Mediterranean savanna. J. Mammal. **64**, 322—325.

Drei Schritte der Literaturrecherche

1. Quelle lokalisieren (Suchmaschine, z.B. Pubmed, google scholar oder via Web-Lexika, z.B. Wikipedia – die Web-Lexika selber sind keine Quelle, aber ggf. eine Quellensammlung)
2. In der Quelle zitierte Literatur (insbesondere in Einleitung und Diskussion)
3. Literatur, die diese Quelle zitiert (‘cited by’-Funktion)

Drei Schritte der Literaturrecherche

1. Quelle lokalisieren (Suchmaschine, z.B. Pubmed, google scholar oder via Web-Lexika, z.B. Wikipedia – die Web-Lexika selber sind keine Quelle, aber ggf. eine Quellensammlung)
2. In der Quelle zitierte Literatur (insbesondere in Einleitung und Diskussion)
3. Literatur, die diese Quelle zitiert ('cited by'-Funktion)



Drei Schritte der Literaturrecherche

1. Quelle lokalisieren (Suchmaschine, z.B. Pubmed, google scholar oder via Web-Lexika, z.B. Wikipedia – die Web-Lexika selber sind keine Quelle, aber ggf. eine Quellensammlung)
2. In der Quelle zitierte Literatur (insbesondere in Einleitung und Diskussion)
3. Literatur, die diese Quelle zitiert (‘cited by’-Funktion)

& so weiter, bis man nichts Neues mehr findet.

Wissens-Recherche (= Literturrecherche)

Fragestellung:

L. Mit der Fütterung sind die arttypischen Merkmale der Nahrungsaufnahme (räumlich und zeitlich variierendes Futterangebot, Futterbeschaffung, Futterbearbeitung und Dauer der Futteraufnahme) zu simulieren.

WAS IST DIE NATÜRLICHE NAHRUNG? WIEVIEL ZEIT WIRD PRO TAG MIT FRESSEN VERBRACHT?

Raum 1 – Bern A-i: Kaninchen (rabbit, *Oryctolagus cuniculus*)

Raum 2 – Bern J-R: Meerschweinchen und Chinchilla (guinea pig, *Cavia* spp., *Chinchilla lanigera*)

Raum 3 – Bern S-Z: Degu (*Octodon degus*)

Raum 4 – Zürich A-i: Landschildkröten Gattung *Testudo*

Raum 5 – Zürich J-R: Wellensittich (budgerigar, *Melopsittacus undulatus*)

Raum 6 – Zürich S-Z: Europäischer Igel (hedgehog, *Erinaceus europaeus*)

Go to **www.menti.com** and use the code **8339 9889**

Was ist die wichtigste Aufgabe von "Ernährung"?

University of Zurich[UZH]

Clinic for Zoo Animals, Exotic Pets and Wildlife

Kaninchen

Natürliche Futterwahl: Kaninchen

Kaninchen sind in freier Wildbahn hauptsächlich...

Grasäser	Kräuter-, Stauden- und Laubäser
Homolka (1985)*, Böhmen 44% Gräser	
Bhdresa (1987)*, England hauptsächlich Gräser	
Hulbert et al. (1996)*, Schottland hauptsächlich Gräser	
Wolfe et al. (1996)*, Küste Irlands 85% Gräser	
Marques & Mathias (2001)*, Portugal Sanddüne: 53% Gräser	**Marques & Mathias (2001)***, Portugal Buschland: 48% Dicotyledonen
Robley et al. (2001)*, W-Australien Winter: Gräser	**Robley et al. (2001)***, W-Australien Sommer: Wurzeln, Blätter, Stauden

*: Analyse des gesammelten Kotes

Natürliche Futterwahl: Kaninchen

Kaninchen sind in freier Wildbahn hauptsächlich...

Grasäser	**Kräuter-, Stauden- und Laubäser**
Martins et al. (2002)*, Portugal Sommer: 50%, Winter: 42%	
Katona et al. (2004)*, Ungarn Frühjahr: 83%; Herbst: 60%	**Katona et al. (2004)***, Ungarn Sommer: 75%; Winter: 51%
Alves et al. (2006)*, Portugal Buschland, Winter: 60%	**Alves et al. (2006)***, Portugal Buschland, Sommer: 67% Pinienwald: Sommer: 64%, Winter: 80%
Bonino & Borrelli (2006)*, Argentinien hauptsächlich Gras	
Martin et al. (2007)°, Australien Weideland, Winter: 70% Buschland, Sommer: Gräser, Grassamen: 55%	**Martin et al. (2007)°**, Australien Weideland, Sommer: 60% Buschland, Winter: 50% Dicotyledonen

*:Analyse des gesammelten Kotes
° :Analyse des Mageninhaltes

Natürliche Futterwahl: Kaninchen

1. Wallage-Drees & Deinum, 1986, Sanddüne an der Küste Hollands: Jahresdurchschnitt in % der TS:
   - NDF: 59%
   - Rohfaser*: 29%
   - Rohprotein: 20%

2. Thomson & King, 1994, Mitteleuropa: Durchschnitt in % der TS:
   Frühjahr:
   - NDF*: 53%
   - Rohfaser: 25%
   - Rohprotein: 20%

   Sommer:
   - NDF*: 61%
   - Rohfaser: 30%
   - Rohprotein: 13%

*:Umrechungsformel Rfa ⇨ NDF aus Kamphues et al., 2004

Fütterung und Aktivitäts-Budget

Applied Animal Behaviour Science 169 (2015) 86–92

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

The effect of four different feeding regimes on rabbit behaviour

Jennifer L. Prebble[a,1,2], Fritha M. Langford[b], Darren J. Shaw[a], Anna L. Meredith[a,*]

[a] Royal (Dick) School of Veterinary Studies and the Roslin Institute, University of Edinburgh, Easter Bush Campus, Midlothian EH25 9RG, United Kingdom
[b] Animal and Veterinary Sciences, SRUC, West Mains Road, Edinburgh EH9 3JG, United Kingdom

ARTICLE INFO

Article history:
Received 10 June 2014
Received in revised form 4 May 2015
Accepted 10 May 2015
Available online 22 May 2015

Keywords:
Rabbit
Feeding
Behaviour
Abnormal behaviour
Hay

ABSTRACT

Dietary composition and presentation impacts on the behaviour of animals, and failure to provide a suitable diet can lead to reduced welfare through the development of poor health, the inability to express normal behaviours and the development of abnormal behaviours. This study assessed the effects of two commonly fed pet rabbit diets (extruded nuggets with hay (EH) and muesli with hay (MH)) alongside hay only (HO) and muesli only (MO) on the behaviour of 32 Dutch rabbits observed over 17 months. Increased time spent feeding was observed in the groups fed ad libitum hay (HO, EH, MH) compared to the MO group ($P < 0.05$). A corresponding high level of inactivity was observed in the MO group compared to rabbits receiving hay ($P < 0.05$). In the groups provided with hay a preference to consume hay in a natural grazing posture was observed. The higher activity levels and absence of abnormal behaviours when hay was fed support recommendations that forage should form a significant portion of the diet for domestic rabbits.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

As herbivores, wild rabbits consume relatively large amounts of a high fibre diet of low nutritional quality (Williams and Wells, 1974). This requires them to apportion a large amount of their time budget to grazing. Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962). Caecotrophy is performed while underground (Southern, 1942). Domestic rabbits kept in free range conditions exhibit a similar feeding pattern to their wild counterparts (Vastrade, 1987; Lehmann, 1991). In contrast, many pet rabbits are housed in small hutches with limited exercise opportunities (Mullan and Main, 2006; PDSA, 2011) and a diet consisting largely of concentrates (mono-component nugget or muesli mixes) (PDSA, 2011) which can be consumed rapidly (Lidfors, 1997), with limited or no access to hay or grass (Mullan and Main, 2006; PDSA, 2011).

Stereotypic behaviours are described as behaviours that are relatively invariant, regularly repeated and without an obvious function (Mason, 1991). Stereotypic behaviours reported to occur in laboratory rabbits include excessive grooming, sham chewing (chewing with nothing in mouth), bar biting, licking parts of cage, digging against cage, biting water nipple, sliding nose against bars, head pressing and running repeatedly in a defined pattern (Gunn and Morton, 1995; Lidfors, 1997). An apathetic state of inactivity and boredom has also been reported by Gunn and Morton (1995). Stereotypic behaviours occur most frequently during the night (Gunn and Morton, 1995) when rabbits are naturally at their most active (Mykytowycz, 1958).

Whilst not studied in pet rabbits, the beneficial impact of providing hay to laboratory rabbits has been demonstrated (Lidfors, 1997; Berthelsen and Hansen, 1999). The provision of hay to individually housed laboratory rabbits has proved effective at reducing the expression of abnormal behaviours (Lidfors, 1997; Berthelsen and Hansen, 1999).

Rabbits can consume pelleted feeds rapidly (Lidfors, 1997) and, whilst they may provide adequate nutrition for the maintenance of the rabbit, foraging behaviour is limited. If fed in limited amounts the rapid consumption of the daily ration may leave the rabbit in a state of hunger for a considerable portion of the day (Lidfors, 1997). It has been suggested that stereotypies in pigs and broiler

* Corresponding author. Tel.: +44 1316517457.
E-mail address: Anna.Meredith@ed.ac.uk (A.L. Meredith).
[1] J.P. was employed on a KTP partnership between the Royal (Dick) School of Veterinary Studies and Burgess Pet Care, Victory Mill, Priestman's Lane, Thornton-Le-Dale, Pickering, North Yorkshire YO18 7RU, United Kingdom.
[2] Current address: Askham Bryan College, Askham Bryan, York YO23 3FR, United Kingdom.

http://dx.doi.org/10.1016/j.applanim.2015.05.003
0168-1591/© 2015 Elsevier B.V. All rights reserved.

Fütterung und Aktivitäts-Budget

Applied Animal Behaviour Science 169 (2015) 86–92

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

The effect of four different feeding regimes on rabbit behaviour

Jennifer L. Prebble[a,1,2], Fritha M. Langford[b], Darren J. Shaw[a], Anna L. Meredith[a,*]

[a] Royal (Dick) School of Veterinary Studies and the Roslin Institute, University of Edinburgh, Easter Bush Campus, Midlothian EH25 9RG, United Kingdom
[b] Animal and Veterinary Sciences, SRUC, West Mains Road, Edinburgh EH9 3JG, United Kingdom

ARTICLE INFO

Article history:
Received 10 June 2014
Received in revised form 4 May 2015
Accepted 10 May 2015
Available online 22 May 2015

Keywords:
Rabbit
Feeding
Behaviour
Abnormal behaviour
Hay

ABSTRACT

Dietary composition and presentation impacts on the behaviour of animals, and failure to provide a suitable diet can lead to reduced welfare through the development of poor health, the inability to express normal behaviours and the development of abnormal behaviours. This study assessed the effects of two commonly fed pet rabbit diets (extruded nuggets with hay (EH) and muesli with hay (MH)) alongside hay only (HO) and muesli only (MO) on the behaviour of 32 Dutch rabbits observed over 17 months. Increased time spent feeding was observed in the groups fed ad libitum hay (HO, EH, MH) compared to the MO group ($P < 0.05$). A corresponding high level of inactivity was observed in the MO group compared to rabbits receiving hay ($P < 0.05$). In the groups provided with hay a preference to consume hay in a natural grazing posture was observed. The higher activity levels and absence of abnormal behaviours when hay was fed support recommendations that forage should form a significant portion of the diet for domestic rabbits.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

As herbivores, wild rabbits consume relatively large amounts of a high fibre diet of low nutritional quality (Williams and Wells, 1974). This requires them to apportion a large amount of their time budget to grazing. Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962). Caecotrophy is performed while underground (Southern, 1942). Domestic rabbits kept in free range conditions exhibit a similar feeding pattern to their wild counterparts (Vastrade, 1987; Lehmann, 1991). In contrast, many pet rabbits are housed in small hutches with limited exercise opportunities (Mullan and Main, 2006; PDSA, 2011) and a diet consisting largely of concentrates (mono-component nugget or muesli mixes) (PDSA, 2011) which can be consumed rapidly (Lidfors, 1997), with limited or no access to hay or grass (Mullan and Main, 2006; PDSA, 2011).

Stereotypic behaviours are described as behaviours that are relatively invariant, regularly repeated and without an obvious function (Mason, 1991). Stereotypic behaviours reported to occur in laboratory rabbits include excessive grooming, sham chewing (chewing with nothing in mouth), bar biting, licking parts of cage, digging against cage, biting water nipple, sliding nose against bars, head pressing and running repeatedly in a defined pattern (Gunn and Morton, 1995; Lidfors, 1997). An apathetic state of inactivity and boredom has also been reported by Gunn and Morton (1995). Stereotypic behaviours occur most frequently during the night (Gunn and Morton, 1995) when rabbits are naturally at their most active (Mykytowycz, 1958).

Whilst not studied in pet rabbits, the beneficial impact of providing hay to laboratory rabbits has been demonstrated (Lidfors, 1997; Berthelsen and Hansen, 1999). The provision of hay to individually housed laboratory rabbits has proved effective at reducing the expression of abnormal behaviours (Lidfors, 1997; Berthelsen and Hansen, 1999).

Rabbits can consume pelleted feeds rapidly (Lidfors, 1997) and, whilst they may provide adequate nutrition for the maintenance of the rabbit, foraging behaviour is limited. If fed in limited amounts the rapid consumption of the daily ration may leave the rabbit in a state of hunger for a considerable portion of the day (Lidfors, 1997). It has been suggested that stereotypies in pigs and broiler

* Corresponding author. Tel.: +44 1316517457.
E-mail address: Anna.Meredith@ed.ac.uk (A.L. Meredith).
[1] J.P. was employed on a KTP partnership between the Royal (Dick) School of Veterinary Studies and Burgess Pet Care, Victory Mill, Priestman's Lane, Thornton-Le-Dale, Pickering, North Yorkshire YO18 7RU, United Kingdom.
[2] Current address: Askham Bryan College, Askham Bryan, York YO23 3FR, United Kingdom.

http://dx.doi.org/10.1016/j.applanim.2015.05.003
0168-1591/© 2015 Elsevier B.V. All rights reserved.

Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962).

Fütterung und Aktivitäts-Budget

Applied Animal Behaviour Science 169 (2015) 86–92

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

The effect of four different feeding regimes on rabbit behaviour

Jennifer L. Prebble[a,1,2], Fritha M. Langford[b], Darren J. Shaw[a], Anna L. Meredith[a,*]

[a] Royal (Dick) School of Veterinary Studies and the Roslin Institute, University of Edinburgh, Easter Bush Campus, Midlothian EH25 9RG, United Kingdom
[b] Animal and Veterinary Sciences, SRUC, West Mains Road, Edinburgh EH9 3JG, United Kingdom

ARTICLE INFO

Article history:
Received 10 June 2014
Received in revised form 4 May 2015
Accepted 10 May 2015
Available online 22 May 2015

Keywords:
Rabbit
Feeding
Behaviour
Abnormal behaviour
Hay

ABSTRACT

Dietary composition and presentation impacts on the behaviour of animals, and failure to provide a suitable diet can lead to reduced welfare through the development of poor health, the inability to express normal behaviours and the development of abnormal behaviours. This study assessed the effects of two commonly fed pet rabbit diets (extruded nuggets with hay (EH) and muesli with hay (MH)) alongside hay only (HO) and muesli only (MO) on the behaviour of 32 Dutch rabbits observed over 17 months. Increased time spent feeding was observed in the groups fed ad libitum hay (HO, EH, MH) compared to the MO group ($P < 0.05$). A corresponding high level of inactivity was observed in the MO group compared to rabbits receiving hay ($P < 0.05$). In the groups provided with hay a preference to consume hay in a natural grazing posture was observed. The higher activity levels and absence of abnormal behaviours when hay was fed support recommendations that forage should form a significant portion of the diet for domestic rabbits.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

As herbivores, wild rabbits consume relatively large amounts of a high fibre diet of low nutritional quality (Williams and Wells, 1974). This requires them to apportion a large amount of their time budget to grazing. Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962). Caecotrophy is performed while underground (Southern, 1942). Domestic rabbits kept in free range conditions exhibit a similar feeding pattern to their wild counterparts (Vastrade, 1987; Lehmann, 1991). In contrast, many pet rabbits are housed in small hutches with limited exercise opportunities (Mullan and Main, 2006; PDSA, 2011) and a diet consisting largely of concentrates (mono-component nugget or muesli mixes) (PDSA, 2011) which can be consumed rapidly (Lidfors, 1997), with limited or no access to hay or grass (Mullan and Main, 2006; PDSA, 2011).

Stereotypic behaviours are described as behaviours that are relatively invariant, regularly repeated and without an obvious function (Mason, 1991). Stereotypic behaviours reported to occur in laboratory rabbits include excessive grooming, sham chewing (chewing with nothing in mouth), bar biting, licking parts of cage, digging against cage, biting water nipple, sliding nose against bars, head pressing and running repeatedly in a defined pattern (Gunn and Morton, 1995; Lidfors, 1997). An apathetic state of inactivity and boredom has also been reported by Gunn and Morton (1995). Stereotypic behaviours occur most frequently during the night (Gunn and Morton, 1995) when rabbits are naturally at their most active (Mykytowycz, 1958).

Whilst not studied in pet rabbits, the beneficial impact of providing hay to laboratory rabbits has been demonstrated (Lidfors, 1997; Berthelsen and Hansen, 1999). The provision of hay to individually housed laboratory rabbits has proved effective at reducing the expression of abnormal behaviours (Lidfors, 1997; Berthelsen and Hansen, 1999).

Rabbits can consume pelleted feeds rapidly (Lidfors, 1997) and, whilst they may provide adequate nutrition for the maintenance of the rabbit, foraging behaviour is limited. If fed in limited amounts the rapid consumption of the daily ration may leave the rabbit in a state of hunger for a considerable portion of the day (Lidfors, 1997). It has been suggested that stereotypies in pigs and broiler

* Corresponding author. Tel.: +44 1316517457.
E-mail address: Anna.Meredith@ed.ac.uk (A.L. Meredith).
[1] J.P. was employed on a KTP partnership between the Royal (Dick) School of Veterinary Studies and Burgess Pet Care, Victory Mill, Priestman's Lane, Thornton-Le-Dale, Pickering, North Yorkshire YO18 7RU, United Kingdom.
[2] Current address: Askham Bryan College, Askham Bryan, York YO23 3FR, United Kingdom.

http://dx.doi.org/10.1016/j.applanim.2015.05.003
0168-1591/© 2015 Elsevier B.V. All rights reserved.

Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962).

Fütterung und Aktivitäts-Budget

Applied Animal Behaviour Science 169 (2015) 86–92

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

The effect of four different feeding regimes on rabbit behaviour

Jennifer L. Prebble[a,1,2], Fritha M. Langford[b], Darren J. Shaw[a], Anna L. Meredith[a,*]

[a] Royal (Dick) School of Veterinary Studies and the Roslin Institute, University of Edinburgh, Easter Bush Campus, Midlothian EH25 9RG, United Kingdom
[b] Animal and Veterinary Sciences, SRUC, West Mains Road, Edinburgh EH9 3JG, United Kingdom

ARTICLE INFO

Article history:
Received 10 June 2014
Received in revised form 4 May 2015
Accepted 10 May 2015
Available online 22 May 2015

Keywords:
Rabbit
Feeding
Behaviour
Abnormal behaviour
Hay

ABSTRACT

Dietary composition and presentation impacts on the behaviour of animals, and failure to provide a suitable diet can lead to reduced welfare through the development of poor health, the inability to express normal behaviours and the development of abnormal behaviours. This study assessed the effects of two commonly fed pet rabbit diets (extruded nuggets with hay (EH) and muesli with hay (MH)) alongside hay only (HO) and muesli only (MO) on the behaviour of 32 Dutch rabbits observed over 17 months. Increased time spent feeding was observed in the groups fed ad libitum hay (HO, EH, MH) compared to the MO group ($P < 0.05$). A corresponding high level of inactivity was observed in the MO group compared to rabbits receiving hay ($P < 0.05$). In the groups provided with hay a preference to consume hay in a natural grazing posture was observed. The higher activity levels and absence of abnormal behaviours when hay was fed support recommendations that forage should form a significant portion of the diet for domestic rabbits.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

As herbivores, wild rabbits consume relatively large amounts of a high fibre diet of low nutritional quality (Williams and Wells, 1974). This requires them to apportion a large amount of their time budget to grazing. Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962). Caecotrophy is performed while underground (Southern, 1942). Domestic rabbits kept in free range conditions exhibit a similar feeding pattern to their wild counterparts (Vastrade, 1987; Lehmann, 1991). In contrast, many pet rabbits are housed in small hutches with limited exercise opportunities (Mullan and Main, 2006; PDSA, 2011) and a diet consisting largely of concentrates (mono-component nugget or muesli mixes) (PDSA, 2011) which can be consumed rapidly (Lidfors, 1997), with limited or no access to hay or grass (Mullan and Main, 2006; PDSA, 2011).

Stereotypic behaviours are described as behaviours that are relatively invariant, regularly repeated and without an obvious function (Mason, 1991). Stereotypic behaviours reported to occur in laboratory rabbits include excessive grooming, sham chewing (chewing with nothing in mouth), bar biting, licking parts of cage, digging against cage, biting water nipple, sliding nose against bars, head pressing and running repeatedly in a defined pattern (Gunn and Morton, 1995; Lidfors, 1997). An apathetic state of inactivity and boredom has also been reported by Gunn and Morton (1995). Stereotypic behaviours occur most frequently during the night (Gunn and Morton, 1995) when rabbits are naturally at their most active (Mykytowycz, 1958).

Whilst not studied in pet rabbits, the beneficial impact of providing hay to laboratory rabbits has been demonstrated (Lidfors, 1997; Berthelsen and Hansen, 1999). The provision of hay to individually housed laboratory rabbits has proved effective at reducing the expression of abnormal behaviours (Lidfors, 1997; Berthelsen and Hansen, 1999).

Rabbits can consume pelleted feeds rapidly (Lidfors, 1997) and, whilst they may provide adequate nutrition for the maintenance of the rabbit, foraging behaviour is limited. If fed in limited amounts the rapid consumption of the daily ration may leave the rabbit in a state of hunger for a considerable portion of the day (Lidfors, 1997). It has been suggested that stereotypies in pigs and broiler

* Corresponding author. Tel.: +44 1316517457.
E-mail address: Anna.Meredith@ed.ac.uk (A.L. Meredith).
[1] J.P. was employed on a KTP partnership between the Royal (Dick) School of Veterinary Studies and Burgess Pet Care, Victory Mill, Priestman's Lane, Thornton-Le-Dale, Pickering, North Yorkshire YO18 7RU, United Kingdom.
[2] Current address: Askham Bryan College, Askham Bryan, York YO23 3FR, United Kingdom.

http://dx.doi.org/10.1016/j.applanim.2015.05.003
0168-1591/© 2015 Elsevier B.V. All rights reserved.

Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962).

Fütterung und Aktivitäts-Budget

Applied Animal Behaviour Science 169 (2015) 86–92

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

The effect of four different feeding regimes on rabbit behaviour

Jennifer L. Prebble[a,1,2], Fritha M. Langford[b], Darren J. Shaw[a], Anna L. Meredith[a,*]

[a] Royal (Dick) School of Veterinary Studies and the Roslin Institute, University of Edinburgh, Easter Bush Campus, Midlothian EH25 9RG, United Kingdom
[b] Animal and Veterinary Sciences, SRUC, West Mains Road, Edinburgh EH9 3JG, United Kingdom

ARTICLE INFO

Article history:
Received 10 June 2014
Received in revised form 4 May 2015
Accepted 10 May 2015
Available online 22 May 2015

Keywords:
Rabbit
Feeding
Behaviour
Abnormal behaviour
Hay

ABSTRACT

Dietary composition and presentation impacts on the behaviour of animals, and failure to provide a suitable diet can lead to reduced welfare through the development of poor health, the inability to express normal behaviours and the development of abnormal behaviours. This study assessed the effects of two commonly fed pet rabbit diets (extruded nuggets with hay (EH) and muesli with hay (MH)) alongside hay only (HO) and muesli only (MO) on the behaviour of 32 Dutch rabbits observed over 17 months. Increased time spent feeding was observed in the groups fed ad libitum hay (HO, EH, MH) compared to the MO group ($P < 0.05$). A corresponding high level of inactivity was observed in the MO group compared to rabbits receiving hay ($P < 0.05$). In the groups provided with hay a preference to consume hay in a natural grazing posture was observed. The higher activity levels and absence of abnormal behaviours when hay was fed support recommendations that forage should form a significant portion of the diet for domestic rabbits.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

As herbivores, wild rabbits consume relatively large amounts of a high fibre diet of low nutritional quality (Williams and Wells, 1974). This requires them to apportion a large amount of their time budget to grazing. Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962). Caecotrophy is performed while underground (Southern, 1942). Domestic rabbits kept in free range conditions exhibit a similar feeding pattern to their wild counterparts (Vastrade, 1987; Lehmann, 1991). In contrast, many pet rabbits are housed in small hutches with limited exercise opportunities (Mullan and Main, 2006; PDSA, 2011) and a diet consisting largely of concentrates (mono-component nugget or muesli mixes) (PDSA, 2011) which can be consumed rapidly (Lidfors, 1997), with limited or no access to hay or grass (Mullan and Main, 2006; PDSA, 2011).

Stereotypic behaviours are described as behaviours that are relatively invariant, regularly repeated and without an obvious function (Mason, 1991). Stereotypic behaviours reported to occur in laboratory rabbits include excessive grooming, sham chewing (chewing with nothing in mouth), bar biting, licking parts of cage, digging against cage, biting water nipple, sliding nose against bars, head pressing and running repeatedly in a defined pattern (Gunn and Morton, 1995; Lidfors, 1997). An apathetic state of inactivity and boredom has also been reported by Gunn and Morton (1995). Stereotypic behaviours occur most frequently during the night (Gunn and Morton, 1995) when rabbits are naturally at their most active (Mykytowycz, 1958).

Whilst not studied in pet rabbits, the beneficial impact of providing hay to laboratory rabbits has been demonstrated (Lidfors, 1997; Berthelsen and Hansen, 1999). The provision of hay to individually housed laboratory rabbits has proved effective at reducing the expression of abnormal behaviours (Lidfors, 1997; Berthelsen and Hansen, 1999).

Rabbits can consume pelleted feeds rapidly (Lidfors, 1997) and, whilst they may provide adequate nutrition for the maintenance of the rabbit, foraging behaviour is limited. If fed in limited amounts the rapid consumption of the daily ration may leave the rabbit in a state of hunger for a considerable portion of the day (Lidfors, 1997). It has been suggested that stereotypies in pigs and broiler

* Corresponding author. Tel.: +44 1316517457.
E-mail address: Anna.Meredith@ed.ac.uk (A.L. Meredith).
[1] J.P. was employed on a KTP partnership between the Royal (Dick) School of Veterinary Studies and Burgess Pet Care, Victory Mill, Priestman's Lane, Thornton-Le-Dale, Pickering, North Yorkshire YO18 7RU, United Kingdom.
[2] Current address: Askham Bryan College, Askham Bryan, York YO23 3FR, United Kingdom.

http://dx.doi.org/10.1016/j.applanim.2015.05.003
0168-1591/© 2015 Elsevier B.V. All rights reserved.

Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962).

Mykytowycz, R., 1958. Continuous observations of the activity of the wild rabbit, Oryctolagus cuniculus (L.), during 24-hour periods. C.S.I.R.O. Wildl. Res.

Fütterung und Aktivitäts-Budget

Applied Animal Behaviour Science 169 (2015) 86–92

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

The effect of four different feeding regimes on rabbit behaviour

Jennifer L. Prebble[a,1,2], Fritha M. Langford[b], Darren J. Shaw[a], Anna L. Meredith[a,*]

[a] Royal (Dick) School of Veterinary Studies and the Roslin Institute, University of Edinburgh, Easter Bush Campus, Midlothian EH25 9RG, United Kingdom
[b] Animal and Veterinary Sciences, SRUC, West Mains Road, Edinburgh EH9 3JG, United Kingdom

ARTICLE INFO

Article history:
Received 10 June 2014
Received in revised form 4 May 2015
Accepted 10 May 2015
Available online 22 May 2015

Keywords:
Rabbit
Feeding
Behaviour
Abnormal behaviour
Hay

ABSTRACT

Dietary composition and presentation impacts on the behaviour of animals, and failure to provide a suitable diet can lead to reduced welfare through the development of poor health, the inability to express normal behaviours and the development of abnormal behaviours. This study assessed the effects of two commonly fed pet rabbit diets (extruded nuggets with hay (EH) and muesli with hay (MH)) alongside hay only (HO) and muesli only (MO) on the behaviour of 32 Dutch rabbits observed over 17 months. Increased time spent feeding was observed in the groups fed ad libitum hay (HO, EH, MH) compared to the MO group ($P < 0.05$). A corresponding high level of inactivity was observed in the MO group compared to rabbits receiving hay ($P < 0.05$). In the groups provided with hay a preference to consume hay in a natural grazing posture was observed. The higher activity levels and absence of abnormal behaviours when hay was fed support recommendations that forage should form a significant portion of the diet for domestic rabbits.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

As herbivores, wild rabbits consume relatively large amounts of a high fibre diet of low nutritional quality (Williams and Wells, 1974). This requires them to apportion a large amount of their time budget to grazing. Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962). Caecotrophy is performed while underground (Southern, 1942). Domestic rabbits kept in free range conditions exhibit a similar feeding pattern to their wild counterparts (Vastrade, 1987; Lehmann, 1991). In contrast, many pet rabbits are housed in small hutches with limited exercise opportunities (Mullan and Main, 2006; PDSA, 2011) and a diet consisting largely of concentrates (mono-component nugget or muesli mixes) (PDSA, 2011) which can be consumed rapidly (Lidfors, 1997), with limited or no access to hay or grass (Mullan and Main, 2006; PDSA, 2011).

Stereotypic behaviours are described as behaviours that are relatively invariant, regularly repeated and without an obvious function (Mason, 1991). Stereotypic behaviours reported to occur in laboratory rabbits include excessive grooming, sham chewing (chewing with nothing in mouth), bar biting, licking parts of cage, digging against cage, biting water nipple, sliding nose against bars, head pressing and running repeatedly in a defined pattern (Gunn and Morton, 1995; Lidfors, 1997). An apathetic state of inactivity and boredom has also been reported by Gunn and Morton (1995). Stereotypic behaviours occur most frequently during the night (Gunn and Morton, 1995) when rabbits are naturally at their most active (Mykytowycz, 1958).

Whilst not studied in pet rabbits, the beneficial impact of providing hay to laboratory rabbits has been demonstrated (Lidfors, 1997; Berthelsen and Hansen, 1999). The provision of hay to individually housed laboratory rabbits has proved effective at reducing the expression of abnormal behaviours (Lidfors, 1997; Berthelsen and Hansen, 1999).

Rabbits can consume pelleted feeds rapidly (Lidfors, 1997) and, whilst they may provide adequate nutrition for the maintenance of the rabbit, foraging behaviour is limited. If fed in limited amounts the rapid consumption of the daily ration may leave the rabbit in a state of hunger for a considerable portion of the day (Lidfors, 1997). It has been suggested that stereotypies in pigs and broiler

* Corresponding author. Tel.: +44 1316517457.
E-mail address: Anna.Meredith@ed.ac.uk (A.L. Meredith).
[1] J.P. was employed on a KTP partnership between the Royal (Dick) School of Veterinary Studies and Burgess Pet Care, Victory Mill, Priestman's Lane, Thornton-Le-Dale, Pickering, North Yorkshire YO18 7RU, United Kingdom.
[2] Current address: Askham Bryan College, Askham Bryan, York YO23 3FR, United Kingdom.

http://dx.doi.org/10.1016/j.applanim.2015.05.003
0168-1591/© 2015 Elsevier B.V. All rights reserved.

Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962).

Mykytowycz, R., 1958. Continuous observations of the activity of the wild rabbit, Oryctolagus cuniculus (L.), during 24-hour periods. C.S.I.R.O. Wildl. Res.

Mykytowycz, R, Rowley, I., 1958. Continuous observations of the activity of the wild rabbit, Oryctolagus cuniculus (L.), during 24 hour periods. *CSIRO Wildl. Res.* 3: 26-31

Aktivitäts-Budget ?

BIOLOGY OF THE RABBIT (ORYCTOLAGUS CUNICULUS (L.))
IN CENTRAL OTAGO, NEW ZEALAND,
WITH EMPHASIS ON BEHAVIOUR AND ITS RELEVANCE TO
POISON CONTROL OPERATIONS

A thesis
submitted in fulfilment
of the requirements for the Degree
of
Doctor of Philosophy in Zoology
in the
University of Canterbury
by
K W Fraser

University of Canterbury
1985

Table 6.1 Frequency of occurrence of observations in the 10 behaviour categories for transect sampling.

		Percent of observations									
Season	n	Miscellaneous	Feeding	Grooming	Resting	Locomotory	Alert	Reproductive	Territorial	Aggressive	Displacement
Spr 80	2533	0.8	60.6	3.9	15.6	11.1	2.2	3.0	0.7	2.1	0.1
Sum 80/81	5485	0.3	65.5	4.5	17.6	9.0	1.4	0.4	0.4	0.8	0.1
Aut 81	5417	0.3	67.6	4.9	13.8	8.4	1.5	0.4	0.4	2.6	0.2
Win 81	4518	0.1	61.8	6.2	19.7	6.9	1.6	0.8	0.6	2.1	0.2
Spr 81	6238	0.1	67.0	4.8	18.4	4.9	1.1	1.4	0.5	1.8	0.2
Sum 81/82	6554	0.1	65.9	5.0	21.2	5.0	1.2	0.2	0.3	1.0	0.1
Aut 82	4734	0.0	67.9	4.7	20.6	5.0	0.5	0.3	0.1	0.9	0.0
Win 82	7642	0.1	61.6	4.0	24.6	6.0	0.7	0.7	0.6	1.2	0.3
Spr 82	3221	0.1	59.5	4.9	26.1	5.7	0.8	1.0	0.7	1.0	0.3
Total	46342	0.2	64.5	4.8	19.9	6.6	1.2	0.8	0.4	1.5	0.2

Aktivitäts-Budget ?

BIOLOGY OF THE RABBIT (ORYCTOLAGUS CUNICULUS (L.))
IN CENTRAL OTAGO, NEW ZEALAND,
WITH EMPHASIS ON BEHAVIOUR AND ITS RELEVANCE TO
POISON CONTROL OPERATIONS

A thesis
submitted in fulfilment
of the requirements for the Degree
of
Doctor of Philosophy in Zoology
in the
University of Canterbury
by
K W Fraser

University of Canterbury
1985

Table 6.1 Frequency of occurrence of observations in the 10 behaviour categories for transect sampling.

		Percent of observations									
Season	n	Miscellaneous	Feeding	Grooming	Resting	Locomotory	Alert	Reproductive	Territorial	Aggressive	Displacement
Spr 80	2533	0.8	60.6	3.9	15.6	11.1	2.2	3.0	0.7	2.1	0.1
Sum 80/81	5485	0.3	65.5	4.5	17.6	9.0	1.4	0.4	0.4	0.8	0.1
Aut 81	5417	0.3	67.6	4.9	13.8	8.4	1.5	0.4	0.4	2.6	0.2
Win 81	4518	0.1	61.8	6.2	19.7	6.9	1.6	0.8	0.6	2.1	0.2
Spr 81	6238	0.1	67.0	4.8	18.4	4.9	1.1	1.4	0.5	1.8	0.2
Sum 81/82	6554	0.1	65.9	5.0	21.2	5.0	1.2	0.2	0.3	1.0	0.1
Aut 82	4734	0.0	67.9	4.7	20.6	5.0	0.5	0.3	0.1	0.9	0.0
Win 82	7642	0.1	61.6	4.0	24.6	6.0	0.7	0.7	0.6	1.2	0.3
Spr 82	3221	0.1	59.5	4.9	26.1	5.7	0.8	1.0	0.7	1.0	0.3
Total	46342	0.2	64.5	4.8	19.9	6.6	1.2	0.8	0.4	1.5	0.2

Aktivitäts-Budget

CONTINUOUS OBSERVATIONS OF THE ACTIVITY OF THE WILD RABBIT, *ORYCTOLAGUS CUNICULUS* (L.), DURING 24-HOUR PERIODS

By R. Mykytowycz* and Ian Rowley*

[*Manuscript received March 11, 1958*]

Summary

Continuous observations during three separate 24-hour periods were carried out in late spring on a population of individually marked wild rabbits, *Oryctolagus cuniculus* (L.), established in an artificially illuminated enclosure. Rabbits were observed to feed throughout the night, with a peak at 2100 hr. Sexual behaviour during post-partum oestrus, and copulation between a buck and a virgin doe, are described. An account of the daily activities of individual rabbits is given; and the bearing of the observed pattern of activity on the reliability of sight counts for the estimation of rabbit populations is discussed.

I. Introduction

Although it is generally accepted that a knowledge of an animal's activity throughout the 24 hours is essential to the interpretation of its behaviour very few animals have been thus observed. There are some reports dealing with domestic species (Tribe 1949), but the problems involved in the study of wild ones are very much greater. This is especially so in the case of the rabbit, which is mainly nocturnal. During studies of a rabbit colony in an enclosure which could be artificially illuminated at night (Mykytowycz 1958), a unique opportunity arose for continuous observation, and some of the results are reported in this paper.

These observations cover only a limited period and relate to specific conditions of both population density and breeding cycle; and some of them might not apply under different circumstances and at a different season. Thus Rowley (1957) has recorded seasonal changes in emergence time; and shortly after the termination of the observations recorded in this paper, a deterioration in the quantity and quality of the pasture led to changes in grazing behaviour.

II. Methods

The specially built enclosure which was used and the facilities available for watching the rabbits are described elsewhere (Mykytowycz 1958). Not counting nestlings, at the time of observations reported here the enclosure was occupied by 53 animals all of which, except for 10 very young kittens, were conspicuously fur-dyed with individual patterns and carried "Scotchlite" ear tags. This assured an easy recording of surface activity both by day and night. Some of these rabbits were warren-dwellers whilst others remained permanently above ground. When the latter occupied their habitual resting "squats" (which were, in effect, equivalent to warrens) they were not considered as being "active on the surface".

*Wildlife Survey Section, C.S.I.R.O., Canberra.

TIME SPENT BY REPRESENTATIVE INDIVIDUAL RABBITS IN VARIOUS ACTIVITIES OVER A 24-HOUR PERIOD

Status of Rabbit	Percentage of Total Time						Total Time Visible (hr)
	Grazing	Resting	Running	Washing	Aggression	Copulation	
Dominant buck	37	19	14	7	16	7	13¾
Dominant doe (pregnant)	64	20	2	7	7	0	11
Subordinate doe (pregnant)	53	36	2	7	2	0	11¼
Juvenile buck	53	15	4	19	9*	0	11¼
Virgin doe	29	17	5	3	10*	36	13¼

Aktivitäts-Budget

CONTINUOUS OBSERVATIONS OF THE ACTIVITY OF THE WILD RABBIT, *ORYCTOLAGUS CUNICULUS* (L.), DURING 24-HOUR PERIODS

By R. Mykytowycz* and Ian Rowley*

[*Manuscript received March 11, 1958*]

Summary

Continuous observations during three separate 24-hour periods were carried out in late spring on a population of individually marked wild rabbits, *Oryctolagus cuniculus* (L.), established in an artificially illuminated enclosure. Rabbits were observed to feed throughout the night, with a peak at 2100 hr. Sexual behaviour during post-partum oestrus, and copulation between a buck and a virgin doe, are described. An account of the daily activities of individual rabbits is given; and the bearing of the observed pattern of activity on the reliability of sight counts for the estimation of rabbit populations is discussed.

I. Introduction

Although it is generally accepted that a knowledge of an animal's activity throughout the 24 hours is essential to the interpretation of its behaviour very few animals have been thus observed. There are some reports dealing with domestic species (Tribe 1949), but the problems involved in the study of wild ones are very much greater. This is especially so in the case of the rabbit, which is mainly nocturnal. During studies of a rabbit colony in an enclosure which could be artificially illuminated at night (Mykytowycz 1958), a unique opportunity arose for continuous observation, and some of the results are reported in this paper.

These observations cover only a limited period and relate to specific conditions of both population density and breeding cycle; and some of them might not apply under different circumstances and at a different season. Thus Rowley (1957) has recorded seasonal changes in emergence time; and shortly after the termination of the observations recorded in this paper, a deterioration in the quantity and quality of the pasture led to changes in grazing behaviour.

II. Methods

The specially built enclosure which was used and the facilities available for watching the rabbits are described elsewhere (Mykytowycz 1958). Not counting nestlings, at the time of observations reported here the enclosure was occupied by 53 animals all of which, except for 10 very young kittens, were conspicuously fur-dyed with individual patterns and carried "Scotchlite" ear tags. This assured an easy recording of surface activity both by day and night. Some of these rabbits were warren-dwellers whilst others remained permanently above ground. When the latter occupied their habitual resting "squats" (which were, in effect, equivalent to warrens) they were not considered as being "active on the surface".

*Wildlife Survey Section, C.S.I.R.O., Canberra.

TIME SPENT BY REPRESENTATIVE INDIVIDUAL RABBITS IN VARIOUS ACTIVITIES OVER A 24-HOUR PERIOD

Status of Rabbit	Percentage of Total Time						Total Time Visible (hr)
	Grazing	Resting	Running	Washing	Aggression	Copulation	
Dominant buck	37	19	14	7	16	7	13¾
Dominant doe (pregnant)	64	20	2	7	7	0	11
Subordinate doe (pregnant)	53	36	2	7	2	0	11¼
Juvenile buck	53	15	4	19	9*	0	11¼
Virgin doe	29	17	5	3	10*	36	13¼

Aktivitäts-Budget

CONTINUOUS OBSERVATIONS OF THE ACTIVITY OF THE WILD RABBIT, *ORYCTOLAGUS CUNICULUS* (L.), DURING 24-HOUR PERIODS

By R. Mykytowycz* and Ian Rowley*

[*Manuscript received March 11, 1958*]

Summary

Continuous observations during three separate 24-hour periods were carried out in late spring on a population of individually marked wild rabbits, *Oryctolagus cuniculus* (L.), established in an artificially illuminated enclosure. Rabbits were observed to feed throughout the night, with a peak at 2100 hr. Sexual behaviour during post-partum oestrus, and copulation between a buck and a virgin doe, are described. An account of the daily activities of individual rabbits is given; and the bearing of the observed pattern of activity on the reliability of sight counts for the estimation of rabbit populations is discussed.

I. Introduction

Although it is generally accepted that a knowledge of an animal's activity throughout the 24 hours is essential to the interpretation of its behaviour very few animals have been thus observed. There are some reports dealing with domestic species (Tribe 1949), but the problems involved in the study of wild ones are very much greater. This is especially so in the case of the rabbit, which is mainly nocturnal. During studies of a rabbit colony in an enclosure which could be artificially illuminated at night (Mykytowycz 1958), a unique opportunity arose for continuous observation, and some of the results are reported in this paper.

These observations cover only a limited period and relate to specific conditions of both population density and breeding cycle; and some of them might not apply under different circumstances and at a different season. Thus Rowley (1957) has recorded seasonal changes in emergence time; and shortly after the termination of the observations recorded in this paper, a deterioration in the quantity and quality of the pasture led to changes in grazing behaviour.

II. Methods

The specially built enclosure which was used and the facilities available for watching the rabbits are described elsewhere (Mykytowycz 1958). Not counting nestlings, at the time of observations reported here the enclosure was occupied by 53 animals all of which, except for 10 very young kittens, were conspicuously fur-dyed with individual patterns and carried "Scotchlite" ear tags. This assured an easy recording of surface activity both by day and night. Some of these rabbits were warren-dwellers whilst others remained permanently above ground. When the latter occupied their habitual resting "squats" (which were, in effect, equivalent to warrens) they were not considered as being "active on the surface".

*Wildlife Survey Section, C.S.I.R.O., Canberra.

TIME SPENT BY REPRESENTATIVE INDIVIDUAL RABBITS IN VARIOUS ACTIVITIES OVER A 24-HOUR PERIOD

Status of Rabbit	Percentage of Total Time						Total Time Visible (hr)
	Grazing	Resting	Running	Washing	Aggression	Copulation	
Dominant buck	37	19	14	7	16	7	13¾
Dominant doe (pregnant)	64	20	2	7	7	0	11
Subordinate doe (pregnant)	53	36	2	7	2	0	11¼
Juvenile buck	53	15	4	19	9*	0	11¼
Virgin doe	29	17	5	3	10*	36	13¼

4-7 h Futteraufnahme

Fütterung und Aktivitäts-Budget

SHORT COMMUNICATION: ASSESSMENT OF ACTIVITY PATTERNS OF GROWING RABBITS IN A FLUX-CONTROLLED CHAMBER

OLIVAS I.*, RODRÍGUEZ-LATORRE A.†, ESTELLÉS F.†, CALVET S.†, VILLAGRÁ A.*

World Rabbit Sci. 2013, 21: 107-110

	Average percentage of time (%)		
	Day	Night	Total
Lying	22.56±8.45	20.57±10.82	21.67±8.42
Sleeping	46.95[a]±8.39	33.46[b]±9.98	40.87±8.13
Sitting	5.74±1.57	5.23±1.68	5.55±1.54
Eating	6.60[a]±2.98	13.27[b]±4.93	9.56±3.45

Fütterung und Aktivitäts-Budget

SHORT COMMUNICATION: ASSESSMENT OF ACTIVITY PATTERNS OF GROWING RABBITS IN A FLUX-CONTROLLED CHAMBER

OLIVAS I.*, RODRÍGUEZ-LATORRE A.†, ESTELLÉS F.†, CALVET S.†, VILLAGRÁ A.*

World Rabbit Sci. 2013, 21: 107-110

	Average percentage of time (%)		
	Day	Night	Total
Lying	22.56±8.45	20.57±10.82	21.67±8.42
Sleeping	46.95[a]±8.39	33.46[b]±9.98	40.87±8.13
Sitting	5.74±1.57	5.23±1.68	5.55±1.54
Eating	6.60[a]±2.98	13.27[b]±4.93	9.56±3.45

Fütterung und Aktivitäts-Budget

SHORT COMMUNICATION: ASSESSMENT OF ACTIVITY PATTERNS OF GROWING RABBITS IN A FLUX-CONTROLLED CHAMBER

OLIVAS I.*, RODRÍGUEZ-LATORRE A.†, ESTELLÉS F.†, CALVET S.†, VILLAGRÁ A.*

World Rabbit Sci. 2013, 21: 107-110

	Average percentage of time (%)		
	Day	Night	Total
Lying	22.56±8.45	20.57±10.82	21.67±8.42
Sleeping	46.95[a]±8.39	33.46[b]±9.98	40.87±8.13
Sitting	5.74±1.57	5.23±1.68	5.55±1.54
Eating	6.60[a]±2.98	13.27[b]±4.93	9.56±3.45

2 h Futteraufnahme

Fütterung und Aktivitäts-Budget

Applied Animal Behaviour Science 169 (2015) 86–92

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

The effect of four different feeding regimes on rabbit behaviour

Jennifer L. Prebble[a,1,2], Fritha M. Langford[b], Darren J. Shaw[a], Anna L. Meredith[a,*]

[a] Royal (Dick) School of Veterinary Studies and the Roslin Institute, University of Edinburgh, Easter Bush Campus, Midlothian EH25 9RG, United Kingdom
[b] Animal and Veterinary Sciences, SRUC, West Mains Road, Edinburgh EH9 3JG, United Kingdom

ARTICLE INFO

Article history:
Received 10 June 2014
Received in revised form 4 May 2015
Accepted 10 May 2015
Available online 22 May 2015

Keywords:
Rabbit
Feeding
Behaviour
Abnormal behaviour
Hay

ABSTRACT

Dietary composition and presentation impacts on the behaviour of animals, and failure to provide a suitable diet can lead to reduced welfare through the development of poor health, the inability to express normal behaviours and the development of abnormal behaviours. This study assessed the effects of two commonly fed pet rabbit diets (extruded nuggets with hay (EH) and muesli with hay (MH)) alongside hay only (HO) and muesli only (MO) on the behaviour of 32 Dutch rabbits observed over 17 months. Increased time spent feeding was observed in the groups fed ad libitum hay (HO, EH, MH) compared to the MO group ($P < 0.05$). A corresponding high level of inactivity was observed in the MO group compared to rabbits receiving hay ($P < 0.05$). In the groups provided with hay a preference to consume hay in a natural grazing posture was observed. The higher activity levels and absence of abnormal behaviours when hay was fed support recommendations that forage should form a significant portion of the diet for domestic rabbits.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

As herbivores, wild rabbits consume relatively large amounts of a high fibre diet of low nutritional quality (Williams and Wells, 1974). This requires them to apportion a large amount of their time budget to grazing. Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962). Caecotrophy is performed while underground (Southern, 1942). Domestic rabbits kept in free range conditions exhibit a similar feeding pattern to their wild counterparts (Vastrade, 1987; Lehmann, 1991). In contrast, many pet rabbits are housed in small hutches with limited exercise opportunities (Mullan and Main, 2006; PDSA, 2011) and a diet consisting largely of concentrates (mono-component nugget or muesli mixes) (PDSA, 2011) which can be consumed rapidly (Lidfors, 1997), with limited or no access to hay or grass (Mullan and Main, 2006; PDSA, 2011).

Stereotypic behaviours are described as behaviours that are relatively invariant, regularly repeated and without an obvious function (Mason, 1991). Stereotypic behaviours reported to occur in laboratory rabbits include excessive grooming, sham chewing (chewing with nothing in mouth), bar biting, licking parts of cage, digging against cage, biting water nipple, sliding nose against bars, head pressing and running repeatedly in a defined pattern (Gunn and Morton, 1995; Lidfors, 1997). An apathetic state of inactivity and boredom has also been reported by Gunn and Morton (1995). Stereotypic behaviours occur most frequently during the night (Gunn and Morton, 1995) when rabbits are naturally at their most active (Mykytowycz, 1958).

Whilst not studied in pet rabbits, the beneficial impact of providing hay to laboratory rabbits has been demonstrated (Lidfors, 1997; Berthelsen and Hansen, 1999). The provision of hay to individually housed laboratory rabbits has proved effective at reducing the expression of abnormal behaviours (Lidfors, 1997; Berthelsen and Hansen, 1999).

Rabbits can consume pelleted feeds rapidly (Lidfors, 1997) and, whilst they may provide adequate nutrition for the maintenance of the rabbit, foraging behaviour is limited. If fed in limited amounts the rapid consumption of the daily ration may leave the rabbit in a state of hunger for a considerable portion of the day (Lidfors, 1997). It has been suggested that stereotypies in pigs and broiler

* Corresponding author. Tel.: +44 1316517457.
E-mail address: Anna.Meredith@ed.ac.uk (A.L. Meredith).
[1] J.P. was employed on a KTP partnership between the Royal (Dick) School of Veterinary Studies and Burgess Pet Care, Victory Mill, Priestman's Lane, Thornton-Le-Dale, Pickering, North Yorkshire YO18 7RU, United Kingdom.
[2] Current address: Askham Bryan College, Askham Bryan, York YO23 3FR, United Kingdom.

http://dx.doi.org/10.1016/j.applanim.2015.05.003
0168-1591/© 2015 Elsevier B.V. All rights reserved.

Fütterung und Aktivitäts-Budget

Applied Animal Behaviour Science 169 (2015) 86–92

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

The effect of four different feeding regimes on rabbit behaviour

Jennifer L. Prebble[a,1,2], Fritha M. Langford[b], Darren J. Shaw[a], Anna L. Meredith[a,*]

[a] Royal (Dick) School of Veterinary Studies and the Roslin Institute, University of Edinburgh, Easter Bush Campus, Midlothian EH25 9RG, United Kingdom
[b] Animal and Veterinary Sciences, SRUC, West Mains Road, Edinburgh EH9 3JG, United Kingdom

ARTICLE INFO

Article history:
Received 10 June 2014
Received in revised form 4 May 2015
Accepted 10 May 2015
Available online 22 May 2015

Keywords:
Rabbit
Feeding
Behaviour
Abnormal behaviour
Hay

ABSTRACT

Dietary composition and presentation impacts on the behaviour of animals, and failure to provide a suitable diet can lead to reduced welfare through the development of poor health, the inability to express normal behaviours and the development of abnormal behaviours. This study assessed the effects of two commonly fed pet rabbit diets (extruded nuggets with hay (EH) and muesli with hay (MH)) alongside hay only (HO) and muesli only (MO) on the behaviour of 32 Dutch rabbits observed over 17 months. Increased time spent feeding was observed in the groups fed ad libitum hay (HO, EH, MH) compared to the MO group ($P < 0.05$). A corresponding high level of inactivity was observed in the MO group compared to rabbits receiving hay ($P < 0.05$). In the groups provided with hay a preference to consume hay in a natural grazing posture was observed. The higher activity levels and absence of abnormal behaviours when hay was fed support recommendations that forage should form a significant portion of the diet for domestic rabbits.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

As herbivores, wild rabbits consume relatively large amounts of a high fibre diet of low nutritional quality (Williams and Wells, 1974). This requires them to apportion a large amount of their time budget to grazing. Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962). Caecotrophy is performed while underground (Southern, 1942). Domestic rabbits kept in free range conditions exhibit a similar feeding pattern to their wild counterparts (Vastrade, 1987; Lehmann, 1991). In contrast, many pet rabbits are housed in small hutches with limited exercise opportunities (Mullan and Main, 2006; PDSA, 2011) and a diet consisting largely of concentrates (mono-component nugget or muesli mixes) (PDSA, 2011) which can be consumed rapidly (Lidfors, 1997), with limited or no access to hay or grass (Mullan and Main, 2006; PDSA, 2011).

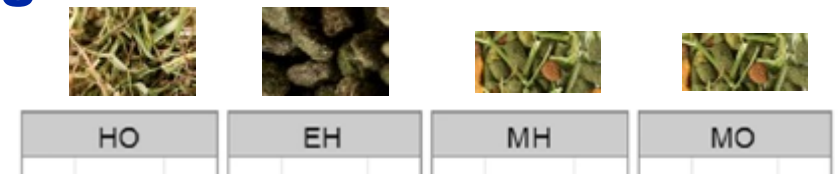
Stereotypic behaviours are described as behaviours that are relatively invariant, regularly repeated and without an obvious function (Mason, 1991). Stereotypic behaviours reported to occur in laboratory rabbits include excessive grooming, sham chewing (chewing with nothing in mouth), bar biting, licking parts of cage, digging against cage, biting water nipple, sliding nose against bars, head pressing and running repeatedly in a defined pattern (Gunn and Morton, 1995; Lidfors, 1997). An apathetic state of inactivity and boredom has also been reported by Gunn and Morton (1995). Stereotypic behaviours occur most frequently during the night (Gunn and Morton, 1995) when rabbits are naturally at their most active (Mykytowycz, 1958).

Whilst not studied in pet rabbits, the beneficial impact of providing hay to laboratory rabbits has been demonstrated (Lidfors, 1997; Berthelsen and Hansen, 1999). The provision of hay to individually housed laboratory rabbits has proved effective at reducing the expression of abnormal behaviours (Lidfors, 1997; Berthelsen and Hansen, 1999).

Rabbits can consume pelleted feeds rapidly (Lidfors, 1997) and, whilst they may provide adequate nutrition for the maintenance of the rabbit, foraging behaviour is limited. If fed in limited amounts the rapid consumption of the daily ration may leave the rabbit in a state of hunger for a considerable portion of the day (Lidfors, 1997). It has been suggested that stereotypies in pigs and broiler

* Corresponding author. Tel.: +44 1316517457.
E-mail address: Anna.Meredith@ed.ac.uk (A.L. Meredith).
[1] J.P. was employed on a KTP partnership between the Royal (Dick) School of Veterinary Studies and Burgess Pet Care, Victory Mill, Priestman's Lane, Thornton-Le-Dale, Pickering, North Yorkshire YO18 7RU, United Kingdom.
[2] Current address: Askham Bryan College, Askham Bryan, York YO23 3FR, United Kingdom.

http://dx.doi.org/10.1016/j.applanim.2015.05.003
0168-1591/© 2015 Elsevier B.V. All rights reserved.



Fütterung und Aktivitäts-Budget

Applied Animal Behaviour Science 169 (2015) 86–92

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

The effect of four different feeding regimes on rabbit behaviour

Jennifer L. Prebble[a,1,2], Fritha M. Langford[b], Darren J. Shaw[a], Anna L. Meredith[a,*]

[a] Royal (Dick) School of Veterinary Studies and the Roslin Institute, University of Edinburgh, Easter Bush Campus, Midlothian EH25 9RG, United Kingdom
[b] Animal and Veterinary Sciences, SRUC, West Mains Road, Edinburgh EH9 3JG, United Kingdom

ARTICLE INFO

Article history:
Received 10 June 2014
Received in revised form 4 May 2015
Accepted 10 May 2015
Available online 22 May 2015

Keywords:
Rabbit
Feeding
Behaviour
Abnormal behaviour
Hay

ABSTRACT

Dietary composition and presentation impacts on the behaviour of animals, and failure to provide a suitable diet can lead to reduced welfare through the development of poor health, the inability to express normal behaviours and the development of abnormal behaviours. This study assessed the effects of two commonly fed pet rabbit diets (extruded nuggets with hay (EH) and muesli with hay (MH)) alongside hay only (HO) and muesli only (MO) on the behaviour of 32 Dutch rabbits observed over 17 months. Increased time spent feeding was observed in the groups fed ad libitum hay (HO, EH, MH) compared to the MO group ($P < 0.05$). A corresponding high level of inactivity was observed in the MO group compared to rabbits receiving hay ($P < 0.05$). In the groups provided with hay a preference to consume hay in a natural grazing posture was observed. The higher activity levels and absence of abnormal behaviours when hay was fed support recommendations that forage should form a significant portion of the diet for domestic rabbits.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

As herbivores, wild rabbits consume relatively large amounts of a high fibre diet of low nutritional quality (Williams and Wells, 1974). This requires them to apportion a large amount of their time budget to grazing. Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962). Caecotrophy is performed while underground (Southern, 1942). Domestic rabbits kept in free range conditions exhibit a similar feeding pattern to their wild counterparts (Vastrade, 1987; Lehmann, 1991). In contrast, many pet rabbits are housed in small hutches with limited exercise opportunities (Mullan and Main, 2006; PDSA, 2011) and a diet consisting largely of concentrates (mono-component nugget or muesli mixes) (PDSA, 2011) which can be consumed rapidly (Lidfors, 1997), with limited or no access to hay or grass (Mullan and Main, 2006; PDSA, 2011).

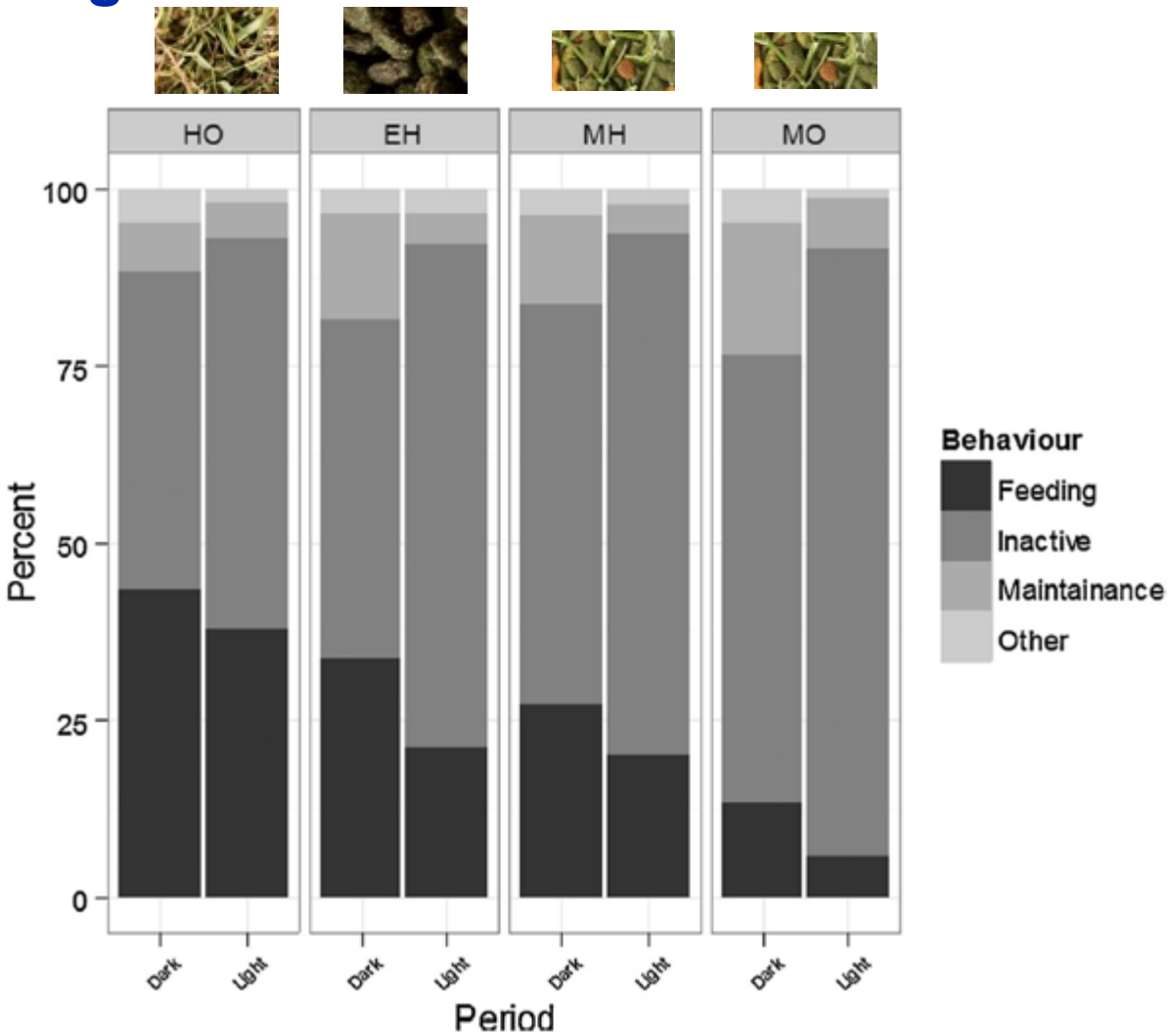
Stereotypic behaviours are described as behaviours that are relatively invariant, regularly repeated and without an obvious function (Mason, 1991). Stereotypic behaviours reported to occur in laboratory rabbits include excessive grooming, sham chewing (chewing with nothing in mouth), bar biting, licking parts of cage, digging against cage, biting water nipple, sliding nose against bars, head pressing and running repeatedly in a defined pattern (Gunn and Morton, 1995; Lidfors, 1997). An apathetic state of inactivity and boredom has also been reported by Gunn and Morton (1995). Stereotypic behaviours occur most frequently during the night (Gunn and Morton, 1995) when rabbits are naturally at their most active (Mykytowycz, 1958).

Whilst not studied in pet rabbits, the beneficial impact of providing hay to laboratory rabbits has been demonstrated (Lidfors, 1997; Berthelsen and Hansen, 1999). The provision of hay to individually housed laboratory rabbits has proved effective at reducing the expression of abnormal behaviours (Lidfors, 1997; Berthelsen and Hansen, 1999).

Rabbits can consume pelleted feeds rapidly (Lidfors, 1997) and, whilst they may provide adequate nutrition for the maintenance of the rabbit, foraging behaviour is limited. If fed in limited amounts the rapid consumption of the daily ration may leave the rabbit in a state of hunger for a considerable portion of the day (Lidfors, 1997). It has been suggested that stereotypies in pigs and broiler

* Corresponding author. Tel.: +44 1316517457.
E-mail address: Anna.Meredith@ed.ac.uk (A.L. Meredith).
[1] J.P. was employed on a KTP partnership between the Royal (Dick) School of Veterinary Studies and Burgess Pet Care, Victory Mill, Priestman's Lane, Thornton-Le-Dale, Pickering, North Yorkshire YO18 7RU, United Kingdom.
[2] Current address: Askham Bryan College, Askham Bryan, York YO23 3FR, United Kingdom.

http://dx.doi.org/10.1016/j.applanim.2015.05.003
0168-1591/© 2015 Elsevier B.V. All rights reserved.



Fütterung und Aktivitäts-Budget

Applied Animal Behaviour Science 169 (2015) 86–92

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

The effect of four different feeding regimes on rabbit behaviour

Jennifer L. Prebble[a,1,2], Fritha M. Langford[b], Darren J. Shaw[a], Anna L. Meredith[a,*]

[a] Royal (Dick) School of Veterinary Studies and the Roslin Institute, University of Edinburgh, Easter Bush Campus, Midlothian EH25 9RG, United Kingdom
[b] Animal and Veterinary Sciences, SRUC, West Mains Road, Edinburgh EH9 3JG, United Kingdom

ARTICLE INFO

Article history:
Received 10 June 2014
Received in revised form 4 May 2015
Accepted 10 May 2015
Available online 22 May 2015

Keywords:
Rabbit
Feeding
Behaviour
Abnormal behaviour
Hay

ABSTRACT

Dietary composition and presentation impacts on the behaviour of animals, and failure to provide a suitable diet can lead to reduced welfare through the development of poor health, the inability to express normal behaviours and the development of abnormal behaviours. This study assessed the effects of two commonly fed pet rabbit diets (extruded nuggets with hay (EH) and muesli with hay (MH)) alongside hay only (HO) and muesli only (MO) on the behaviour of 32 Dutch rabbits observed over 17 months. Increased time spent feeding was observed in the groups fed ad libitum hay (HO, EH, MH) compared to the MO group ($P < 0.05$). A corresponding high level of inactivity was observed in the MO group compared to rabbits receiving hay ($P < 0.05$). In the groups provided with hay a preference to consume hay in a natural grazing posture was observed. The higher activity levels and absence of abnormal behaviours when hay was fed support recommendations that forage should form a significant portion of the diet for domestic rabbits.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

As herbivores, wild rabbits consume relatively large amounts of a high fibre diet of low nutritional quality (Williams and Wells, 1974). This requires them to apportion a large amount of their time budget to grazing. Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962). Caecotrophy is performed while underground (Southern, 1942). Domestic rabbits kept in free range conditions exhibit a similar feeding pattern to their wild counterparts (Vastrade, 1987; Lehmann, 1991). In contrast, many pet rabbits are housed in small hutches with limited exercise opportunities (Mullan and Main, 2006; PDSA, 2011) and a diet consisting largely of concentrates (mono-component nugget or muesli mixes) (PDSA, 2011) which can be consumed rapidly (Lidfors, 1997), with limited or no access to hay or grass (Mullan and Main, 2006; PDSA, 2011).

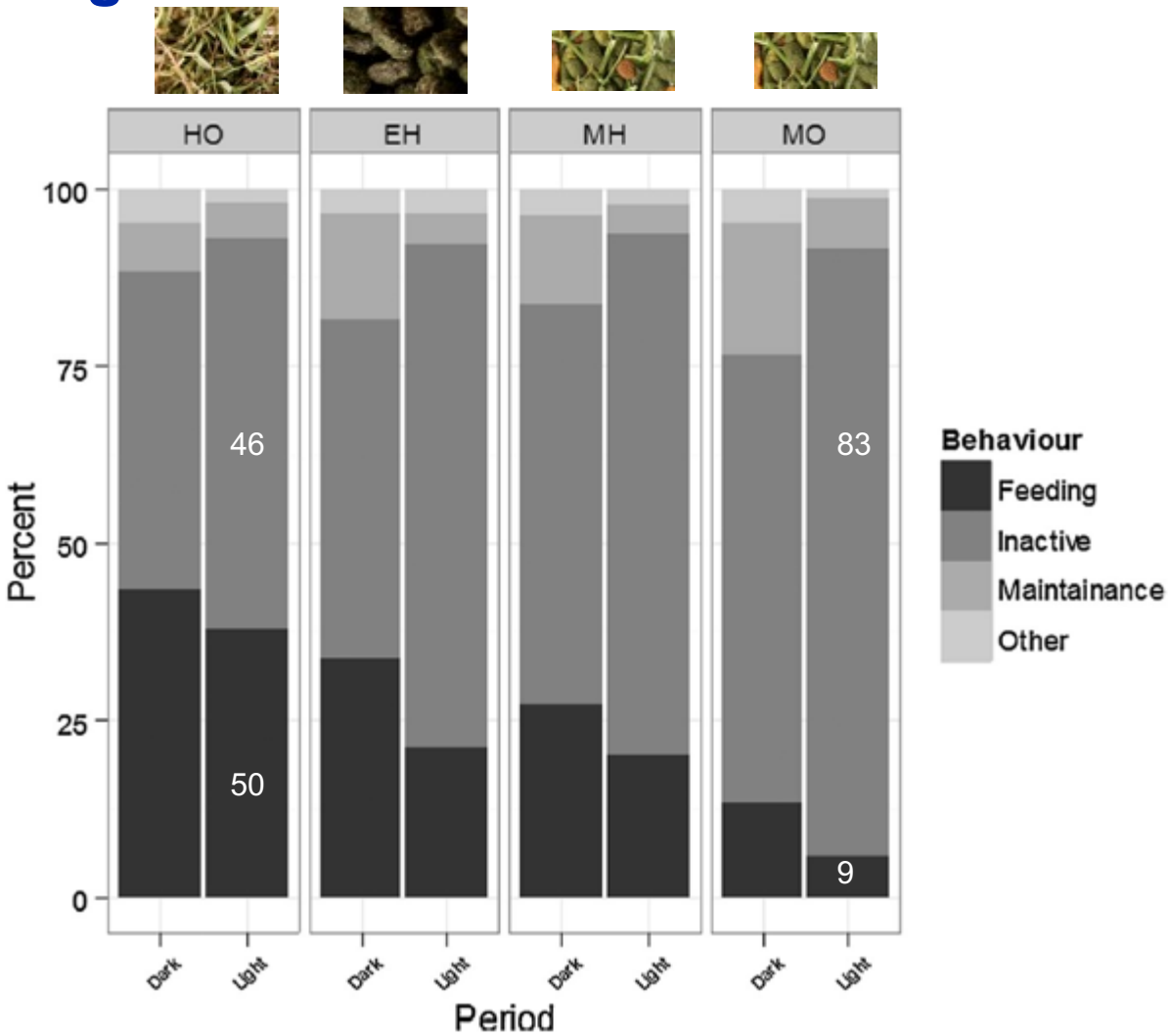
Stereotypic behaviours are described as behaviours that are relatively invariant, regularly repeated and without an obvious function (Mason, 1991). Stereotypic behaviours reported to occur in laboratory rabbits include excessive grooming, sham chewing (chewing with nothing in mouth), bar biting, licking parts of cage, digging against cage, biting water nipple, sliding nose against bars, head pressing and running repeatedly in a defined pattern (Gunn and Morton, 1995; Lidfors, 1997). An apathetic state of inactivity and boredom has also been reported by Gunn and Morton (1995). Stereotypic behaviours occur most frequently during the night (Gunn and Morton, 1995) when rabbits are naturally at their most active (Mykytowycz, 1958).

Whilst not studied in pet rabbits, the beneficial impact of providing hay to laboratory rabbits has been demonstrated (Lidfors, 1997; Berthelsen and Hansen, 1999). The provision of hay to individually housed laboratory rabbits has proved effective at reducing the expression of abnormal behaviours (Lidfors, 1997; Berthelsen and Hansen, 1999).

Rabbits can consume pelleted feeds rapidly (Lidfors, 1997) and, whilst they may provide adequate nutrition for the maintenance of the rabbit, foraging behaviour is limited. If fed in limited amounts the rapid consumption of the daily ration may leave the rabbit in a state of hunger for a considerable portion of the day (Lidfors, 1997). It has been suggested that stereotypies in pigs and broiler

* Corresponding author. Tel.: +44 1316517457.
E-mail address: Anna.Meredith@ed.ac.uk (A.L. Meredith).
[1] J.P. was employed on a KTP partnership between the Royal (Dick) School of Veterinary Studies and Burgess Pet Care, Victory Mill, Priestman's Lane, Thornton-Le-Dale, Pickering, North Yorkshire YO18 7RU, United Kingdom.
[2] Current address: Askham Bryan College, Askham Bryan, York YO23 3FR, United Kingdom.

http://dx.doi.org/10.1016/j.applanim.2015.05.003
0168-1591/© 2015 Elsevier B.V. All rights reserved.



Fütterung und Aktivitäts-Budget

Applied Animal Behaviour Science 169 (2015) 86–92

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

The effect of four different feeding regimes on rabbit behaviour

Jennifer L. Prebble[a,1,2], Fritha M. Langford[b], Darren J. Shaw[a], Anna L. Meredith[a,*]

[a] Royal (Dick) School of Veterinary Studies and the Roslin Institute, University of Edinburgh, Easter Bush Campus, Midlothian EH25 9RG, United Kingdom
[b] Animal and Veterinary Sciences, SRUC, West Mains Road, Edinburgh EH9 3JG, United Kingdom

ARTICLE INFO

Article history:
Received 10 June 2014
Received in revised form 4 May 2015
Accepted 10 May 2015
Available online 22 May 2015

Keywords:
Rabbit
Feeding
Behaviour
Abnormal behaviour
Hay

ABSTRACT

Dietary composition and presentation impacts on the behaviour of animals, and failure to provide a suitable diet can lead to reduced welfare through the development of poor health, the inability to express normal behaviours and the development of abnormal behaviours. This study assessed the effects of two commonly fed pet rabbit diets (extruded nuggets with hay (EH) and muesli with hay (MH)) alongside hay only (HO) and muesli only (MO) on the behaviour of 32 Dutch rabbits observed over 17 months. Increased time spent feeding was observed in the groups fed ad libitum hay (HO, EH, MH) compared to the MO group ($P < 0.05$). A corresponding high level of inactivity was observed in the MO group compared to rabbits receiving hay ($P < 0.05$). In the groups provided with hay a preference to consume hay in a natural grazing posture was observed. The higher activity levels and absence of abnormal behaviours when hay was fed support recommendations that forage should form a significant portion of the diet for domestic rabbits.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

As herbivores, wild rabbits consume relatively large amounts of a high fibre diet of low nutritional quality (Williams and Wells, 1974). This requires them to apportion a large amount of their time budget to grazing. Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962). Caecotrophy is performed while underground (Southern, 1942). Domestic rabbits kept in free range conditions exhibit a similar feeding pattern to their wild counterparts (Vastrade, 1987; Lehmann, 1991). In contrast, many pet rabbits are housed in small hutches with limited exercise opportunities (Mullan and Main, 2006; PDSA, 2011) and a diet consisting largely of concentrates (mono-component nugget or muesli mixes) (PDSA, 2011) which can be consumed rapidly (Lidfors, 1997), with limited or no access to hay or grass (Mullan and Main, 2006; PDSA, 2011).

Stereotypic behaviours are described as behaviours that are relatively invariant, regularly repeated and without an obvious function (Mason, 1991). Stereotypic behaviours reported to occur in laboratory rabbits include excessive grooming, sham chewing (chewing with nothing in mouth), bar biting, licking parts of cage, digging against cage, biting water nipple, sliding nose against bars, head pressing and running repeatedly in a defined pattern (Gunn and Morton, 1995; Lidfors, 1997). An apathetic state of inactivity and boredom has also been reported by Gunn and Morton (1995). Stereotypic behaviours occur most frequently during the night (Gunn and Morton, 1995) when rabbits are naturally at their most active (Mykytowycz, 1958).

Whilst not studied in pet rabbits, the beneficial impact of providing hay to laboratory rabbits has been demonstrated (Lidfors, 1997; Berthelsen and Hansen, 1999). The provision of hay to individually housed laboratory rabbits has proved effective at reducing the expression of abnormal behaviours (Lidfors, 1997; Berthelsen and Hansen, 1999).

Rabbits can consume pelleted feeds rapidly (Lidfors, 1997) and, whilst they may provide adequate nutrition for the maintenance of the rabbit, foraging behaviour is limited. If fed in limited amounts the rapid consumption of the daily ration may leave the rabbit in a state of hunger for a considerable portion of the day (Lidfors, 1997). It has been suggested that stereotypies in pigs and broiler

* Corresponding author. Tel.: +44 1316517457.
E-mail address: Anna.Meredith@ed.ac.uk (A.L. Meredith).
[1] J.P. was employed on a KTP partnership between the Royal (Dick) School of Veterinary Studies and Burgess Pet Care, Victory Mill, Priestman's Lane, Thornton-Le-Dale, Pickering, North Yorkshire YO18 7RU, United Kingdom.
[2] Current address: Askham Bryan College, Askham Bryan, York YO23 3FR, United Kingdom.

http://dx.doi.org/10.1016/j.applanim.2015.05.003
0168-1591/© 2015 Elsevier B.V. All rights reserved.

8-10 h Fressen
10 h ‘inaktiv’

2 h Fressen
15-18 h ‘inaktiv’

Fütterung und Aktivitäts-Budget

Applied Animal Behaviour Science 169 (2015) 86–92

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

The effect of four different feeding regimes on rabbit behaviour

Jennifer L. Prebble[a,1,2], Fritha M. Langford[b], Darren J. Shaw[a], Anna L. Meredith[a,*]

[a] Royal (Dick) School of Veterinary Studies and the Roslin Institute, University of Edinburgh, Easter Bush Campus, Midlothian EH25 9RG, United Kingdom
[b] Animal and Veterinary Sciences, SRUC, West Mains Road, Edinburgh EH9 3JG, United Kingdom

ARTICLE INFO

Article history:
Received 10 June 2014
Received in revised form 4 May 2015
Accepted 10 May 2015
Available online 22 May 2015

Keywords:
Rabbit
Feeding
Behaviour
Abnormal behaviour
Hay

ABSTRACT

Dietary composition and presentation impacts on the behaviour of animals, and failure to provide a suitable diet can lead to reduced welfare through the development of poor health, the inability to express normal behaviours and the development of abnormal behaviours. This study assessed the effects of two commonly fed pet rabbit diets (extruded nuggets with hay (EH) and muesli with hay (MH)) alongside hay only (HO) and muesli only (MO) on the behaviour of 32 Dutch rabbits observed over 17 months. Increased time spent feeding was observed in the groups fed ad libitum hay (HO, EH, MH) compared to the MO group ($P < 0.05$). A corresponding high level of inactivity was observed in the MO group compared to rabbits receiving hay ($P < 0.05$). In the groups provided with hay a preference to consume hay in a natural grazing posture was observed. The higher activity levels and absence of abnormal behaviours when hay was fed support recommendations that forage should form a significant portion of the diet for domestic rabbits.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

As herbivores, wild rabbits consume relatively large amounts of a high fibre diet of low nutritional quality (Williams and Wells, 1974). This requires them to apportion a large amount of their time budget to grazing. Rabbits spend 30–70% of time outside the burrow grazing, pausing occasionally to groom (Mykytowycz, 1958; Myers and Poole, 1961; Myers and Mykytowycz, 1958; Lockley, 1961). Time spent eating varies with age, sex and social status within the group and has also been shown to increase when food availability falls during drought (Myers and Mykytowycz, 1958; Mykytowycz, 1958). Grazing occurs mainly during late afternoon and throughout the night and daylight hours are spent underground in warrens (Myers and Mykytowycz, 1958; Mykytowycz, 1958; Lockley, 1961, 1962). Caecotrophy is performed while underground (Southern, 1942). Domestic rabbits kept in free range conditions exhibit a similar feeding pattern to their wild counterparts (Vastrade, 1987; Lehmann, 1991). In contrast, many pet rabbits are housed in small hutches with limited exercise opportunities (Mullan and Main, 2006; PDSA, 2011) and a diet consisting largely of concentrates (mono-component nugget or muesli mixes) (PDSA, 2011) which can be consumed rapidly (Lidfors, 1997), with limited or no access to hay or grass (Mullan and Main, 2006; PDSA, 2011).

Stereotypic behaviours are described as behaviours that are relatively invariant, regularly repeated and without an obvious function (Mason, 1991). Stereotypic behaviours reported to occur in laboratory rabbits include excessive grooming, sham chewing (chewing with nothing in mouth), bar biting, licking parts of cage, digging against cage, biting water nipple, sliding nose against bars, head pressing and running repeatedly in a defined pattern (Gunn and Morton, 1995; Lidfors, 1997). An apathetic state of inactivity and boredom has also been reported by Gunn and Morton (1995). Stereotypic behaviours occur most frequently during the night (Gunn and Morton, 1995) when rabbits are naturally at their most active (Mykytowycz, 1958).

Whilst not studied in pet rabbits, the beneficial impact of providing hay to laboratory rabbits has been demonstrated (Lidfors, 1997; Berthelsen and Hansen, 1999). The provision of hay to individually housed laboratory rabbits has proved effective at reducing the expression of abnormal behaviours (Lidfors, 1997; Berthelsen and Hansen, 1999).

Rabbits can consume pelleted feeds rapidly (Lidfors, 1997) and, whilst they may provide adequate nutrition for the maintenance of the rabbit, foraging behaviour is limited. If fed in limited amounts the rapid consumption of the daily ration may leave the rabbit in a state of hunger for a considerable portion of the day (Lidfors, 1997). It has been suggested that stereotypies in pigs and broiler

* Corresponding author. Tel.: +44 1316517457.
E-mail address: Anna.Meredith@ed.ac.uk (A.L. Meredith).
[1] J.P. was employed on a KTP partnership between the Royal (Dick) School of Veterinary Studies and Burgess Pet Care, Victory Mill, Priestman's Lane, Thornton-Le-Dale, Pickering, North Yorkshire YO18 7RU, United Kingdom.
[2] Current address: Askham Bryan College, Askham Bryan, York YO23 3FR, United Kingdom.

http://dx.doi.org/10.1016/j.applanim.2015.05.003
0168-1591/© 2015 Elsevier B.V. All rights reserved.

8-10 h Fressen
10 h 'inaktiv'

wie im natürlichen Habitat

2 h Fressen
15-18 h 'inaktiv'

wie bei Laborkaninchen

University of Zurich[UZH]

Clinic for Zoo Animals, Exotic Pets and Wildlife

Meerschweinchen & Chinchilla

Natürliche Futterwahl: Meerschweinchen

Meerschweinchen fressen in freier Wildbahn hauptsächlich Gräser

Guichón & Cassini (1998), Argentinien:

	Rohfaser	NDF	Rohprotein
Gramineae	30	61	10
Lolium	25	53	16
Cynodon	26	55	10

Angaben zu RF, NDF und RP (in % TS) aus: Duke JA., Atchley AA. 1986. CRC Handbook of proximate analysis tabales of higher plants. CRC Press

Role of diet selection in the use of habitat by pampas cavies *Cavia aperea pamparum* (Mammalia, Rodentia)

by M.L. GUICHÓN and M.H. CASSINI

Universidad Nacional de Luján, Ruta 5 y 7, 6700 Luján, Argentina

Summary. – Wild guinea pigs (cavies : *Cavia aperea pamparum*) are neotropical rodents that frequently inhabit linear habitats as field margins and roadsides which have a zone of tall and dense vegetation. Cavies use them for protection from predators, and feed in adjacent open zones of short vegetation. The aim of this study is to determine the factors that influence the spatial distribution of cavies along these linear habitats. Our hypothesis was that diet preferences for certain plant species or group of species influenced the use of space by cavies. The study area was a field margin of 750 m long, sampled in winter and summer. Diet selection was studied by microhistological analysis of faeces and by field experiments. The composition of the vegetation was sampled by a punctual interception method and abundance of cavies was estimated by direct observation of the animals. Cavies preferred Gramineae plants and, in particular, *Lolium sp.*; but animal distribution along the field margin was not related to these plant preferences. Other characteristics of the feeding sites, e.g. quality of the food with respect to its water content, availability of shade, and differential predation risk, could explain the spatial distribution of the animals. This is the first systematic study of diet and habitat use conducted on cavies, which combines observational and experimental studies in the field to study the relationship between these two important aspects of behaviour.

Résumé. – Les cobayes sauvages *(Cavia aperea pamparum)* sont des rongeurs de la région néotropicale qui fréquentent des habitats linéaires tels que les bords de champs et de routes, possédant une végétation haute et dense servant de protection contre les prédateurs, et situés à côté de zones plus ouvertes de végétation basse où ils s'alimentent. L'objectif de ce travail est de déterminer les facteurs qui influencent la distribution spatiale des cobayes le long de ces éléments linéaires. Nous posons pour hypothèse que le choix de certaines espèces de plantes ou groupes d'espèces influence l'utilisation de l'espace par les cobayes. La zone d'étude concerne une bordure de 750 m de long, relevée en hiver et en été. Les choix alimentaires ont été étudiés par des analyses coprologiques et par des expériences de terrain. La composition de la végétation a été évaluée par une méthode d'interception ponctuelle et l'abondance des cobayes par l'observation directe des animaux. Ceux-ci préfèrent les Graminées et, en particulier, *Lolium sp.* ; cependant la distribution des individus sur la bordure n'apparaît pas corrélée à leurs préférences. D'autres caractéristiques comme la qualité de nourriture en relation avec son contenu en eau, la disponibilité de l'ombre, et le risque d'attaque, pourraient expliquer la distribution spatiale des animaux. Ce travail est la première étude systématique sur la nourriture et l'utilisation de l'habitat par les cobayes, et combine des observations et des expériences de terrain pour étudier la relation entre ces deux aspects de leur éco-éthologie.

Mammalia, t. 62, n° 1, 1998 : 23-35.

Aktivitäts-Budget Meerschweinchen

Behav. Ecol. Sociobiol. 6, 265–276 (1980)

Behavioral Ecology and Sociobiology
© by Springer-Verlag 1980

Spacing Patterns in a Colony of Guinea Pigs: Predictability from Environmental and Social Factors

Stefan Fuchs

Zoologisches Institut der Technischen Hochschule Darmstadt, Schnittspahnstrasse 3, D-6100 Darmstadt, Federal Republic of Germany

Received December 27, 1978 / Accepted November 20, 1979

Summary. 1. Positions and behavior of six male and eight female guinea pigs kept outside in a 12×12 m^2 pen with a central shelter were recorded over one month in 288 scans. Data were analyzed by statistical and by information analysis methods. Two main states were distinguished: behavior in the field ('activity,' 47%), consisting mainly of feeding (42%); and that at the shelter ('inactivity,' 53%), consisting mainly of resting (46%). Only 2% of the observations were of social behavior. Males were about 10% more often active than females, apparently as a result of being subject to more aggressive acts, especially within the resting site. Observations of aggressive interactions also showed one male dominating all others, which were all of equal rank.

2. The daytime distribution of activity showed two peaks at 0600–0700 hours and 1800–2000 hours. Some activity took place during the night. An 18% reduction of uncertainty in prediction of an individual's activity resulted if the time of day was considered, and for group activity (> 5 animals active) the reduction was 29%. Activity was socially synchronized within the group, as was shown experimentally. The uncertainty of an average individual's activity was reduced by 29% if group activity was considered.

3. In the shelter, sexes and individuals showed preferences for specific locations. Males kept closer to the entrance. Nearest-neighbor frequencies, huddle frequencies, and frequencies at which animals were inside the shelter at the same time did not differ significantly, but males kept further apart from other animals than did females. In the field, no differences were found in nearest-neighbor frequencies or nearest-neighbor distances. Individuals had preferred areas, and the uncertainty of an average animal's location was reduced by 1% if its identity was known. Location in the field was affected by time of day, knowledge of which reduced the uncertainty of an average individual's position by 9%. Group cohesion affected the animal's position more strongly, however, reducing uncertainty by 16%. Active maintainance of proximity during feeding was shown experimentally.

Introduction

The aim of this study is to investigate the degree of predictability of the pattern of animal's spatial distribution for a group of guinea pigs. This is of interest since the choice of location by an individual might provide insight into some of the factors responsible for this distribution. The analysis of these factors is complicated by their variety: there are environmental factors such as the local conditions or time of day, and social factors such as sex or individual characteristics. The question arises as to what extent the positions of the animals can be conceived to be determined by these simple influences. Information theory is useful in this regard (Shannon and Weaver, 1964). Hazlett and Estabrook (1974) developed information theory into a procedure which enabled them to quantify the influence of several factors on the outcome of agonistic behavior sequences. In a similar fashion, it is now applied to a problem of spatial organization where it provides an estimate of the degree of predictability of the animal's position, given some simple social or environmental factors.

Most of the various studies dealing with guinea pig behavior investigate behavior patterns of one or a few animals in laboratory test situations. The much smaller number of authors who were interested in the behavior of animals within colonies concentrated on qualitative or quantitative descriptions of behavior patterns (e.g., Kunkel and Kunkel, 1964; King, 1956; Rood, 1972) or tried to clarify separate aspects, e.g., dominance relations (Berryman, 1978) or male-female associations (Jacobs, 1976). Since the location of an animal is a component of behavior crucial to the

0340-5443/80/0006/0265/$02.40

Aktivitäts-Budget Meerschweinchen

Behav. Ecol. Sociobiol. 6, 265–276 (1980)

Behavioral Ecology and Sociobiology
© by Springer-Verlag 1980

Spacing Patterns in a Colony of Guinea Pigs: Predictability from Environmental and Social Factors

Stefan Fuchs

Zoologisches Institut der Technischen Hochschule Darmstadt, Schnittspahnstrasse 3, D-6100 Darmstadt, Federal Republic of Germany

Received December 27, 1978 / Accepted November 20, 1979

Summary. 1. Positions and behavior of six male and eight female guinea pigs kept outside in a 12 × 12 m^2 pen with a central shelter were recorded over one month in 288 scans. Data were analyzed by statistical and by information analysis methods. Two main states were distinguished: behavior in the field ('activity,' 47%), consisting mainly of feeding (42%); and that at the shelter ('inactivity,' 53%), consisting mainly of resting (46%). Only 2% of the observations were of social behavior. Males were about 10% more often active than females, apparently as a result of being subject to more aggressive acts, especially within the resting site. Observations of aggressive interactions also showed one male dominating all others, which were all of equal rank.

2. The daytime distribution of activity showed two peaks at 0600–0700 hours and 1800–2000 hours. Some activity took place during the night. An 18% reduction of uncertainty in prediction of an individual's activity resulted if the time of day was considered, and for group activity (> 5 animals active) the reduction was 29%. Activity was socially synchronized within the group, as was shown experimentally. The uncertainty of an average individual's activity was reduced by 29% if group activity was considered.

3. In the shelter, sexes and individuals showed preferences for specific locations. Males kept closer to the entrance. Nearest-neighbor frequencies, huddle frequencies, and frequencies at which animals were inside the shelter at the same time did not differ significantly, but males kept further apart from other animals than did females. In the field, no differences were found in nearest-neighbor frequencies or nearest-neighbor distances. Individuals had preferred areas, and the uncertainty of an average animal's location was reduced by 1% if its identity was known. Location in the field was affected by time of day, knowledge of which reduced the uncertainty of an average individual's position by 9%. Group cohesion affected the animal's position more strongly, however, reducing uncertainty by 16%. Active maintainance of proximity during feeding was shown experimentally.

Introduction

The aim of this study is to investigate the degree of predictability of the pattern of animal's spatial distribution for a group of guinea pigs. This is of interest since the choice of location by an individual might provide insight into some of the factors responsible for this distribution. The analysis of these factors is complicated by their variety: there are environmental factors such as the local conditions or time of day, and social factors such as sex or individual characteristics. The question arises as to what extent the positions of the animals can be conceived to be determined by these simple influences. Information theory is useful in this regard (Shannon and Weaver, 1964). Hazlett and Estabrook (1974) developed information theory into a procedure which enabled them to quantify the influence of several factors on the outcome of agonistic behavior sequences. In a similar fashion, it is now applied to a problem of spatial organization where it provides an estimate of the degree of predictability of the animal's position, given some simple social or environmental factors.

Most of the various studies dealing with guinea pig behavior investigate behavior patterns of one or a few animals in laboratory test situations. The much smaller number of authors who were interested in the behavior of animals within colonies concentrated on qualitative or quantitative descriptions of behavior patterns (e.g., Kunkel and Kunkel, 1964; King, 1956; Rood, 1972) or tried to clarify separate aspects, e.g., dominance relations (Berryman, 1978) or male-female associations (Jacobs, 1976). Since the location of an animal is a component of behavior crucial to the

0340-5443/80/0006/0265/$02.40

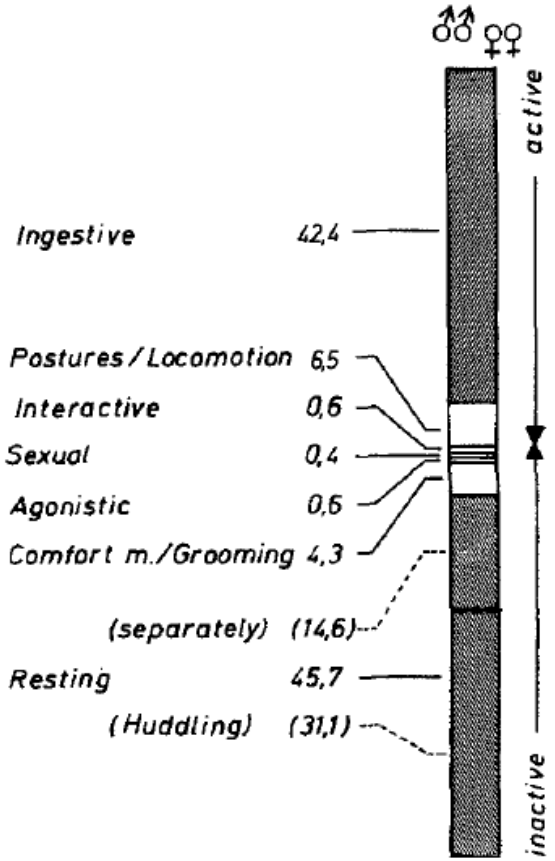


Fig. 1. Percentages of main behavioral categories observed in 180 scans during daylight (0600–2000 hours),

Aktivitäts-Budget Meerschweinchen

Behav. Ecol. Sociobiol. 6, 265–276 (1980)

Behavioral Ecology and Sociobiology
© by Springer-Verlag 1980

Spacing Patterns in a Colony of Guinea Pigs: Predictability from Environmental and Social Factors

Stefan Fuchs

Zoologisches Institut der Technischen Hochschule Darmstadt, Schnittspahnstrasse 3, D-6100 Darmstadt, Federal Republic of Germany

Received December 27, 1978 / Accepted November 20, 1979

Summary. 1. Positions and behavior of six male and eight female guinea pigs kept outside in a 12×12 m^2 pen with a central shelter were recorded over one month in 288 scans. Data were analyzed by statistical and by information analysis methods. Two main states were distinguished: behavior in the field ('activity,' 47%), consisting mainly of feeding (42%); and that at the shelter ('inactivity,' 53%), consisting mainly of resting (46%). Only 2% of the observations were of social behavior. Males were about 10% more often active than females, apparently as a result of being subject to more aggressive acts, especially within the resting site. Observations of aggressive interactions also showed one male dominating all others, which were all of equal rank.

2. The daytime distribution of activity showed two peaks at 0600–0700 hours and 1800–2000 hours. Some activity took place during the night. An 18% reduction of uncertainty in prediction of an individual's activity resulted if the time of day was considered, and for group activity (> 5 animals active) the reduction was 29%. Activity was socially synchronized within the group, as was shown experimentally. The uncertainty of an average individual's activity was reduced by 29% if group activity was considered.

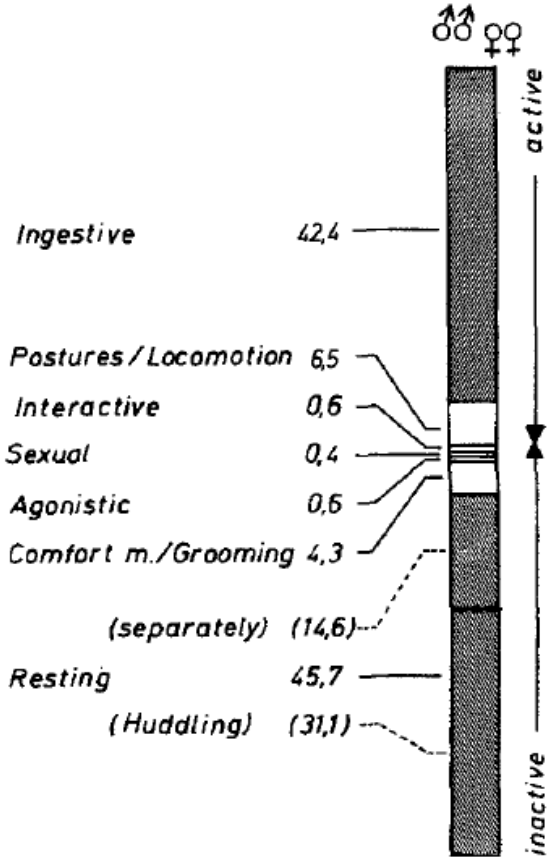
3. In the shelter, sexes and individuals showed preferences for specific locations. Males kept closer to the entrance. Nearest-neighbor frequencies, huddle frequencies, and frequencies at which animals were inside the shelter at the same time did not differ significantly, but males kept further apart from other animals than did females. In the field, no differences were found in nearest-neighbor frequencies or nearest-neighbor distances. Individuals had preferred areas, and the uncertainty of an average animal's location was reduced by 1% if its identity was known. Location in the field was affected by time of day, knowledge of which reduced the uncertainty of an average individual's position by 9%. Group cohesion affected the animal's position more strongly, however, reducing uncertainty by 16%. Active maintainance of proximity during feeding was shown experimentally.

Introduction

The aim of this study is to investigate the degree of predictability of the pattern of animal's spatial distribution for a group of guinea pigs. This is of interest since the choice of location by an individual might provide insight into some of the factors responsible for this distribution. The analysis of these factors is complicated by their variety: there are environmental factors such as the local conditions or time of day, and social factors such as sex or individual characteristics. The question arises as to what extent the positions of the animals can be conceived to be determined by these simple influences. Information theory is useful in this regard (Shannon and Weaver, 1964). Hazlett and Estabrook (1974) developed information theory into a procedure which enabled them to quantify the influence of several factors on the outcome of agonistic behavior sequences. In a similar fashion, it is now applied to a problem of spatial organization where it provides an estimate of the degree of predictability of the animal's position, given some simple social or environmental factors.

Most of the various studies dealing with guinea pig behavior investigate behavior patterns of one or a few animals in laboratory test situations. The much smaller number of authors who were interested in the behavior of animals within colonies concentrated on qualitative or quantitative descriptions of behavior patterns (e.g., Kunkel and Kunkel, 1964; King, 1956; Rood, 1972) or tried to clarify separate aspects, e.g., dominance relations (Berryman, 1978) or male-female associations (Jacobs, 1976). Since the location of an animal is a component of behavior crucial to the

0340-5443/80/0006/0265/$02.40



The states 'activity' and 'inactivity' could be determined even during the night. Over all 24 h, males were more often active than were females ($P < 0.001$) (44% and 32% of the observations, respectively).

Fig. 1. Percentages of main behavioral categories observed in 180 scans during daylight (0600–2000 hours),

Aktivitäts-Budget Meerschweinchen

Behav. Ecol. Sociobiol. 6, 265–276 (1980)

Behavioral Ecology and Sociobiology

© by Springer-Verlag 1980

Spacing Patterns in a Colony of Guinea Pigs: Predictability from Environmental and Social Factors

Stefan Fuchs

Zoologisches Institut der Technischen Hochschule Darmstadt, Schnittspahnstrasse 3, D-6100 Darmstadt, Federal Republic of Germany

Received December 27, 1978 / Accepted November 20, 1979

Summary. 1. Positions and behavior of six male and eight female guinea pigs kept outside in a $12 \times 12\ m^2$ pen with a central shelter were recorded over one month in 288 scans. Data were analyzed by statistical and by information analysis methods. Two main states were distinguished: behavior in the field ('activity,' 47%), consisting mainly of feeding (42%); and that at the shelter ('inactivity,' 53%), consisting mainly of resting (46%). Only 2% of the observations were of social behavior. Males were about 10% more often active than females, apparently as a result of being subject to more aggressive acts, especially within the resting site. Observations of aggressive interactions also showed one male dominating all others, which were all of equal rank.

2. The daytime distribution of activity showed two peaks at 0600–0700 hours and 1800–2000 hours. Some activity took place during the night. An 18% reduction of uncertainty in prediction of an individual's activity resulted if the time of day was considered, and for group activity (> 5 animals active) the reduction was 29%. Activity was socially synchronized within the group, as was shown experimentally. The uncertainty of an average individual's activity was reduced by 29% if group activity was considered.

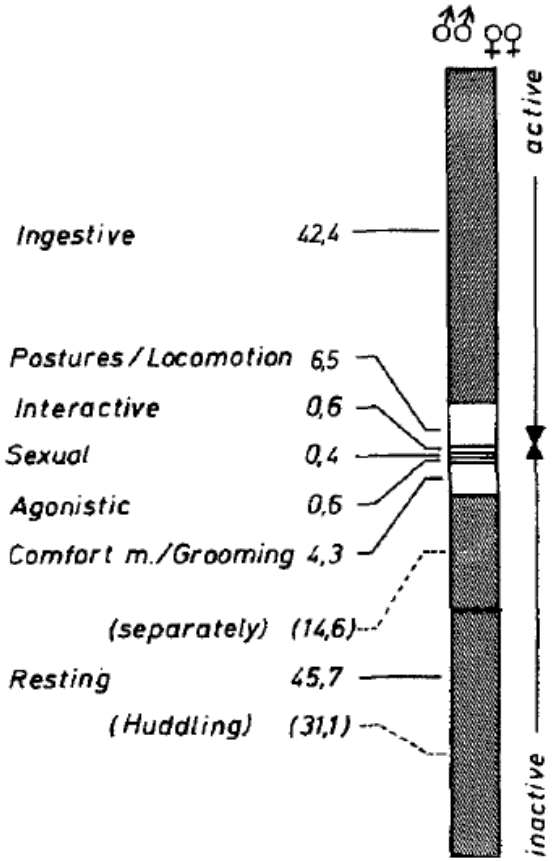
3. In the shelter, sexes and individuals showed preferences for specific locations. Males kept closer to the entrance. Nearest-neighbor frequencies, huddle frequencies, and frequencies at which animals were inside the shelter at the same time did not differ significantly, but males kept further apart from other animals than did females. In the field, no differences were found in nearest-neighbor frequencies or nearest-neighbor distances. Individuals had preferred areas, and the uncertainty of an average animal's location was reduced by 1% if its identity was known. Location in the field was affected by time of day, knowledge of which reduced the uncertainty of an average individual's position by 9%. Group cohesion affected the animal's position more strongly, however, reducing uncertainty by 16%. Active maintainance of proximity during feeding was shown experimentally.

Introduction

The aim of this study is to investigate the degree of predictability of the pattern of animal's spatial distribution for a group of guinea pigs. This is of interest since the choice of location by an individual might provide insight into some of the factors responsible for this distribution. The analysis of these factors is complicated by their variety: there are environmental factors such as the local conditions or time of day, and social factors such as sex or individual characteristics. The question arises as to what extent the positions of the animals can be conceived to be determined by these simple influences. Information theory is useful in this regard (Shannon and Weaver, 1964). Hazlett and Estabrook (1974) developed information theory into a procedure which enabled them to quantify the influence of several factors on the outcome of agonistic behavior sequences. In a similar fashion, it is now applied to a problem of spatial organization where it provides an estimate of the degree of predictability of the animal's position, given some simple social or environmental factors.

Most of the various studies dealing with guinea pig behavior investigate behavior patterns of one or a few animals in laboratory test situations. The much smaller number of authors who were interested in the behavior of animals within colonies concentrated on qualitative or quantitative descriptions of behavior patterns (e.g., Kunkel and Kunkel, 1964; King, 1956; Rood, 1972) or tried to clarify separate aspects, e.g., dominance relations (Berryman, 1978) or male-female associations (Jacobs, 1976). Since the location of an animal is a component of behavior crucial to the

0340-5443/80/0006/0265/$02.40



The states 'activity' and 'inactivity' could be determined even during the night. Over all 24 h, males were more often active than were females ($P < 0.001$) (44% and 32% of the observations, respectively).

Futteraufnahme 7.5-10 h / Tag

Fig. 1. Percentages of main behavioral categories observed in 180 scans during daylight (0600–2000 hours),

Natürliche Futterwahl: Chinchillas

Chinchillas fressen in freier Wildbahn hauptsächlich...

Cortes et al. (2002), Chile

	Sommer	Winter
Sträucher	6.5	9.7
Kräuter	9.9	5.2
Sukkulenten	2.6	3.2
Samen	2.6	0.6
Fasern	73	73

Angaben in %

Differenz auf 100% durch nicht identifizierte Kotbestandteile

Mamm. biol. **67** (2002) 167–175
© Urban & Fischer Verlag
http://www.urbanfischer.de/journals/mammbiol

Mammalian Biology
Zeitschrift für Säugetierkunde

Original investigation

Seasonal food habits of the endangered long-tailed chinchilla (*Chinchilla lanigera*): the effect of precipitation

By A. Cortés, E. Miranda, and J. E. Jiménez

Departamento de Biología, Universidad de La Serena, La Serena and Departamento de Ciencias Básicas, Universidad de Los Lagos, Osorno, Chile

Receipt of Ms. 19. 04. 2001
Acceptance of Ms. 19.09. 2001

Abstract

Based on the content of feces, we studied the food habits of the endangered rodent *Chinchilla lanigera*. On a seasonal basis, during two years of contrasting rain levels (1992 = 242 mm; 1993 = 123 mm), we collected chinchilla feces from El Cuyano ravine, adjacent to the Chinchilla National Reserve in north central Chile (31° 29′ 10.8″ S, 71°03′ 43.9″ W). The main plant species eaten was the perennial graminoid *Nassella chilensis*. Chinchillas showed a broader trophic niche during the rainy year, than during the dry year, consuming 55.5 and 40.7% of the 38 and 27 plants available, respectively. Within the wet year the diet differed less between winter and summer (Horn similarity index $R_0 = 0.58$) than within the dry year ($R_0 = 0.83$). Between years, the diet differed more during winters ($R_0 = 0.20$) than during summers ($R_0 = 0.52$). Chinchillas are folivorous, using a feeding pattern of a generalist species. The opportunistic feeding behavior of chinchillas may be an adaptation to the harsh conditions and high variability in food availability triggered by fluctuations in rainfall among years in the arid north central Chile.

Key words: *Chinchilla lanigera*, food habits, Chile, rainfall

Introduction

The long-tailed chinchilla (*Chinchilla lanigera* Molina, 1782) is a medium-sized hystricognath rodent endemic to north central Chile. These chinchillas had a relatively wide distribution in the past, ranging in the rugged coastal mountains from the Choapa River (32° S) north to Potrerillos (26° S; Jiménez 1996). Because of over-exploitation for its valuable fur, it was almost extirpated by the end of the 19th century and was considered extinct until the 1970's (Jiménez 1994). This chinchilla is currently considered endangered and known only from the locality of Aucó (31° 38′ S, 71° 06′ W), in the Chinchilla National Reserve and its surroundings, and from a colony north of Coquimbo (29° 33′ S, 71°04′ W; Jiménez 1995). However, despite protection in the reserve, chinchilla abundance is still declining (Jiménez 1990).
Information on the ecology and natural history of these chinchillas is scant. They are herbivorous, live in discrete colonies, and are nocturnal (Jiménez 1995). Ecological densities (within colonies) vary widely in

Natürliche Futterwahl: Chinchillas

Chinchillas fressen in freier Wildbahn hauptsächlich...

Cortes et al. (2002), Chile

Jahresdurchschnitt in % der TS:

- NDF: 41% #
- Rohfaser*: 18%
- Rohprotein: 13%

*:Umrechungsformel Rfa ⇨ NDF aus Kamphues et al. (2004)
#:Duke JA., Atchley AA. 1986. CRC Handbook of proximate analysis tabales of higher plants. CRC Press

Fütterung und Aktivitäts-Budget

Journal of Veterinary Behavior 11 (2016) 60–64

Contents lists available at ScienceDirect

Journal of Veterinary Behavior

journal homepage: www.journalvetbehavior.com

Research

Fur chewing and other abnormal repetitive behaviors in chinchillas (*Chinchilla lanigera*), under commercial fur-farming conditions

Valeria Franchi [a], O. Alejandro Aleuy [b], Tamara Alejandra Tadich [a,*]

[a] Departamento de Fomento de la Producción Animal, Facultad de Ciencias Veterinarias y Pecuarias, Universidad de Chile, Santiago, Chile
[b] Department of Biological Sciences, University of Calgary, Calgary, Alberta, Canada

ARTICLE INFO

Article history:
Received 11 May 2015
Received in revised form
5 October 2015
Accepted 6 October 2015
Available online 23 October 2015

Keywords:
chinchilla
abnormal repetitive behavior
welfare
fur-farming
fur-chewing

ABSTRACT

Fur chewing is a behavioral disorder frequently reported in chinchillas kept for fur-farming purposes. Rodents kept in barren cages usually develop some form of abnormal repetitive behavior, which can indicate a past or present welfare problem. Fur chewing may not be the only form of abnormal repetitive behavior present but is the one reported because of its direct repercussion on fur production. The aim of this study was to describe the frequency of occurrence of fur chewing and the distribution of time dedicated to it in chinchillas diagnosed as presenting this behavior. A secondary aim was to determine the presentation of other abnormal repetitive behaviors. Ten chinchillas, 5 fur chewers and 5 controls, were video recorded for 24 hours with an infrared camera. Behavioral analysis was done with The Observer XT from Noldus (The Netherlands). Focal sampling and continual recording were used, the 24-hour time budget was calculated, and abnormal repetitive behaviors were analyzed in terms of time dedication and frequency of presentation. A paired *t* test was used to compare differences in the amount of nocturnal versus daytime abnormal behavior. When normality was not met, a 2-sample *t* test and randomization test were used to compare data between treatments. No differences were observed between the time budgets of fur-chewing and control chinchillas, and all individuals exhibited more than one abnormal repetitive behavior. The amount of time devoted to abnormal repetitive behaviors was significantly higher during night in both groups and reached its lowest level between 13:00 and 17:00 hours. Fur chewing is not the only abnormal repetitive behavior developed by chinchillas in fur-farming systems, although it is the only one reported by the producer. The presence of bar chewing, cage scratching, and backflipping should also be welfare concerns. The higher presentation of abnormal repetitive behaviors at night may be associated with the lack of recognition by the producer, especially because these abnormal behaviors do not result in direct product loss as does fur chewing.
© 2016 Elsevier Inc. All rights reserved.

Introduction

The chinchilla (*Chinchilla lanigera*) is a hystricomorphic rodent endemic from the central and northern area of Chile (Cortés et al., 2002). The fur of chinchillas is one of the most valuable in the world, and the chinchilla has been domesticated, selected, and bred for its quality (Grau, 1986). The establishment of intensive chinchilla fur-farming systems has led to the development of fur-chewing or fur-biting behavior, where the chinchilla either continuously or intermittently chews its own fur from the lumbar area down to the tail (Ponzio et al., 2007). The chewed areas are usually covered by short hair and the skin turns darker because of hyperpigmentation, resembling the distinctive lesions of hyperadrenocorticism in dogs (Tisljar et al., 2002). By 1962, it was estimated that 30% of chinchillas in fur-farming systems were affected by this abnormal behavior (Rees, 1962). Tisljar et al. (2002) reported an incidence of 15%-20% in Croatia, but more recent studies estimate that between 3% and 15% of chinchillas are affected in Poland and Chile (Lapinski et al., 2014; Tadich et al., 2013). The etiology of the behavior is still unknown. Several theories have been postulated among which malnutrition, bacteriologic, mycological, and parasitological theories have been rejected. Environmental stress and hyperadrenocorticism remain as possible causes (Ponzio et al., 2007; Tisljar et al., 2002).

* Address for reprint requests and correspondence: Tamara Alejandra Tadich, Departamento de Fomento de la Producción Animal, Facultad de Ciencias Veterinarias y Pecuarias, Universidad de Chile, Santa Rosa 11735, La Pintana-Santiago, Chile. Tel: +56 2 29785572.
E-mail address: tamaratadich@u.uchile.cl (T.A. Tadich).

http://dx.doi.org/10.1016/j.jveb.2015.10.002
1558-7878/© 2016 Elsevier Inc. All rights reserved.

Fütterung und Aktivitäts-Budget

Journal of Veterinary Behavior 11 (2016) 60–64

Contents lists available at ScienceDirect

Journal of Veterinary Behavior

journal homepage: www.journalvetbehavior.com

Research

Fur chewing and other abnormal repetitive behaviors in chinchillas (*Chinchilla lanigera*), under commercial fur-farming conditions

Valeria Franchi [a], O. Alejandro Aleuy [b], Tamara Alejandra Tadich [a,*]

[a] Departamento de Fomento de la Producción Animal, Facultad de Ciencias Veterinarias y Pecuarias, Universidad de Chile, Santiago, Chile
[b] Department of Biological Sciences, University of Calgary, Calgary, Alberta, Canada

ARTICLE INFO

Article history:
Received 11 May 2015
Received in revised form
5 October 2015
Accepted 6 October 2015
Available online 23 October 2015

Keywords:
chinchilla
abnormal repetitive behavior
welfare
fur-farming
fur-chewing

ABSTRACT

Fur chewing is a behavioral disorder frequently reported in chinchillas kept for fur-farming purposes. Rodents kept in barren cages usually develop some form of abnormal repetitive behavior, which can indicate a past or present welfare problem. Fur chewing may not be the only form of abnormal repetitive behavior present but is the one reported because of its direct repercussion on fur production. The aim of this study was to describe the frequency of occurrence of fur chewing and the distribution of time dedicated to it in chinchillas diagnosed as presenting this behavior. A secondary aim was to determine the presentation of other abnormal repetitive behaviors. Ten chinchillas, 5 fur chewers and 5 controls, were video recorded for 24 hours with an infrared camera. Behavioral analysis was done with The Observer XT from Noldus (The Netherlands). Focal sampling and continual recording were used, the 24-hour time budget was calculated, and abnormal repetitive behaviors were analyzed in terms of time dedication and frequency of presentation. A paired *t* test was used to compare differences in the amount of nocturnal versus daytime abnormal behavior. When normality was not met, a 2-sample *t* test and randomization test were used to compare data between treatments. No differences were observed between the time budgets of fur-chewing and control chinchillas, and all individuals exhibited more than one abnormal repetitive behavior. The amount of time devoted to abnormal repetitive behaviors was significantly higher during night in both groups and reached its lowest level between 13:00 and 17:00 hours. Fur chewing is not the only abnormal repetitive behavior developed by chinchillas in fur-farming systems, although it is the only one reported by the producer. The presence of bar chewing, cage scratching, and backflipping should also be welfare concerns. The higher presentation of abnormal repetitive behaviors at night may be associated with the lack of recognition by the producer, especially because these abnormal behaviors do not result in direct product loss as does fur chewing.
© 2016 Elsevier Inc. All rights reserved.

Introduction

The chinchilla (*Chinchilla lanigera*) is a hystricomorphic rodent endemic from the central and northern area of Chile (Cortés et al., 2002). The fur of chinchillas is one of the most valuable in the world, and the chinchilla has been domesticated, selected, and bred for its quality (Grau, 1986). The establishment of intensive chinchilla fur-farming systems has led to the development of fur-chewing or fur-biting behavior, where the chinchilla either continuously or intermittently chews its own fur from the lumbar area down to the tail (Ponzio et al., 2007). The chewed areas are usually covered by short hair and the skin turns darker because of hyperpigmentation, resembling the distinctive lesions of hyperadrenocorticism in dogs (Tisljar et al., 2002). By 1962, it was estimated that 30% of chinchillas in fur-farming systems were affected by this abnormal behavior (Rees, 1962). Tisljar et al. (2002) reported an incidence of 15%-20% in Croatia, but more recent studies estimate that between 3% and 15% of chinchillas are affected in Poland and Chile (Lapinski et al., 2014; Tadich et al., 2013). The etiology of the behavior is still unknown. Several theories have been postulated among which malnutrition, bacteriologic, mycological, and parasitological theories have been rejected. Environmental stress and hyperadrenocorticism remain as possible causes (Ponzio et al., 2007; Tisljar et al., 2002).

* Address for reprint requests and correspondence: Tamara Alejandra Tadich, Departamento de Fomento de la Producción Animal, Facultad de Ciencias Veterinarias y Pecuarias, Universidad de Chile, Santa Rosa 11735, La Pintana-Santiago, Chile. Tel: +56 2 29785572.
E-mail address: tamaratadich@u.uchile.cl (T.A. Tadich).

http://dx.doi.org/10.1016/j.jveb.2015.10.002
1558-7878/© 2016 Elsevier Inc. All rights reserved.

Category	Behavioral patterns included
Resting	Sleeping, sitting, lying down
Feeding	Caecotrophy, exploration of feed, eating pellets or alfalfa, drinking
Locomotion	Climb, crawl, walk
Self-directed	Rolling, grooming, shaking, face washing, dust bath
Other behaviors	Play, exploring nonfeedstuff materials, urination, defecation

Fütterung und Aktivitäts-Budget

Journal of Veterinary Behavior 11 (2016) 60–64

Contents lists available at ScienceDirect

Journal of Veterinary Behavior

journal homepage: www.journalvetbehavior.com

Research

Fur chewing and other abnormal repetitive behaviors in chinchillas (*Chinchilla lanigera*), under commercial fur-farming conditions

Valeria Franchi [a], O. Alejandro Aleuy [b], Tamara Alejandra Tadich [a,*]

[a] Departamento de Fomento de la Producción Animal, Facultad de Ciencias Veterinarias y Pecuarias, Universidad de Chile, Santiago, Chile
[b] Department of Biological Sciences, University of Calgary, Calgary, Alberta, Canada

ARTICLE INFO

Article history:
Received 11 May 2015
Received in revised form
5 October 2015
Accepted 6 October 2015
Available online 23 October 2015

Keywords:
chinchilla
abnormal repetitive behavior
welfare
fur-farming
fur-chewing

ABSTRACT

Fur chewing is a behavioral disorder frequently reported in chinchillas kept for fur-farming purposes. Rodents kept in barren cages usually develop some form of abnormal repetitive behavior, which can indicate a past or present welfare problem. Fur chewing may not be the only form of abnormal repetitive behavior present but is the one reported because of its direct repercussion on fur production. The aim of this study was to describe the frequency of occurrence of fur chewing and the distribution of time dedicated to it in chinchillas diagnosed as presenting this behavior. A secondary aim was to determine the presentation of other abnormal repetitive behaviors. Ten chinchillas, 5 fur chewers and 5 controls, were video recorded for 24 hours with an infrared camera. Behavioral analysis was done with The Observer XT from Noldus (The Netherlands). Focal sampling and continual recording were used, the 24-hour time budget was calculated, and abnormal repetitive behaviors were analyzed in terms of time dedication and frequency of presentation. A paired *t* test was used to compare differences in the amount of nocturnal versus daytime abnormal behavior. When normality was not met, a 2-sample *t* test and randomization test were used to compare data between treatments. No differences were observed between the time budgets of fur-chewing and control chinchillas, and all individuals exhibited more than one abnormal repetitive behavior. The amount of time devoted to abnormal repetitive behaviors was significantly higher during night in both groups and reached its lowest level between 13:00 and 17:00 hours. Fur chewing is not the only abnormal repetitive behavior developed by chinchillas in fur-farming systems, although it is the only one reported by the producer. The presence of bar chewing, cage scratching, and backflipping should also be welfare concerns. The higher presentation of abnormal repetitive behaviors at night may be associated with the lack of recognition by the producer, especially because these abnormal behaviors do not result in direct product loss as does fur chewing.
© 2016 Elsevier Inc. All rights reserved.

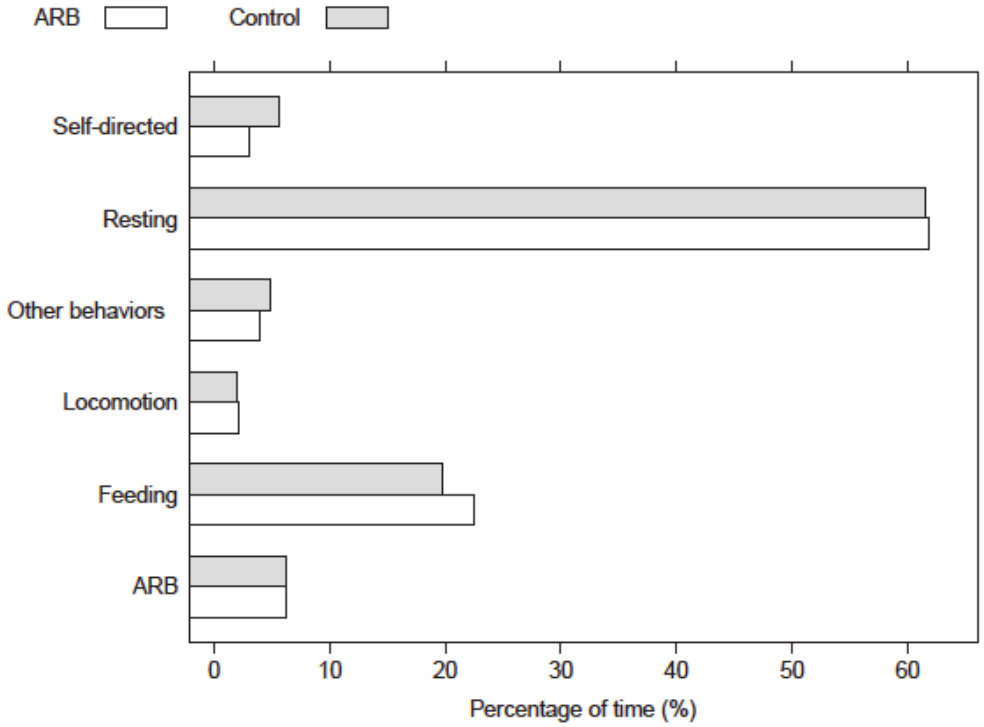
Introduction

The chinchilla (*Chinchilla lanigera*) is a hystricomorphic rodent endemic from the central and northern area of Chile (Cortés et al., 2002). The fur of chinchillas is one of the most valuable in the world, and the chinchilla has been domesticated, selected, and bred for its quality (Grau, 1986). The establishment of intensive chinchilla fur-farming systems has led to the development of fur-chewing or fur-biting behavior, where the chinchilla either continuously or intermittently chews its own fur from the lumbar area down to the tail (Ponzio et al., 2007). The chewed areas are usually covered by short hair and the skin turns darker because of hyperpigmentation, resembling the distinctive lesions of hyperadrenocorticism in dogs (Tisljar et al., 2002). By 1962, it was estimated that 30% of chinchillas in fur-farming systems were affected by this abnormal behavior (Rees, 1962). Tisljar et al. (2002) reported an incidence of 15%-20% in Croatia, but more recent studies estimate that between 3% and 15% of chinchillas are affected in Poland and Chile (Lapinski et al., 2014; Tadich et al., 2013). The etiology of the behavior is still unknown. Several theories have been postulated among which malnutrition, bacteriologic, mycological, and parasitological theories have been rejected. Environmental stress and hyperadrenocorticism remain as possible causes (Ponzio et al., 2007; Tisljar et al., 2002).

* Address for reprint requests and correspondence: Tamara Alejandra Tadich, Departamento de Fomento de la Producción Animal, Facultad de Ciencias Veterinarias y Pecuarias, Universidad de Chile, Santa Rosa 11735, La Pintana-Santiago, Chile. Tel: +56 2 29785572.
E-mail address: tamaratadich@u.uchile.cl (T.A. Tadich).

http://dx.doi.org/10.1016/j.jveb.2015.10.002
1558-7878/© 2016 Elsevier Inc. All rights reserved.

Category	Behavioral patterns included
Resting	Sleeping, sitting, lying down
Feeding	Caecotrophy, exploration of feed, eating pellets or alfalfa, drinking
Locomotion	Climb, crawl, walk
Self-directed	Rolling, grooming, shaking, face washing, dust bath
Other behaviors	Play, exploring nonfeedstuff materials, urination, defecation



Fütterung und Aktivitäts-Budget

Journal of Veterinary Behavior 11 (2016) 60–64

Contents lists available at ScienceDirect

Journal of Veterinary Behavior

journal homepage: www.journalvetbehavior.com

Research

Fur chewing and other abnormal repetitive behaviors in chinchillas (*Chinchilla lanigera*), under commercial fur-farming conditions

Valeria Franchi [a], O. Alejandro Aleuy [b], Tamara Alejandra Tadich [a,*]

[a] Departamento de Fomento de la Producción Animal, Facultad de Ciencias Veterinarias y Pecuarias, Universidad de Chile, Santiago, Chile
[b] Department of Biological Sciences, University of Calgary, Calgary, Alberta, Canada

ARTICLE INFO

Article history:
Received 11 May 2015
Received in revised form
5 October 2015
Accepted 6 October 2015
Available online 23 October 2015

Keywords:
chinchilla
abnormal repetitive behavior
welfare
fur-farming
fur-chewing

ABSTRACT

Fur chewing is a behavioral disorder frequently reported in chinchillas kept for fur-farming purposes. Rodents kept in barren cages usually develop some form of abnormal repetitive behavior, which can indicate a past or present welfare problem. Fur chewing may not be the only form of abnormal repetitive behavior present but is the one reported because of its direct repercussion on fur production. The aim of this study was to describe the frequency of occurrence of fur chewing and the distribution of time dedicated to it in chinchillas diagnosed as presenting this behavior. A secondary aim was to determine the presentation of other abnormal repetitive behaviors. Ten chinchillas, 5 fur chewers and 5 controls, were video recorded for 24 hours with an infrared camera. Behavioral analysis was done with The Observer XT from Noldus (The Netherlands). Focal sampling and continual recording were used, the 24-hour time budget was calculated, and abnormal repetitive behaviors were analyzed in terms of time dedication and frequency of presentation. A paired *t* test was used to compare differences in the amount of nocturnal versus daytime abnormal behavior. When normality was not met, a 2-sample *t* test and randomization test were used to compare data between treatments. No differences were observed between the time budgets of fur-chewing and control chinchillas, and all individuals exhibited more than one abnormal repetitive behavior. The amount of time devoted to abnormal repetitive behaviors was significantly higher during night in both groups and reached its lowest level between 13:00 and 17:00 hours. Fur chewing is not the only abnormal repetitive behavior developed by chinchillas in fur-farming systems, although it is the only one reported by the producer. The presence of bar chewing, cage scratching, and backflipping should also be welfare concerns. The higher presentation of abnormal repetitive behaviors at night may be associated with the lack of recognition by the producer, especially because these abnormal behaviors do not result in direct product loss as does fur chewing.
© 2016 Elsevier Inc. All rights reserved.

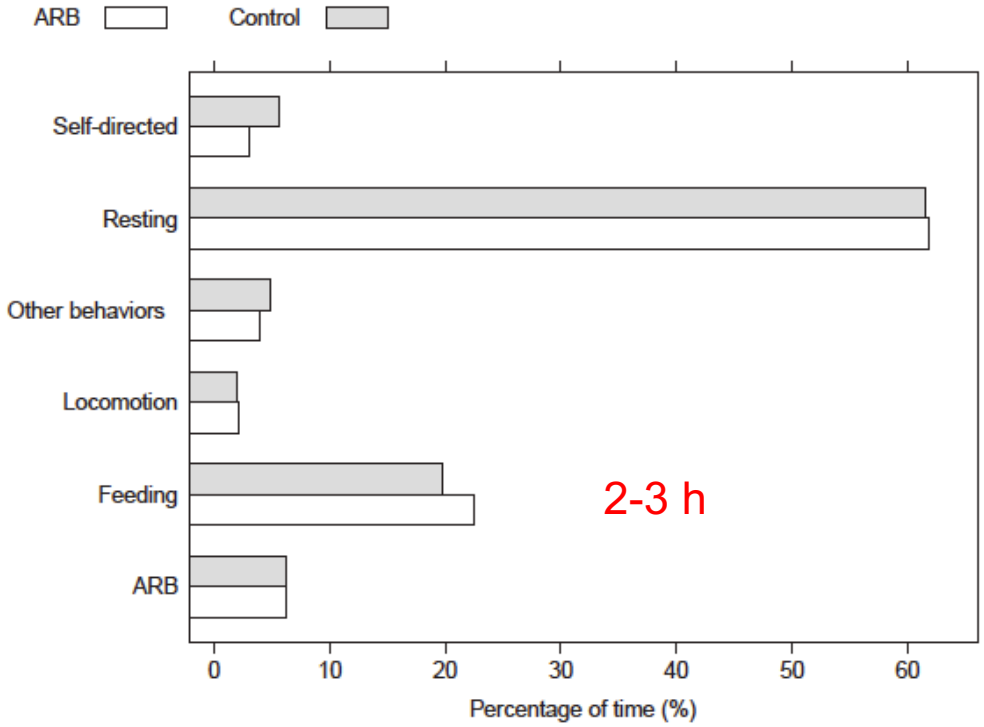
Introduction

The chinchilla (*Chinchilla lanigera*) is a hystricomorphic rodent endemic from the central and northern area of Chile (Cortés et al., 2002). The fur of chinchillas is one of the most valuable in the world, and the chinchilla has been domesticated, selected, and bred for its quality (Grau, 1986). The establishment of intensive chinchilla fur-farming systems has led to the development of fur-chewing or fur-biting behavior, where the chinchilla either continuously or intermittently chews its own fur from the lumbar area down to the tail (Ponzio et al., 2007). The chewed areas are usually covered by short hair and the skin turns darker because of hyperpigmentation, resembling the distinctive lesions of hyperadrenocorticism in dogs (Tisljar et al., 2002). By 1962, it was estimated that 30% of chinchillas in fur-farming systems were affected by this abnormal behavior (Rees, 1962). Tisljar et al. (2002) reported an incidence of 15%-20% in Croatia, but more recent studies estimate that between 3% and 15% of chinchillas are affected in Poland and Chile (Lapinski et al., 2014; Tadich et al., 2013). The etiology of the behavior is still unknown. Several theories have been postulated among which malnutrition, bacteriologic, mycological, and parasitological theories have been rejected. Environmental stress and hyperadrenocorticism remain as possible causes (Ponzio et al., 2007; Tisljar et al., 2002).

* Address for reprint requests and correspondence: Tamara Alejandra Tadich, Departamento de Fomento de la Producción Animal, Facultad de Ciencias Veterinarias y Pecuarias, Universidad de Chile, Santa Rosa 11735, La Pintana-Santiago, Chile. Tel: +56 2 29785572.
E-mail address: tamaratadich@u.uchile.cl (T.A. Tadich).

http://dx.doi.org/10.1016/j.jveb.2015.10.002
1558-7878/© 2016 Elsevier Inc. All rights reserved.

Category	Behavioral patterns included
Resting	Sleeping, sitting, lying down
Feeding	Caecotrophy, exploration of feed, eating pellets or alfalfa, drinking
Locomotion	Climb, crawl, walk
Self-directed	Rolling, grooming, shaking, face washing, dust bath
Other behaviors	Play, exploring nonfeedstuff materials, urination, defecation



Fütterung und Aktivitäts-Budget

Journal of Veterinary Behavior 11 (2016) 60–64

Contents lists available at ScienceDirect

Journal of Veterinary Behavior

journal homepage: www.journalvetbehavior.com

Research

Fur chewing and other abnormal repetitive behaviors in chinchillas (*Chinchilla lanigera*), under commercial fur-farming conditions

Valeria Franchi [a], O. Alejandro Aleuy [b], Tamara Alejandra Tadich [a,*]

[a] Departamento de Fomento de la Producción Animal, Facultad de Ciencias Veterinarias y Pecuarias, Universidad de Chile, Santiago, Chile
[b] Department of Biological Sciences, University of Calgary, Calgary, Alberta, Canada

ARTICLE INFO

Article history:
Received 11 May 2015
Received in revised form
5 October 2015
Accepted 6 October 2015
Available online 23 October 2015

Keywords:
chinchilla
abnormal repetitive behavior
welfare
fur-farming
fur-chewing

ABSTRACT

Fur chewing is a behavioral disorder frequently reported in chinchillas kept for fur-farming purposes. Rodents kept in barren cages usually develop some form of abnormal repetitive behavior, which can indicate a past or present welfare problem. Fur chewing may not be the only form of abnormal repetitive behavior present but is the one reported because of its direct repercussion on fur production. The aim of this study was to describe the frequency of occurrence of fur chewing and the distribution of time dedicated to it in chinchillas diagnosed as presenting this behavior. A secondary aim was to determine the presentation of other abnormal repetitive behaviors. Ten chinchillas, 5 fur chewers and 5 controls, were video recorded for 24 hours with an infrared camera. Behavioral analysis was done with The Observer XT from Noldus (The Netherlands). Focal sampling and continual recording were used, the 24-hour time budget was calculated, and abnormal repetitive behaviors were analyzed in terms of time dedication and frequency of presentation. A paired *t* test was used to compare differences in the amount of nocturnal versus daytime abnormal behavior. When normality was not met, a 2-sample *t* test and randomization test were used to compare data between treatments. No differences were observed between the time budgets of fur-chewing and control chinchillas, and all individuals exhibited more than one abnormal repetitive behavior. The amount of time devoted to abnormal repetitive behaviors was significantly higher during night in both groups and reached its lowest level between 13:00 and 17:00 hours. Fur chewing is not the only abnormal repetitive behavior developed by chinchillas in fur-farming systems, although it is the only one reported by the producer. The presence of bar chewing, cage scratching, and backflipping should also be welfare concerns. The higher presentation of abnormal repetitive behaviors at night may be associated with the lack of recognition by the producer, especially because these abnormal behaviors do not result in direct product loss as does fur chewing.
© 2016 Elsevier Inc. All rights reserved.

Introduction

The chinchilla (*Chinchilla lanigera*) is a hystricomorphic rodent endemic from the central and northern area of Chile (Cortés et al., 2002). The fur of chinchillas is one of the most valuable in the world, and the chinchilla has been domesticated, selected, and bred for its quality (Grau, 1986). The establishment of intensive chinchilla fur-farming systems has led to the development of fur-chewing or fur-biting behavior, where the chinchilla either continuously or intermittently chews its own fur from the lumbar area down to the tail (Ponzio et al., 2007). The chewed areas are usually covered by short hair and the skin turns darker because of hyperpigmentation, resembling the distinctive lesions of hyperadrenocorticism in dogs (Tisljar et al., 2002). By 1962, it was estimated that 30% of chinchillas in fur-farming systems were affected by this abnormal behavior (Rees, 1962). Tisljar et al. (2002) reported an incidence of 15%-20% in Croatia, but more recent studies estimate that between 3% and 15% of chinchillas are affected in Poland and Chile (Lapinski et al., 2014; Tadich et al., 2013). The etiology of the behavior is still unknown. Several theories have been postulated among which malnutrition, bacteriologic, mycological, and parasitological theories have been rejected. Environmental stress and hyperadrenocorticism remain as possible causes (Ponzio et al., 2007; Tisljar et al., 2002).

* Address for reprint requests and correspondence: Tamara Alejandra Tadich, Departamento de Fomento de la Producción Animal, Facultad de Ciencias Veterinarias y Pecuarias, Universidad de Chile, Santa Rosa 11735, La Pintana-Santiago, Chile. Tel: +56 2 29785572.
E-mail address: tamaratadich@u.uchile.cl (T.A. Tadich).

http://dx.doi.org/10.1016/j.jveb.2015.10.002
1558-7878/© 2016 Elsevier Inc. All rights reserved.

no time budgets for wild chinchillas were found in the available literature, so we cannot know if production systems have significantly altered this behavior.

Degu

Natürliche Futterwahl: Degus

TROPHIC RELATIONSHIPS AMONG SMALL MAMMALS IN A CHILEAN SEMIARID THORN SCRUB COMMUNITY

PETER L. MESERVE

ABSTRACT.—The food habits of seven species of small mammals were analyzed for a 15-month period during a live-trapping and snap-trapping study in a semiarid thorn scrub community in north-central Chile. The species included four cricetids (*Akodon olivaceus*, *A. longipilis*, *Phyllotis darwini*, and *Oryzomys longicaudatus*), two caviomorphs (*Octodon degus* and *Abrocoma bennetti*), and a didelphid (*Marmosa elegans*). The community was characterized by a semiarid mediterranean climate with low winter precipitation and frequent fog formation. Dominant physical features included high cover of spiny evergreen and drought-deciduous shrubs, low ground cover of herbaceous plants, and open sandy areas. Year-round food habit trends indicated three functional trophic guilds and one omnivorous species. *A. longipilis* and *M. elegans* were insectivorous, *O. degus* and *A. bennetti* were herbivorous, *P. darwini* and *O. longicaudatus* were granivorous, and *A. olivaceus* was omnivorous. This pattern of trophic specialization agrees generally with other studies of various species in the Chilean region, and suggests contrasts with patterns in the mediterranean and desert communities of North America and Argentina.

The documentation of trophic relationships in animal communities has received increased attention with the interest in quantifying niche utilization and overlap in potentially competing species. Yet, there are relatively few food habit studies of multispecies assemblages of small mammals not only because of the difficulty in identifying food items in stomach or other material, but also because of the problem of obtaining adequate sample sizes, particularly on a year-round basis. Some notable exceptions to this dearth of multispecies trophic studies in small mammals include Zimmerman (1965), Whitaker (1966), Vaughan (1974), Reichman (1975), Meserve (1976), and Holisova and Obrtel (1977). These studies have frequently shown small mammals to be relatively omnivorous (Landry, 1970), opportunistic, and varied in their diets during the year. Among some broad patterns of trophic specialization that have been elucidated are the presence of herbivorous and granivorous feeding guilds as well as omnivorous species in California semiarid mediterranean communities (Meserve, 1976; Glanz, 1977). The degree to which we can apply such generalizations to structurally convergent communities in other parts of the world is largely limited by our poor knowledge of their trophic relations. Some recent studies in the Monte Desert of Argentina and the Chilean mediterranean zone suggest relatively poor trophic similarity between small mammal communities there and those in North America (Glanz, 1977; Cody et al., 1977; Mares et al., 1977). Specifically, this is due to the lack of granivores in the Argentine Monte Desert region (Mares et al., 1977), and the greater number of insectivores and herbivores relative to granivores in the Chilean mediterranean region (Glanz, 1977). Because we know little of the trophic relationships of the small mammals in South America, particularly on a year-round basis, it seems especially important to study additional small mammal communities to evaluate the evidence for divergent or convergent patterns.

This paper reports on the trophic relationships of seven species of small mammals in a semiarid thorn scrub community in northern Chile studied over a 15-month period. The small mammals here were first studied by Fulk (1975), and subsequent papers will deal with niche relationships and population trends. The species studied were the following: *Akodon olivaceus olivaceus*, *A. longipilis longipilis*, *Phyllotis darwini darwini*, and *Oryzomys longicaudatus longicaudatus* (family Cricetidae);

J. Mamm., 62(2):304–314, 1981

TABLE 5.—*Food habits by percent volume of* Octodon degus *during November 1973–November 1974. Numbers under month and symbols are as in Table 2.*

Dietary item	November 1973 7 (7)	January 1974 3 (2)	March 1974 22 (15)	May 1974 9 (0)	July 1974 11 (5)	September 1974 12 (6)	November 1974 23 (23)
Shrubs							
Baccharis sp. foliage	0.2	5.1	4.7		0.5	0.2	3.8
Anisomeria litoralis foliage		0.9					2.8
Porlieria chilensis foliage	0.1		8.7	3.5	1.2	0.1	0.6
Chenopodium petiolare foliage	5.5	5.9	15.2	34.9	57.8	29.4	6.1
Other shrub foliage			0.1		0.3	0.1	1.5
Anisomeria seed	0.5	0.9	0.7	0.7		0.7	4.4
Porlieria seed	5.0	13.9	15.7	1.5	9.5	2.4	13.0
Chenopodium seed		2.0	1.2	1.0	1.5	2.3	
Other shrub seed			1.1			0.7	
Shrub conductive tissue	0.5	2.2	18.2	40.7	1.0	3.8	2.8
Forbs and Grasses							
Erodium cicutarium foliage	20.6	0.7	0.2		3.0	20.1	4.0
Plantago sp. foliage	4.3	0.4	0.2	0.1	0.3	0.6	1.1
Hippeastrum sp. foliage	0.5	4.4			0.5	0.1	9.0
Other forb foliage	9.4	5.9	1.6	0.3	0.7	6.9	12.7
Trisetobromus hirtus foliage	0.6		P			0.4	0.6
Vulpia sp. foliage	2.8		0.2			0.6	0.3
Erodium seed	2.0	3.3	0.2			0.1	0.6
Plantago seed	3.2	2.9	0.9	0.4		1.2	2.1
Hippeastrum seed	0.2		P			0.7	0.9
Other forb seeds	1.9	17.2	1.1	0.5	0.9	3.1	1.9
Grass foliage	21.1	2.2	7.1	0.9	5.3	9.7	10.0
Grass seeds	2.5	5.0	4.1	1.2	2.0	0.8	1.6
Arthropods	0.2	P	0.3	0.3		P	0.2
Bait	3.3	9.1	1.9		0.3	1.7	6.0
Unidentified material	15.6	18.0	16.6	14.0	15.2	14.3	13.9

Natürliche Futterwahl: Degus

JM

Journal of Mammalogy, 91(2):458–466, 2010

Seasonal variation in the range areas of the diurnal rodent *Octodon degus*

Verónica Quirici*, Rodrigo A. Castro, Liliana Ortiz-Tolhuysen, Adrian S. Chesh, Joseph Robert Burger, Eduardo Miranda, Arturo Cortés, Loren D. Hayes, and Luis A. Ebensperger

Centro de Estudios Avanzados en Ecología and Biodiversidad, and Departamento de Ecología, Facultad de Ciencias Biológicas, Pontificia Universidad Católica de Chile, 6513677, Santiago, Chile (VQ, RAC, LO-T, LAE)
Department of Biology, University of Louisiana at Monroe, Louisiana 71209, USA (ASC, JRB, LDH)
Departamento de Biología, Universidad de La Serena, La Serena, Chile (EM, AC)

** Correspondent: vquirici@bio.puc.cl*

Both breeding activity and abundance and quality of available food are expected to influence daily movements of animals. Animals are predicted to range over large areas to meet high energy demands associated with reproduction (females) or to increase mating success (males). However, animals should expand their range areas whenever food conditions deteriorate. To examine the extent to which breeding activity versus food availability influence space use, we compared the size and location of range areas (home ranges) of the degu (*Octodon degus*), a diurnal rodent from semiarid environments of north-central Chile, during the austral winter and summer seasons. Degus produce young during the austral spring (September–October) when high-quality food is readily available. In contrast, degus do not breed during the austral summer (January–March) when food is scarce and of low quality. We predicted that degus would range over smaller areas in winter if the availability of food has a greater influence on space than breeding activity. Individuals were radiotracked in winter and the following summer over a 3-year period. Surveys of herbaceous cover were conducted during winter and summer to determine seasonal changes in the abundance and quality of primary food. In summer degus expanded and moved the location of their range areas to locations with available food. Given that preferred food was less abundant in summer than winter, we suggest that degu range areas are strongly influenced by food conditions. DOI: 10.1644/08-MAMM-A-337.1.

Key words: breeding activity, degus, food availability, range size, semiarid environment

© 2010 American Society of Mammalogists

Intraspecific variation in the range areas (home ranges) of individuals can be caused by numerous extrinsic (e.g., food abundance and quality) and endogenous (e.g., changes in the breeding activity and sex of individuals) factors (Burt 1943; Cooper and Randall 2007; Schradin and Pillay 2006; Slobodchikoff 1984). Separating the roles played by each of these factors is challenging. Difficulties arise when 2 or more factors covary and thus, emerging patterns are equally consistent with alternative scenarios. For instance, individuals are expected to range over smaller areas whenever food conditions and overall habitat productivity are high (Gompper and Gittleman 1991; Harestad and Bunnell 1979). This prediction generally has been supported by correlative studies (Corp et al. 1997; Harris and Leitner 2004; Lurz et al. 2000) and in food-supplementation studies in small mammals (Hubbs and Boonstra 1998; Ims 1987; Ostfeld 1986; Slobodchikoff 1984). An alternative argument is that an association between small range areas and high abundance of food is an indirect effect of food on range areas via density of the consumer (Desy et al. 1990; Taitt 1981; Taitt and Krebs 1981; Wauters and Dhondt 1998). In particular, consumer density can increase in response to food availability and cause a density-dependent decrease of range areas. In contrast, high consumer density also can be the direct consequence of animals decreasing their range areas in response to favorable food conditions (Jones 1990; Mares et al. 1982). Understanding the link between these factors is inherently difficult. Field studies may provide evidence of causation whenever the observed variation in spatial behavior is inconsistent with some of these hypotheses.

The range areas of individuals are influenced by breeding activity. Theory predicts that males range over larger areas

Table 1.—Percentages (mean ± *SD*) for specific items of all plant material found in fecal pellets of *Octodon degus* in winter 2005 and 2006. Fecal pellets collected from individual degus were pooled per burrow system to constitute 12 replicates (burrow systems) in 2005 and 5 in 2006.

Family Species	2005	2006
Herbs		
AMARYLLIDACEAE		
Phycella sp.	1.6 ± 2.2	0.6 ± 0.8
BORAGINACEAE		
Pectocarya linearis	0.2 ± 0.3	0.7 ± 1.4
COMPOSITAE		
Madia sativa	0.4 ± 0.9	0.2 ± 0.2
Soliva sessilis	5.1 ± 3.6	33.5 ± 20.8
CRUCIFERAE		
Nasturtium officinale	0.4 ± 0.7	0
GERANIACEAE		
Erodium cicutarium	2.4 ± 1.5	0.3 ± 0.6
Erodium malacoides	0.2 ± 0.4	0.4 ± 0.4
GRAMINEAE		
Nassella sp.	5.4 ± 5.9	2.0 ± 1.8
Graminea sp.	15.4 ± 4.3	21.6 ± 16.2
PAPILIONACEAE		
Medicago polymorpha	7.0 ± 6.6	0.4 ± 0.3
RUBIACEAE		
Galium aparine	0.4 ± 0.3	0.2 ± 0.3
CYPERACEAE	0.9 ± 1.5	1.4 ± 1.5
Subtotal	39.4 ± 8.8	61.1 ± 19.5
Shrub foliage		
MIMOSACEAE		
Acacia caven	0.2 ± 0.4	0
Acacia floribunda	0.3 ± 0.8	0
ANACARDIACEAE		
Lithrea caustica	0.2 ± 0.3	0.1 ± 0.2
Subtotal	0.7 ± 1.1	0.1 ± 0.2
Shrub seeds		
Acacia floribunda (S)	0.04 ± 0.1	0.03 ± 0.1
Lithraea caustica (S)	2.1 ± 2.6	4.0 ± 2.1
Unidentified seeds	0.9 ± 0.7	0.4 ± 0.5
Subtotal	3.0 ± 2.9	4.4 ± 2.5
Unidentified fiber	43.5 ± 9.3	27.2 ± 15.7
Unidentified material	13.4 ± 5.3	7.0 ± 4.8

Natürliche Futterwahl: Degus

Bozinovic (1995), Chile:

Sommer in % TS:
- NDF: 61%
- Rohfaser*: 30%
- Rohprotein: 3%

Herbst/ Winter in % TS:
- NDF: 37%
- Rohfaser*: 15%
- Rohprotein: 7%

*:Umrechungsformel Rfa ⇨ NDF aus Kamphues et al. (2004)

NUTRITIONAL ENERGETICS AND DIGESTIVE RESPONSES OF AN HERBIVOROUS RODENT (*OCTODON DEGUS*) TO DIFFERENT LEVELS OF DIETARY FIBER

FRANCISCO BOZINOVIC

Departamento de Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile, Casilla 653, Santiago, Chile

Complex polysaccharides such as cellulose, hemicellulose, and lignin (fiber) are important structural constituents of plants that often are difficult for small herbivorous mammals to digest. These polysaccharides may affect the efficiency with which food is digested and with which nutrients and energy are transformed and allocated. To determine how small herbivorous mammals cope with such high-fiber food, I used as a model the herbivorous, caviomorph octodontid rodent *Octodon degus*, the degu, an inhabitant of the semiarid and Mediterranean environments of northern and central Chile. When given a choice, degus minimized fiber intake, showing pronounced preferences for food containing low fiber. Because low-fiber items are not available in the field during the dry season, I postulated that observations of degus feeding on grass containing a high percentage (nearly 60%) of fiber during summer are more likely the consequence of necessity than of choice. I suggested that during nutritional bottlenecks, degus operate according to the principles of foraging theory and principles governing digestion. Degus seemed to compensate for the low digestibility of high-fiber food by increasing the volume of digesta in the alimentary canal as a consequence of changes in rates of food intake and, hence, increases in turnover time of digesta. The digestive responses allowed them to increase the amount of energy obtained from fiber and to satisfy their maintenance energy costs during temporal exposures to different levels of food fiber.

Key words: nutritional energetics, foraging, digestion, fiber, *Octodon degus*

Food selection, ingestion, and efficiency of digestion by mammals represent a trade-off between competing factors (Chilcott and Hume, 1985; Sibly, 1981; Weiner, 1992). Nutrient turnover and extraction are related directly to energy metabolism and to the amount of food transported through the digestive tract (Bozinovic, 1993). Quality, digestibility, and environmental availability of food can affect the rate of energy metabolism (Batzli, 1985; McNab, 1986). Species that exploit food with low-energy and high-fiber content, or high cost of digestion, appear to have low mass-independent rates of energy expenditure (Choshniak and Yahav, 1987; Veloso and Bozinovic, 1993; Woodall, 1989). In the evaluation of quality of food consumed by small herbivores, ingestion and digestibility appear as the most important factors (Milton, 1979). Both food preferences and digestibility are decreased by an increase in dietary fiber content (Hume et al., 1993). Because the cell walls of plants (i.e., dietary fiber) are a barrier to the extraction of soluble nutrients from the cell and are difficult to digest, thus affecting overall digestibility and rates of energy metabolism and allocation (Van Soest, 1982), fiber should influence food selection. Thus, plant fiber can be regarded as a chemical component that influences foraging behavior.

Brown and Nicoletto (1991) hypothesized that physiological and allometric con-

Journal of Mammalogy, 76(2):627–637, 1995 627

Aktivitäts-Budget

Revista Chilena de Historia Natural
75: 567-581, 2002

Daily and seasonal limits of time and temperature to activity of degus

Limitaciones diarias y estacionales de tiempo y temperatura sobre la actividad de degus

G.J. KENAGY[1], ROBERTO F. NESPOLO[2], RODRIGO A. VÁSQUEZ[3] & FRANCISCO BOZINOVIC[2]

[1]Department of Zoology and Burke Museum, University of Washington, Seattle, Washington 98195, U.S.A.; e-mail: kenagy@u.washington.edu
[2]Centro de Estudios Avanzados en Ecología & Biodiversidad, Departamento de Ecología, Pontificia Universidad Católica de Chile, CP 651 3677, Santiago, Chile; e-mail: rnespolo@genes.bio.puc.cl; fbozinov@genes.bio.puc.cl
[3]Departamento de Ciencias Ecológicas, Universidad de Chile, Santiago, Chile; e-mail: rvasquez@abello.dic.uchile

ABSTRACT

We present an analysis of behavioral flexibility in a day-active caviomorph rodent, the degu, *Octodon degus*, in response to temporal (daily and seasonal), spatial, and thermal heterogeneity of its environment. We quantified activity and foraging behavior in a population, together with thermal conditions, in an open habitat in the seasonally hot and arid matorral of central Chile. Summer activity was bimodal, with a gap of more than 8 h between the morning bout of 2.5 h of intensive foraging and the afternoon bout of 2 h. More than half of the 4.5 h of summer activity occurred in the shade of early morning or late afternoon when the sun was below the local skyline. Autumn and spring activity were also bimodal, but with greater proportions of activity under direct solar radiation, and with a shorter midday gap between the two major bouts. Winter activity was unimodal and all occurred under direct solar radiation. In summer, autumn, and spring the activity of degus was curtailed as our index of operative temperature, T_e, moved above 40 ºC. We used a single measurement of T_e (measured in a thermal mannequin representing degu size, shape and surface properties) as an index of the interactive effects of solar radiation and convection on body temperature. At the winter solstice (June), when degus remained fully exposed to solar radiation throughout the day, T_e generally remained below 30 ºC. Flexibility in the timing of surface activity allows degus to maintain thermal homeostasis and energy balance throughout the year. Degus shift the times of daily onset and end of activity and the number of major bouts (unimodal or bimodal) over the course of the year. They remain active on the surface under a much narrower range or "window" of thermal conditions than those that occur over the entire broad range of the day and year.

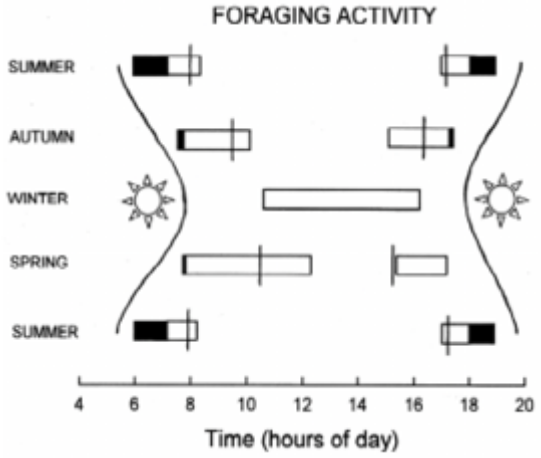
Key words: Chile, foraging, *Octodon degus*, seasonality, thermal ecology.

RESUMEN

Presentamos un análisis de la flexibilidad conductual en la actividad diaria del degu (*Octodon degus*), un roedor caviomorfo, en respuesta a la heterogeneidad del ambiente temporal (diario y estacional), espacial y térmico. Junto con las condiciones térmicas, cuantificamos la conducta de actividad y forrajeo en una población que vive en un hábitat abierto en el matorral árido y estacional de Chile central. La actividad de verano fue bimodal, con 2,5 h de actividad de forrajeo intenso durante la mañana y con 2 h durante la tarde. No hubo actividad por mas de 8 h entre ambos eventos. Más de la mitad de las 4,5 h diarias de actividad de la mañana y de la tarde ocurrieron en la sombra, cuando el sol se encuentra bajo la línea local del cielo. La actividad durante el otoño y la primavera también fue bimodal pero con una mayor proporción de actividad bajo radiación solar directa y con un período de inactividad menor entre los dos eventos principales. La actividad de invierno fue unimodal y bajo radiación solar directa. En verano, otoño y primavera la actividad estuvo sesgada cuando nuestro índice de temperatura operativa, T_e, superó los 40 °C. Usamos una medida de T_e (registrada en un maniquí térmico que representa las propiedades de forma, tamaño y superficie de un degu) como un índice de los efectos interactivos de la radiación solar y la convección sobre la temperatura corporal. Durante el solsticio de invierno (junio), cuando los degus permanecieron todo el día totalmente expuestos al sol, T_e generalmente permaneció bajo 30 °C. La flexibilidad en el tiempo de la actividad superficial le permitió a los degus mantener su homeostasis térmica y balance de energía anual. Los degus cambiaron sus períodos de inicio y término así como el número de eventos de actividad (unimodal o bimodal) durante el año. Estos roedores permanecieron activos en la superficie bajo un rango mucho más estrecho de condiciones térmicas que las que ocurren durante el largo del día y año.

Palabras clave: Chile, forrajeo, *Octodon degus*, estacionalidad, ecología térmica.

Aktivitäts-Budget



Revista Chilena de Historia Natural
75: 567-581, 2002

Daily and seasonal limits of time and temperature to activity of degus

Limitaciones diarias y estacionales de tiempo y temperatura sobre la actividad de degus

G.J. KENAGY[1], ROBERTO F. NESPOLO[2], RODRIGO A. VÁSQUEZ[3] & FRANCISCO BOZINOVIC[2]

[1]Department of Zoology and Burke Museum, University of Washington, Seattle, Washington 98195, U.S.A.; e-mail: kenagy@u.washington.edu
[2]Centro de Estudios Avanzados en Ecología & Biodiversidad, Departamento de Ecología, Pontificia Universidad Católica de Chile, CP 651 3677, Santiago, Chile; e-mail: rnespolo@genes.bio.puc.cl; fbozinov@genes.bio.puc.cl
[3]Departamento de Ciencias Ecológicas, Universidad de Chile, Santiago, Chile; e-mail: rvasquez@abello.dic.uchile

ABSTRACT

We present an analysis of behavioral flexibility in a day-active caviomorph rodent, the degu, *Octodon degus*, in response to temporal (daily and seasonal), spatial, and thermal heterogeneity of its environment. We quantified activity and foraging behavior in a population, together with thermal conditions, in an open habitat in the seasonally hot and arid matorral of central Chile. Summer activity was bimodal, with a gap of more than 8 h between the morning bout of 2.5 h of intensive foraging and the afternoon bout of 2 h. More than half of the 4.5 h of summer activity occurred in the shade of early morning or late afternoon when the sun was below the local skyline. Autumn and spring activity were also bimodal, but with greater proportions of activity under direct solar radiation, and with a shorter midday gap between the two major bouts. Winter activity was unimodal and all occurred under direct solar radiation. In summer, autumn, and spring the activity of degus was curtailed as our index of operative temperature, T_e, moved above 40 ºC. We used a single measurement of T_e (measured in a thermal mannequin representing degu size, shape and surface properties) as an index of the interactive effects of solar radiation and convection on body temperature. At the winter solstice (June), when degus remained fully exposed to solar radiation throughout the day, T_e generally remained below 30 ºC. Flexibility in the timing of surface activity allows degus to maintain thermal homeostasis and energy balance throughout the year. Degus shift the times of daily onset and end of activity and the number of major bouts (unimodal or bimodal) over the course of the year. They remain active on the surface under a much narrower range or "window" of thermal conditions than those that occur over the entire broad range of the day and year.

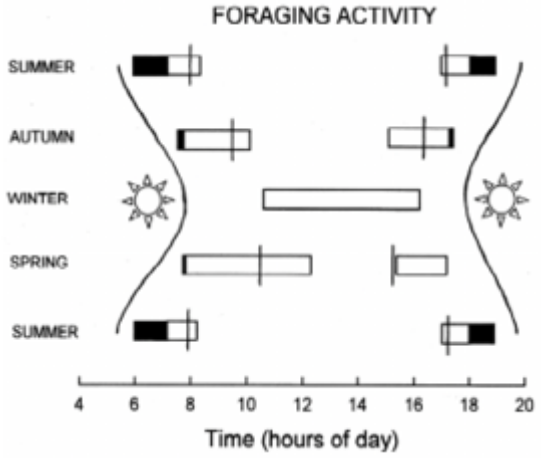
Key words: Chile, foraging, *Octodon degus*, seasonality, thermal ecology.

RESUMEN

Presentamos un análisis de la flexibilidad conductual en la actividad diaria del degu (*Octodon degus*), un roedor caviomorfo, en respuesta a la heterogeneidad del ambiente temporal (diario y estacional), espacial y térmico. Junto con las condiciones térmicas, cuantificamos la conducta de actividad y forrajeo en una población que vive en un hábitat abierto en el matorral árido y estacional de Chile central. La actividad de verano fue bimodal, con 2,5 h de actividad de forrajeo intenso durante la mañana y con 2 h durante la tarde. No hubo actividad por mas de 8 h entre ambos eventos. Más de la mitad de las 4,5 h diarias de actividad de la mañana y de la tarde ocurrieron en la sombra, cuando el sol se encuentra bajo la línea local del cielo. La actividad durante el otoño y la primavera también fue bimodal pero con una mayor proporción de actividad bajo radiación solar directa y con un período de inactividad menor entre los dos eventos principales. La actividad de invierno fue unimodal y bajo radiación solar directa. En verano, otoño y primavera la actividad estuvo sesgada cuando nuestro índice de temperatura operativa, T_e, superó los 40 °C. Usamos una medida de T_e (registrada en un maniquí térmico que representa las propiedades de forma, tamaño y superficie de un degu) como un índice de los efectos interactivos de la radiación solar y la convección sobre la temperatura corporal. Durante el solsticio de invierno (junio), cuando los degus permanecieron todo el día totalmente expuestos al sol, T_e generalmente permaneció bajo 30 °C. La flexibilidad en el tiempo de la actividad superficial le permitió a los degus mantener su homeostasis térmica y balance de energía anual. Los degus cambiaron sus períodos de inicio y término así como el número de eventos de actividad (unimodal o bimodal) durante el año. Estos roedores permanecieron activos en la superficie bajo un rango mucho más estrecho de condiciones térmicas que las que ocurren durante el largo del día y año.

Palabras clave: Chile, forrajeo, *Octodon degus*, estacionalidad, ecología térmica.

Aktivitäts-Budget



Revista Chilena de Historia Natural
75: 567-581, 2002

Daily and seasonal limits of time and temperature to activity of degus

Limitaciones diarias y estacionales de tiempo y temperatura sobre la actividad de degus

G.J. KENAGY[1], ROBERTO F. NESPOLO[2], RODRIGO A. VÁSQUEZ[3] & FRANCISCO BOZINOVIC[2]

[1]Department of Zoology and Burke Museum, University of Washington, Seattle, Washington 98195 U.S.A.
[2]Centro de Estudios Avanzados en
Universidad Católica de Chile, CP
[3]Departamento de Cienci
e-m

We present an analysis of behavioral flexib
to temporal (daily and seasonal), spatial,
foraging behavior in a population, togethe
matorral of central Chile. Summer activity
h of intensive foraging and the afternoon bo
of early morning or late afternoon when t
bimodal, but with greater proportions of a
the two major bouts. Winter activity was
and spring the activity of degus was curtai
a single measurement of T_e (measured in
as an index of the interactive effects of sola
when degus remained fully exposed to sola
in the timing of surface activity allows deg
Degus shift the times of daily onset and en
course of the year. They remain active on t
than those that occur over the entire broa

Key words: Chile, foraging, *Octodon*

Presentamos un análisis de la flexibilida
caviomorfo, en respuesta a la heterogeneid
las condiciones térmicas, cuantificamos l
abierto en el matorral árido y estacional d
de forrajeo intenso durante la mañana y co
Más de la mitad de las 4,5 h diarias de act
encuentra bajo la línea local del cielo. La
mayor proporción de actividad bajo radiac
principales. La actividad de invierno fue
actividad estuvo sesgada cuando nuestro
T_e (registrada en un maniquí térmico que
un índice de los efectos interactivos de la
solsticio de invierno (junio), cuando los degus permanecieron todo el día totalmente expuestos al sol, T_e generalmente
permaneció bajo 30 °C. La flexibilidad en el tiempo de la actividad superficial le permitió a los degus mantener su
homeostasis térmica y balance de energía anual. Los degus cambiaron sus períodos de inicio y término así como el
número de eventos de actividad (unimodal o bimodal) durante el año. Estos roedores permanecieron activos en la
superficie bajo un rango mucho más estrecho de condiciones térmicas que las que ocurren durante el largo del día y año.

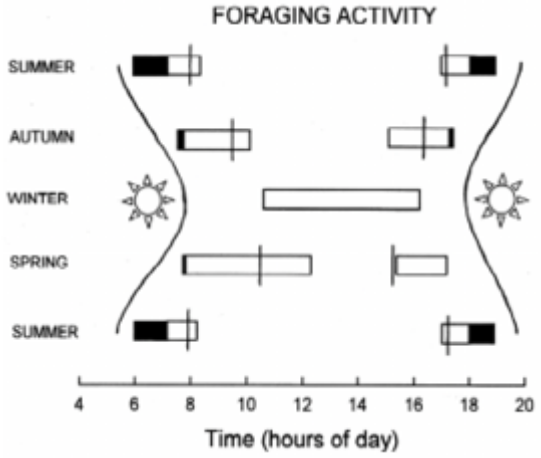
Palabras clave: Chile, forrajeo, *Octodon degus*, estacionalidad, ecología térmica.

Seasonal summary of total time period (h) of population foraging activity of degus and the breakdown of that time according to exposure of the habitat to sun or shade. Data are derived from one continuous all-day count of activity per season

Resumen estacional del período de tiempo total (h) de la actividad de forrajeo poblacional de degus y los componentes de dicho tiempo de acuerdo a la exposición del hábitat al sol o sombra. Los datos provienen de observaciones puntuales de registro continuo de actividad realizadas durante un día en cada estación

	Summer	Autumn	Winter	Spring
Foraging Activity[a]				
Morning	2.5	2.7	5.8	4.6
Afternoon	2.0	2.4	—	1.8
Total	4.5	5.1	5.8	6.4

Aktivitäts-Budget



Revista Chilena de Historia Natural
75: 567-581, 2002

Daily and seasonal limits of time and temperature to activity of degus

Limitaciones diarias y estacionales de tiempo y temperatura sobre la actividad de degus

G.J. KENAGY[1], ROBERTO F. NESPOLO[2], RODRIGO A. VÁSQUEZ[3] & FRANCISCO BOZINOVIC[2]

[1]Department of Zoology and Burke Museum, University of Washington, Seattle, Washington 98195 U.S.A.
[2]Centro de Estudios Avanzados en
Universidad Católica de Chile, CP
[3]Departamento de Cienci
e-m

We present an analysis of behavioral flexib
to temporal (daily and seasonal), spatial,
foraging behavior in a population, togethe
matorral of central Chile. Summer activity
h of intensive foraging and the afternoon bo
of early morning or late afternoon when t
bimodal, but with greater proportions of a
the two major bouts. Winter activity was
and spring the activity of degus was curtai
a single measurement of T_e (measured in
as an index of the interactive effects of sola
when degus remained fully exposed to sola
in the timing of surface activity allows deg
Degus shift the times of daily onset and en
course of the year. They remain active on t
than those that occur over the entire broa

Key words: Chile, foraging, *Octodon*

Presentamos un análisis de la flexibilida
caviomorfo, en respuesta a la heterogeneid
las condiciones térmicas, cuantificamos l
abierto en el matorral árido y estacional d
de forrajeo intenso durante la mañana y co
Más de la mitad de las 4,5 h diarias de act
encuentra bajo la línea local del cielo. La
mayor proporción de actividad bajo radiac
principales. La actividad de invierno fue
actividad estuvo sesgada cuando nuestro í
T_e (registrada en un maniquí térmico que
un índice de los efectos interactivos de la
solsticio de invierno (junio), cuando los degus permanecieron todo el día totalmente expuestos al sol, T_e generalmente
permaneció bajo 30 °C. La flexibilidad en el tiempo de la actividad superficial le permitió a los degus mantener su
homeostasis térmica y balance de energía anual. Los degus cambiaron sus períodos de inicio y término así como el
número de eventos de actividad (unimodal o bimodal) durante el año. Estos roedores permanecieron activos en la
superficie bajo un rango mucho más estrecho de condiciones térmicas que las que ocurren durante el largo del día y año.

Palabras clave: Chile, forrajeo, *Octodon degus*, estacionalidad, ecología térmica.

Seasonal summary of total time period (h) of population foraging activity of degus and the breakdown of that time according to exposure of the habitat to sun or shade. Data are derived from one continuous all-day count of activity per season

Resumen estacional del período de tiempo total (h) de la actividad de forrajeo poblacional de degus y los componentes de dicho tiempo de acuerdo a la exposición del hábitat al sol o sombra. Los datos provienen de observaciones puntuales de registro continuo de actividad realizadas durante un día en cada estación

	Summer	Autumn	Winter	Spring
Foraging Activity[a]				
Morning	2.5	2.7	5.8	4.6
Afternoon	2.0	2.4	—	1.8
Total	4.5	5.1	5.8	6.4

Wenig betonte Verhalten

MAMMALIAN SPECIES No. 67, pp. 1–5, 4 figs.

Octodon degus. By Charles A. Woods and David K. Boraker

Published 21 November 1975 by The American Society of Mammalogists

***Octodon* Bennett, 1832**

Octodon Bennett, 1832:46. Type species *Sciurus degus* Molina, 1782.

CONTEXT AND CONTENT. Order Rodentia, Suborder Hystricognatha, Superfamily Octodontoidea, Family Octodontidae. The genus *Octodon* includes three recent species.

***Octodon degus* (Molina, 1782)**
Degu

Sciurus degus Molina, 1782:303. Type locality Santiago, Chile (called St. Jago by Molina).
Octodon degus Waterhouse, 1848:252.

CONTEXT AND CONTENT. Ellerman (1940) recognized five subspecies, but Thomas (1927) and Yepes (1930) recognized only the lowland *O. d. degus* and a highland race, *O. d. cliviorum*. Osgood (1943) reported examining a large series of specimens and finding no geographic variation. Therefore no subspecies are recognized in this treatment.

DIAGNOSIS. The measurements of adult degus (in millimeters) in published reports and in the University of Vermont Museum of Zoology are from: head and body, 250 to 310; tail, 75 to 130; ear from notch, 24 to 32; hind foot, 35 to 38; weight is 170 to 300 g. Anterior upper cheekteeth have only moderate internal indentations and last upper molar has slight fold on inner side (see figure 1). The other two species of *Octodon* are of larger size in all measurements, have anterior upper cheekteeth with deep indentations that nearly touch the opposite side of the tooth, and have the last upper molar with either no fold on the inner side (*O. lunatus*) or a deep fold on the inner side (*O. bridgesi*). The tail of *Octodon degus* is reported to be more "tufted" than it is in either of the other species (Waterhouse, 1844; Wolffsohn, 1927b). There is a good description of the species and a color plate in Waterhouse (1848). See also Bennett (1841), Cabrera and Yepes (1960), and Walker *et al.* (1964) for descriptions and illustrations. The early description by Bennett (1832) is quite elaborate and useful.

GENERAL CHARACTERS. The degu has a moderately long, black-tipped tail and soft fur. The fur is less soft than that of either *Octodontomys* or *Octomys*. The ears are well developed, but have little fur on them and are darkly pigmented. The pelage is yellow-brown above and creamy-yellow below. Some individuals are paler below than others. There is a noticeable pale yellow area above and below the eye and often, but not always, a pale band about the neck. The feet are pale gray to white. There are four well-developed toes. The fifth toe is poorly developed and on the forefeet bears a nail instead of a claw. Long stiff "comb-like" bristles project over the claws of the hind feet. The tail is shorter than the head and body, and is less well haired than in either of the other two species of the genus; there is a tuft at the tip (see figure 2).

The dental formula is i 1/1, c 0/0, p 1/1, m 3/3, total 20. The cheekteeth are hypsodont and deeply folded in the mid-region. They resemble a figure-of-eight, hence the familial and generic name. The skull has a well-developed infraorbital foramen and an open pterygoid fossa. The bulla are of moderate size, but smaller than in either *Octodontomys* or *Octomys*. The mandible is decidedly hystricognathous (see figure 3).

DISTRIBUTION. The degu is found between Vallenar and Curico on the west slope of the Andes in Chile up to an elevation of 1200 meters (Osgood, 1943). It is confirmed from the provinces of Coquimbo, Aconcagua, Valparaiso, Santiago, and O'Higgins, and is presumed from Atacama in the north and Colchagua and Curico in the south (Cabrera, 1961; Pefaur *et al.*, 1968). This is approximately between 28 and 35 degrees south latitude (see figure 4).

Yepes (1930), Cabrera and Yepes (1960), Walker *et al.* (1964) and Cendrero (1972) all reported that the range of the degu is from central Chile to southern Perú. None of these workers, however, documented their reasons for extending the range northward into Perú. The probable reason for the Peruvian report is a single specimen of a degu collected on the west slope of the Andes at a latitude nearly that of Lima and at an elevation of about 3000 meters (Waterhouse, 1848). Thomas (1927) suggested that this specimen was probably an escaped pet. Pearson (1951) did not mention finding the degu in the highlands of southern Perú. To the south Greer (1965) did not report degus from Malleco Province, which lies between 37.5 and 39 degrees south latitude.

FOSSIL RECORD. *Octodon degus* is known only from recent material. The oldest reported octodontid is *Platypittamys brachydon* from the Deseadan Oligocene of Patagonia (Wood, 1949; Wood and Patterson, 1959). The postcranial skeleton of *Platypittamys* is remarkably similar to that of *Octodon* (Wood and Patterson, 1959).

FORM. There is little in the literature on the osteology of the degu. Fischer (1940) reported that the degu is less of a burrower than are other octodontids, and has a smaller clavicle and deltoid crest. Both structures are well developed, however. The scapular spine extends from near the vertebral border of the scapula to beyond the level of the tip of the coracoid process, and is a thin, unsupported, fingerlike projection from the midscapular region to the ends of the large acromion and metacromion processes. There is an extepicondyloid foramen in the humerus. The proximal ends of the tibia and fibula are fused. The incus and malleus are not fused (Wood and Patterson, 1959). The auditory bulla is well developed and the paroccipital process hugs the posterior edge and surface. There is a large infraorbital foramen with a ven-

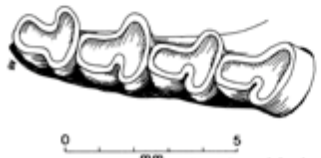


FIGURE 1. View of right upper molar toothrow of *Octodon degus*, anterior at right.

FIGURE 2. External view of an adult *Octodon degus*. Drawn from a living specimen in the University of Vermont laboratory colony by Anne Howland.

Nutrition and Behavior of Degus (*Octodon degus*)

Mark S. Edwards, PhD

KEYWORDS
• *Octodon degus* • Degu • Nutrition • Diet
• Behavior • Management

DESCRIPTION

Three extant species in the genus *Octodon* are each commonly described as degus.[1] *Octodon degus* (degu or trumpet-tailed rat) is a caviomorph rodent inhabiting subtropical to temperate savanna and scrub environments of the western slopes of northern and central Chile.[1–4] *Octodon degus* are semifossorial, diurnal, and live in colonial or familial groups of 5 to 10 animals.[2,5]

Considered an agricultural pest in some regions of its natural range,[2] *O. degus* adapts well to most laboratory conditions for research on reproduction, diabetes mellitus, and cataract development.[1,4] Objective information regarding husbandry, nutrition, and behavior, generated from their documented care under controlled research conditions, can be applied to care of degus kept as companion animals or in other managed environments.

Gastrointestinal Tract

Ocotdon degus are herbivorous, with microbial fermentation of ingesta occurring in a large, haustrated cecum after gastric and autoenzymatic digestion. Other species with similar adaptations for postgastric fermentation of digesta by symbiotic microorganisms include guinea pigs (*Cavia porcellus*), hamsters (*Mesocricetus auratus*), and voles (*Microtus townsendii*).[6]

The species dental formula is i 1/1, c 0/0, p 1/1, m 3/3, total = 20.[7] Incisor enamel is pale orange.[3] Premolars and molars, which are flat-crowned and hypsodont, have deeply infolded margins in the mid-region resembling a figure-eight, thus leading to the family and genus name.[1,3,7] Continually growing teeth are maintained in proper condition by chewing various substrates, including fibrous foods, nontoxic wood,

Comparative Animal Nutrition, Animal Science Department, California Polytechnic State University, 1 Grand Avenue, 010-0147, San Luis Obispo, CA 93407-0255, USA
E-mail address: msedward@calpoly.edu

Vet Clin Exot Anim 12 (2009) 237–253
doi:10.1016/j.cvex.2009.01.003 vetexotic.theclinics.com
1094-9194/09/$ – see front matter © 2009 Published by Elsevier Inc.

Wenig betonte Verhalten

Daily Rhythms of Food Intake and Feces Reingestion in the Degu, an Herbivorous Chilean Rodent: Optimizing Digestion through Coprophagy

G. J. Kenagy[1,2,*]
Claudio Veloso[2,†]
Francisco Bozinovic[2,‡]
[1]Department of Zoology, University of Washington, Seattle, Washington 98195; [2]Departamento de Ecología, Pontificia Universidad Católica de Chile, Santiago, Chile

Accepted 7/8/98

ABSTRACT

Animals must match their foraging and digestion to seasonal changes in availability and quality of food. When these parameters decline, the animal's performance limits for extracting energy and nutrients may be challenged. In the laboratory, we investigated daily patterns of food processing on a low-quality (high-fiber) diet of alfalfa in an herbivorous, day-active rodent, the degu (*Octodon degus*), which inhabits semiarid central Chile. We manipulated timing of food availability, from continuous availability down to as little as 5 h/d. Degus maintained weight while digesting only 53% of dry-matter consumption. With food continuously available in a metabolic cage, the animals ate more food and deposited about twice as much feces in the day as at night. Continuous 24-h behavioral observation revealed that degus were actually defecating at the same rate both night and day but then ingesting most of the feces they produced at night. Further experimental treatments challenged animals with limited periods of food availability that matched natural foraging patterns. With either 11 h of daytime food availability or only 5 h (in morning and afternoon periods of 2.5 h each), degus consumed as much food as those with 24-h food availability. Continuous 24-h behavioral observations revealed in the 11-h group that nearly all feces produced at night were reingested and nearly none were reingested in the day, whereas the 5-h group resorted to further coprophagy during the 6-h midday interval with no food. Despite these differences in timing of food intake and coprophagy in response to the three experimental treatments, the degus were defecating at the same rate both night and day, which indicated a constant rate of output from the colon. This suggests a range of adjustments of digestive physiology to the timing of gut function by balancing coprophagy with ingestion of food. Overall, 38% of 24-h feces production was reingested, and 87% of this coprophagy occurred at night. The ingestion of feces during parts of the day when food is unavailable provides for continued intake into the digestive tract and appears to represent an increase in overall efficiency of gut use.

* E-mail: kenagy@u.washington.edu.
† E-mail: cveloso@genes.bio.puc.cl.
‡ E-mail: fbozinovic@genes.bio.puc.cl.

Physiological and Biochemical Zoology 72(1):78–86. 1999. © 1999 by The University of Chicago. All rights reserved. 1522-2152/99/7201-9806$03.00

Introduction

On a daily basis, animals search for and ingest food in discrete blocks of time that vary minute by minute, hour by hour, and from day to night. The basic structural and functional design of an organism, its behavior, and its environment determine the limits on what food can be obtained and ingested and when. Although the input of food into the digestive tract is typically periodic, it is clear that some aspects of gut function, particularly in endotherms, are likely to be operating more or less continuously day and night. Optimal timing and efficiency of digestion are, therefore, dependent on a balance among behavioral strategies, ecology, and the physiology of the digestive tract.

Herbivorous rodents are interesting among small mammals because of their high rates of food intake and use of foods that are abundant but low in quality (Vorontsov 1962). As "hindgut fermenters," these rodents rely on microbial fermentation in the cecum and subsequent reingestion of feces (coprophagy) to enhance the extraction and absorption of nutrients in their diets (Kenagy and Hoyt 1980; Stevens and Hume 1995). Just as the ingestion of food is limited to discrete times of day and organized rhythmic bouts (Aschoff et al. 1983), coprophagy in rodents is rhythmic and complementary to feeding, apparently being employed mainly during the rest phase of the 24-h cycle (Kenagy and Hoyt 1980). Although few data are available that address the optimization of gut use in small herbivorous mammals that are hindgut fermenters (Sibly 1981; Stevens and Hume 1995), theoretical analyses have suggested that the use of coprophagy provides energetic and nutritional benefits for

Wenig betonte Verhalten

Daily Rhythms of Food Intake and Feces Reingestion in the Degu, an Herbivorous Chilean Rodent: Optimizing Digestion through Coprophagy

G. J. Kenagy[1,2,*]
Claudio Veloso[2,†]
Francisco Bozinovic[2,‡]
[1]Department of Zoology, University of Washington, Seattle, Washington 98195; [2]Departamento de Ecologia, Pontificia Universidad Católica de Chile, Santiago, Chile

Accepted 7/8/98

ABSTRACT

Animals must match their foraging and digestion to seasonal changes in availability and quality of food. When these parameters decline, the animal's performance limits for extracting energy and nutrients may be challenged. In the laboratory, we investigated daily patterns of food processing on a low-quality (high-fiber) diet of alfalfa in an herbivorous, day-active rodent, the degu (*Octodon degus*), which inhabits semiarid central Chile. We manipulated timing of food availability, from continuous availability down to as little as 5 h/d. Degus maintained weight while digesting only 53% of dry-matter consumption. With food continuously available in a metabolic cage, the animals ate more food and deposited about twice as much feces in the day as at night. Continuous 24-h behavioral observation revealed that degus were actually defecating at the same rate both night and day but then ingesting most of the feces they produced at night. Further experimental treatments challenged animals with limited periods of food availability that matched natural foraging patterns. With either 11 h of daytime food availability or only 5 h (in morning and afternoon periods of 2.5 h each), degus consumed as much food as those with 24-h food availability. Continuous 24-h behavioral observations revealed in the 11-h group that nearly all feces produced at night were reingested and nearly none were reingested in the day, whereas the 5-h group resorted to further coprophagy during the 6-h midday interval with no food. Despite these differences in timing of food intake and coprophagy in response to the three experimental treatments, the degus were defecating at the same rate both night and day, which indicated a constant rate of output from the colon. This suggests a range of adjustments of digestive physiology to the timing of gut function by balancing coprophagy with ingestion of food. Overall, 38% of 24-h feces production was reingested, and 87% of this coprophagy occurred at night. The ingestion of feces during parts of the day when food is unavailable provides for continued intake into the digestive tract and appears to represent an increase in overall efficiency of gut use.

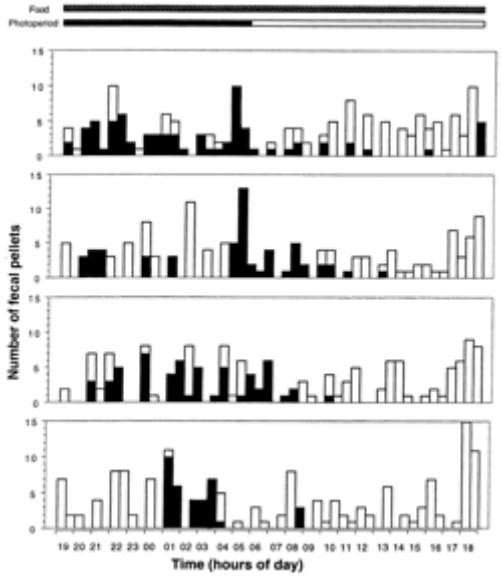
*E-mail: kenagy@u.washington.edu.
†E-mail: cveloso@genes.bio.puc.cl.
‡E-mail: fbozinovic@genes.bio.puc.cl.

Physiological and Biochemical Zoology 72(1):78–86. 1999. © 1999 by The University of Chicago. All rights reserved. 1522-2152/99/7201-9806$03.00

Introduction

On a daily basis, animals search for and ingest food in discrete blocks of time that vary minute by minute, hour by hour, and from day to night. The basic structural and functional design of an organism, its behavior, and its environment determine the limits on what food can be obtained and ingested and when. Although the input of food into the digestive tract is typically periodic, it is clear that some aspects of gut function, particularly in endotherms, are likely to be operating more or less continuously day and night. Optimal timing and efficiency of digestion are, therefore, dependent on a balance among behavioral strategies, ecology, and the physiology of the digestive tract.

Herbivorous rodents are interesting among small mammals because of their high rates of food intake and use of foods that are abundant but low in quality (Vorontsov 1962). As "hindgut fermenters," these rodents rely on microbial fermentation in the cecum and subsequent reingestion of feces (coprophagy) to enhance the extraction and absorption of nutrients in their diets (Kenagy and Hoyt 1980; Stevens and Hume 1995). Just as the ingestion of food is limited to discrete times of day and organized rhythmic bouts (Aschoff et al. 1983), coprophagy in rodents is rhythmic and complementary to feeding, apparently being employed mainly during the rest phase of the 24-h cycle (Kenagy and Hoyt 1980). Although few data are available that address the optimization of gut use in small herbivorous mammals that are hindgut fermenters (Sibly 1981; Stevens and Hume 1995), theoretical analyses have suggested that the use of coprophagy provides energetic and nutritional benefits for



☐ total faeces ■ re-ingested faeces

Wenig betonte Verhalten

Daily Rhythms of Food Intake and Feces Reingestion in the Degu, an Herbivorous Chilean Rodent: Optimizing Digestion through Coprophagy

G. J. Kenagy[1,2,*]
Claudio Veloso[2,†]
Francisco Bozinovic[2,‡]
[1]Department of Zoology, University of Washington, Seattle, Washington 98195; [2]Departamento de Ecología, Pontificia Universidad Católica de Chile, Santiago, Chile

Accepted 7/8/98

ABSTRACT

Animals must match their foraging and digestion to seasonal changes in availability and quality of food. When these parameters decline, the animal's performance limits for extracting energy and nutrients may be challenged. In the laboratory, we investigated daily patterns of food processing on a low-quality (high-fiber) diet of alfalfa in an herbivorous, day-active rodent, the degu (*Octodon degus*), which inhabits semiarid central Chile. We manipulated timing of food availability, from continuous availability down to as little as 5 h/d. Degus maintained weight while digesting only 53% of dry-matter consumption. With food continuously available in a metabolic cage, the animals ate more food and deposited about twice as much feces in the day as at night. Continuous 24-h behavioral observation revealed that degus were actually defecating at the same rate both night and day but then ingesting most of the feces they produced at night. Further experimental treatments challenged animals with limited periods of food availability that matched natural foraging patterns. With either 11 h of daytime food availability or only 5 h (in morning and afternoon periods of 2.5 h each), degus consumed as much food as those with 24-h food availability. Continuous 24-h behavioral observations revealed in the 11-h group that nearly all feces produced at night were reingested and nearly none were reingested in the day, whereas the 5-h group resorted to further coprophagy during the 6-h midday interval with no food. Despite these differences in timing of food intake and coprophagy in response to the three experimental treatments, the degus were defecating at the same rate both night and day, which indicated a constant rate of output from the colon. This suggests a range of adjustments of digestive physiology to the timing of gut function by balancing coprophagy with ingestion of food. Overall, 38% of 24-h feces production was reingested, and 87% of this coprophagy occurred at night. The ingestion of feces during parts of the day when food is unavailable provides for continued intake into the digestive tract and appears to represent an increase in overall efficiency of gut use.

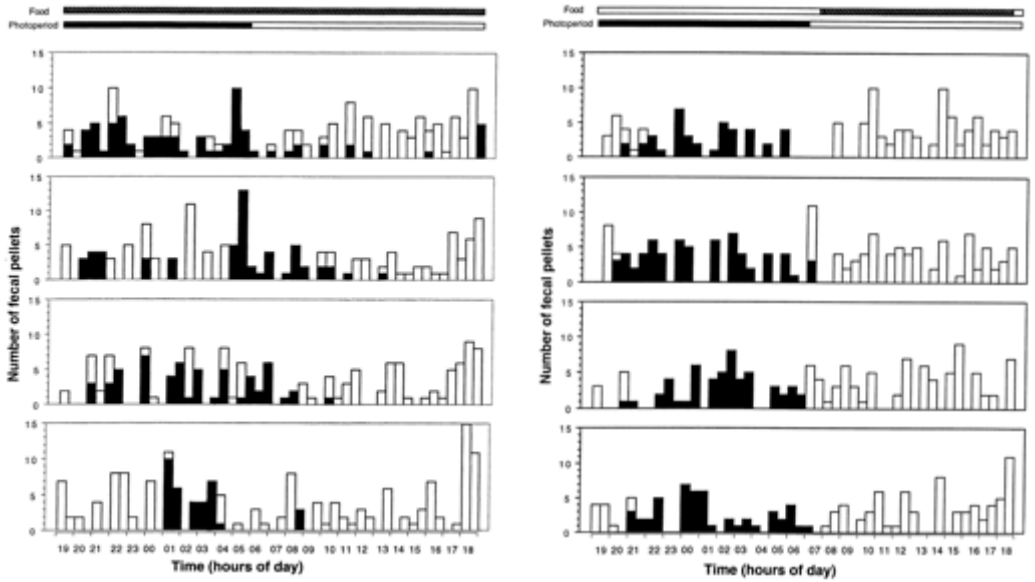
*E-mail: kenagy@u.washington.edu.
†E-mail: cveloso@genes.bio.puc.cl.
‡E-mail: fbozinovic@genes.bio.puc.cl.

Physiological and Biochemical Zoology 72(1):78–86. 1999. © 1999 by The University of Chicago. All rights reserved. 1522-2152/99/7201-9806$03.00

Introduction

On a daily basis, animals search for and ingest food in discrete blocks of time that vary minute by minute, hour by hour, and from day to night. The basic structural and functional design of an organism, its behavior, and its environment determine the limits on what food can be obtained and ingested and when. Although the input of food into the digestive tract is typically periodic, it is clear that some aspects of gut function, particularly in endotherms, are likely to be operating more or less continuously day and night. Optimal timing and efficiency of digestion are, therefore, dependent on a balance among behavioral strategies, ecology, and the physiology of the digestive tract.

Herbivorous rodents are interesting among small mammals because of their high rates of food intake and use of foods that are abundant but low in quality (Vorontsov 1962). As "hindgut fermenters," these rodents rely on microbial fermentation in the cecum and subsequent reingestion of feces (coprophagy) to enhance the extraction and absorption of nutrients in their diets (Kenagy and Hoyt 1980; Stevens and Hume 1995). Just as the ingestion of food is limited to discrete times of day and organized rhythmic bouts (Aschoff et al. 1983), coprophagy in rodents is rhythmic and complementary to feeding, apparently being employed mainly during the rest phase of the 24-h cycle (Kenagy and Hoyt 1980). Although few data are available that address the optimization of gut use in small herbivorous mammals that are hindgut fermenters (Sibly 1981; Stevens and Hume 1995), theoretical analyses have suggested that the use of coprophagy provides energetic and nutritional benefits for



□ total faeces ■ re-ingested faeces

Wenig betonte Verhalten

Daily Rhythms of Food Intake and Feces Reingestion in the Degu, an Herbivorous Chilean Rodent: Optimizing Digestion through Coprophagy

G. J. Kenagy[1,2,*]
Claudio Veloso[2,†]
Francisco Bozinovic[2,‡]
[1]Department of Zoology, University of Washington, Seattle, Washington 98195; [2]Departamento de Ecologia, Pontificia Universidad Católica de Chile, Santiago, Chile

Accepted 7/8/98

ABSTRACT

Animals must match their foraging and digestion to seasonal changes in availability and quality of food. When these parameters decline, the animal's performance limits for extracting energy and nutrients may be challenged. In the laboratory, we investigated daily patterns of food processing on a low-quality (high-fiber) diet of alfalfa in an herbivorous, day-active rodent, the degu (*Octodon degus*), which inhabits semiarid central Chile. We manipulated timing of food availability, from continuous availability down to as little as 5 h/d. Degus maintained weight while digesting only 53% of dry-matter consumption. With food continuously available in a metabolic cage, the animals ate more food and deposited about twice as much feces in the day as at night. Continuous 24-h behavioral observation revealed that degus were actually defecating at the same rate both night and day but then ingesting most of the feces they produced at night. Further experimental treatments challenged animals with limited periods of food availability that matched natural foraging patterns. With either 11 h of daytime food availability or only 5 h (in morning and afternoon periods of 2.5 h each), degus consumed as much food as those with 24-h food availability. Continuous 24-h behavioral observations revealed in the 11-h group that nearly all feces produced at night were reingested and nearly none were reingested in the day, whereas the 5-h group resorted to further coprophagy during the 6-h midday interval with no food. Despite these differences in timing of food intake and coprophagy in response to the three experimental treatments, the degus were defecating at the same rate both night and day, which indicated a constant rate of output from the colon. This suggests a range of adjustments of digestive physiology to the timing of gut function by balancing coprophagy with ingestion of food. Overall, 38% of 24-h feces production was reingested, and 87% of this coprophagy occurred at night. The ingestion of feces during parts of the day when food is unavailable provides for continued intake into the digestive tract and appears to represent an increase in overall efficiency of gut use.

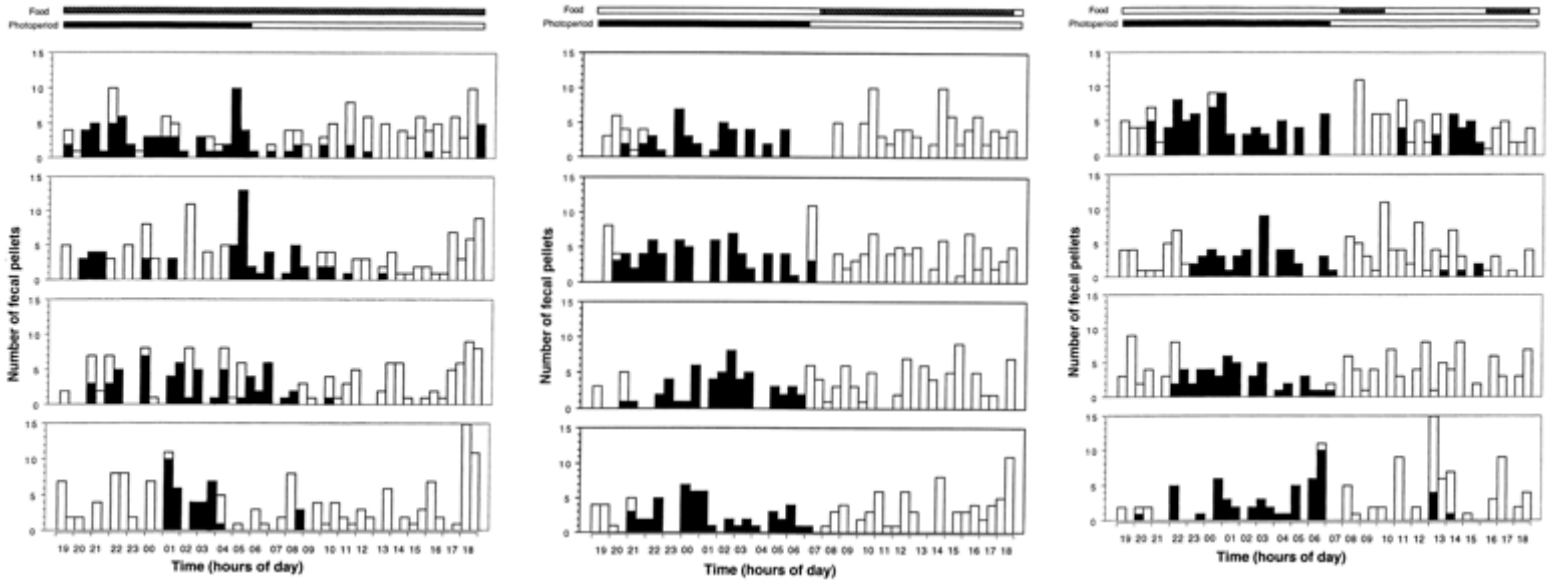
* E-mail: kenagy@u.washington.edu.
† E-mail: cveloso@genes.bio.puc.cl.
‡ E-mail: fbozinovic@genes.bio.puc.cl.

Physiological and Biochemical Zoology 72(1):78–86. 1999. © 1999 by The University of Chicago. All rights reserved. 1522-2152/99/7201-9806$03.00

Introduction

On a daily basis, animals search for and ingest food in discrete blocks of time that vary minute by minute, hour by hour, and from day to night. The basic structural and functional design of an organism, its behavior, and its environment determine the limits on what food can be obtained and ingested and when. Although the input of food into the digestive tract is typically periodic, it is clear that some aspects of gut function, particularly in endotherms, are likely to be operating more or less continuously day and night. Optimal timing and efficiency of digestion are, therefore, dependent on a balance among behavioral strategies, ecology, and the physiology of the digestive tract.

Herbivorous rodents are interesting among small mammals because of their high rates of food intake and use of foods that are abundant but low in quality (Vorontsov 1962). As "hindgut fermenters," these rodents rely on microbial fermentation in the cecum and subsequent reingestion of feces (coprophagy) to enhance the extraction and absorption of nutrients in their diets (Kenagy and Hoyt 1980; Stevens and Hume 1995). Just as the ingestion of food is limited to discrete times of day and organized rhythmic bouts (Aschoff et al. 1983), coprophagy in rodents is rhythmic and complementary to feeding, apparently being employed mainly during the rest phase of the 24-h cycle (Kenagy and Hoyt 1980). Although few data are available that address the optimization of gut use in small herbivorous mammals that are hindgut fermenters (Sibly 1981; Stevens and Hume 1995), theoretical analyses have suggested that the use of coprophagy provides energetic and nutritional benefits for



☐ total faeces ■ re-ingested faeces

Wenig betonte Verhalten

Locomotor and feeding activity rhythms in a light-entrained diurnal rodent, *Octodon degus*

R. GARCÍA-ALLEGUE,[1] P. LAX,[1] A. M. MADARIAGA,[2] AND J. A. MADRID[1]

[1]*Department of Physiology and Pharmacology (Animal Physiology Unit), University of Murcia, 30100 Murcia; and* [2]*Animalario University of Alicante, 03080 Alicante, Spain*

García-Allegue, R., P. Lax, A. M. Madariaga, and J. A. Madrid. Locomotor and feeding activity rhythms in a light-entrained diurnal rodent, *Octodon degus*. *Am. J. Physiol.* 277 (*Regulatory Integrative Comp. Physiol.* 46): R523–R531, 1999.—The wheel running (WR) and feeding activity (FA) of *Octodon degus*, a new laboratory rodent characterized by its diurnal habits, were recorded under different lighting conditions. Under 12:12-h light-dark (LD 12:12) cycles, WR activity exhibited a crepuscular pattern with two peaks, M and E, associated with "dawn" and "dusk," respectively. In both cases, an anticipatory activity was patent, suggesting that, beside the masking effect of LD transitions, both peaks have an endogenous origin. This pattern, which was also observed under a skeleton photoperiod (LD 0.5:11.5), became unimodal after LD 0.5:23.5 and constant darkness (DD) exposure. Simultaneously, FA showed an arrhythmic pattern in most animals, especially under DD, when none of the animals exhibited a significant circadian rhythm. The existence of two groups of oscillators, or two oscillators, would explain most properties of the WR rhythms noted in this species. Our results show that the degu's temporal feeding strategy seems mainly arrhythmic, whereas its WR pattern is driven by a strongly circadian bimodal rhythm.

degu; entrainment; crepuscular; skeleton photoperiod; circadian

OCTODON DEGUS, COMMONLY called degu, a South American hystricomorph rodent, has become an increasingly popular experimental animal in recent years. Degus live in central Chile and are found from sea level to ~2,000 meters (for more data, see Refs. 3 and 8). Its way of life is terrestrial and fossorial, and it displays a very elaborate social behavior (5, 6).

From a chronobiological point of view, the degu is of great interest. Field and laboratory studies have shown that they are active during the day throughout the year, with their activity pattern characterized by two main peaks of activity in the morning and late afternoon (3, 15). Degus were more active immediately before lights-off and the 2 h before lights-on, anticipating the illumination changes. Sleep periods were mainly confined to the nocturnal period, with a minimal amount of sleep during lights-on (4). In accordance with its diurnal behavior, its temperature acrophase occurred at the end of the light period, in close association to the second activity peak (4, 14).

Most animal chronobiological studies on the chronopharmacology, behavior, and physiology of the circadian system have been developed in nocturnal rodents such as rat, hamster, or mouse. The degu's diurnalism, a rare characteristic among rodents, as well as some features of its circadian rhythms, such as the variability of individual rhythms, the presence of different morning-evening chronotypes, and the dramatic bimodal pattern in its circadian locomotor rhythm, make the degu a model of special interest in chronobiology (10). Although the multioscillatory nature of the circadian system is an old issue, the assumption that the mammalian circadian system could be based on the degree of intercommunication of several neural oscillators with different intrinsic frequencies and varying capacities for light synchronization remains open (2). The bimodality of the degu's locomotor rhythms is a useful model for obtaining further evidence to support the above-mentioned hypothesis.

To date, only circadian rhythms of locomotor activity, body temperature, and sleep have been studied (4–6, 9, 10, 12, 14, 15), our study being the first attempt to study feeding and wheel running activity rhythms (FA and WR, respectively) simultaneously in degus kept under laboratory conditions.

The aim of the present experiment was to describe the synchronization of FA and WR rhythms to different light-dark (LD) cycles to characterize the endogenous nature of the two main peaks of activity, described in the above studies. For this, the degu's FA and WR, two exclusive variables, were continuously recorded under complete and skeleton photoperiods and constant darkness (DD).

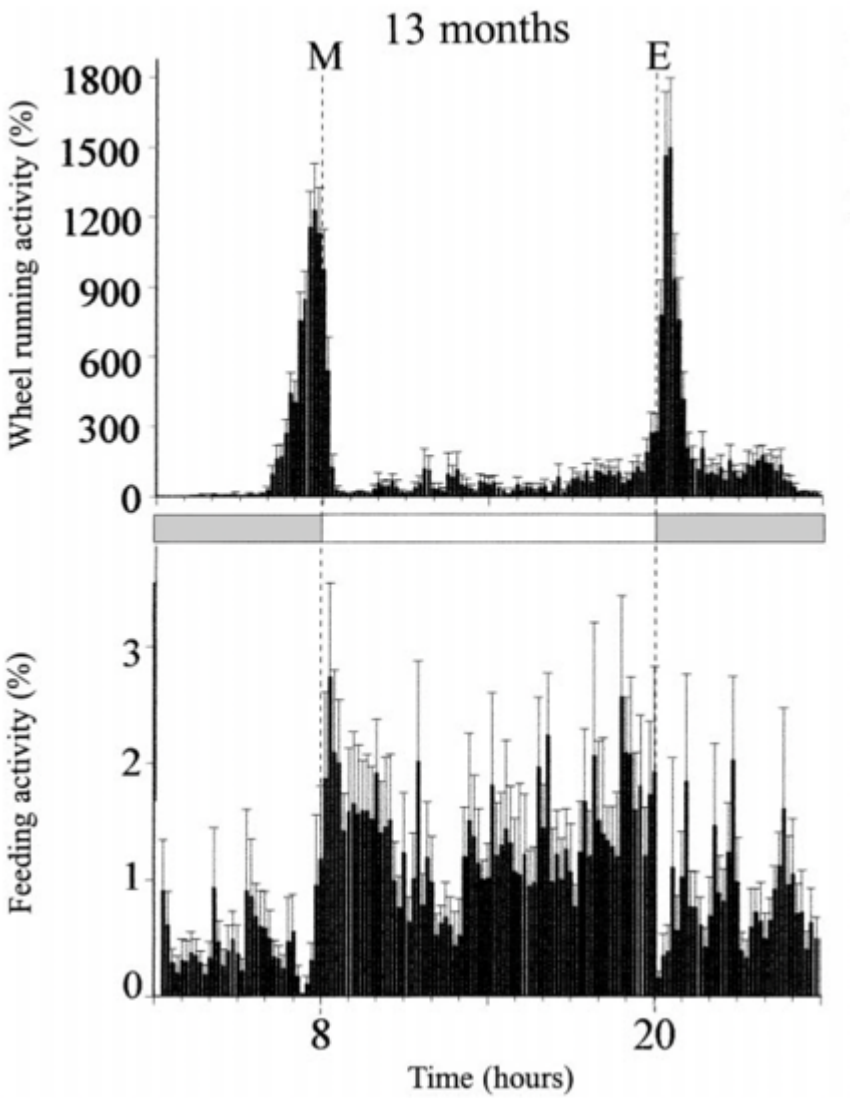
MATERIAL AND METHODS

Animals and housing. Ten male Octodon degus (10 mo old at the beginning of the experiments) reared in a laboratory colony at the University of Alicante were used in the study. At the beginning of the experimental period, the animals were individually housed in a modified Plexiglas cage (52.5 × 27.5 × 15 cm), which allowed the recording of FA and WR. Cages were placed in a light-tight and temperature-controlled chamber with continuous ventilation (200–300 lx during lights-on, a temperature of 23 ± 1°C, and 60 ± 20% relative humidity). Dim red light (intensity <0.5 lx) was present all the time for nocturnal manipulations. A pelleted rat diet (Panlab) and water cups were available ad libitum. The cages were cleaned, and the food and water were refilled every 10 days at random times of the day to prevent synchronization.

Apparatus. All cages were provided with a contact eatometer and a wheel for feeding and locomotor registration. The eatometer has been described in detail elsewhere (11). Briefly, it consisted of a stainless steel grid with a swinging grid mounted inside that had to be activated by the animal to eat, thus allowing the recording of FA. The axis of the wheel (9-cm wide and 25-cm diameter) was provided with an eccentric

The costs of publication of this article were defrayed in part by the payment of page charges. The article must therefore be hereby marked "*advertisement*" in accordance with 18 U.S.C. Section 1734 solely to indicate this fact.

0363-6119/99 $5.00 Copyright © 1999 the American Physiological Society



Wenig betonte Verhalten

NOTES ON THE ACTIVITY, REPRODUCTION, AND SOCIAL BEHAVIOR OF *OCTODON DEGUS*

GEORGE W. FULK

ABSTRACT.—Data on activity and social behavior of the Chilean degu, *Octodon degus*, were gathered by direct observation of animals, some of which had been marked for individual recognition. Data from autopsies and external inspection of trapped animals suggested that most reproduction occurs in September at the latitude of Santiago. Degus are diurnal and show morning and evening activity peaks. Social organization is based on group territories, at least during the period after emergence of the young. Mound building (collecting a pile of sticks, stones, and cow dung) was associated with territorial marking. Females of the same social group may rear their young in a common nest burrow. *Octodon degus* burrows are sometimes used by *Abrocoma bennetti*, a similar sized rodent, and on two occasions nest burrows were found to be shared by young and mothers of both species.

Octodon degus is a common rodent in central Chile and one of the most economically important. In some areas it is an agricultural pest. Degus do considerable damage to cultivated tuna, the edible fruit of the prickly pear cactus; Ipinza *et al.* (1971) reported that degus are known to damage wheat fields, vineyards, and orchards. Pefaur *et al.* (1968) reviewed the parasitological literature and reported that *O. degus* can host three species of parasites known to infect man. In the United States, this hystricomorph is becoming widely used in medical laboratories (Woods and Boraker, 1975).

Despite the importance and abundance of *O. degus*, information on its natural history is almost completely lacking. Woods and Boraker (1975) provided a complete review of the literature on the species. In this paper I report observations made on a natural population of *O. degus*.

METHODS

This study was carried out at the experiment station of the School of Agronomy of the University of Chile at Rinconada de Maipú (70°50′W, 33°31′S) near Santiago. The vegetation was a mixture of grasses and shrubs and was greatly influenced by cattle grazing. The dominant woody plants were *Acacia caven* and *Proustia cuneifolia*. Olivares and Gastó (1971) described secondary plant succession at this site and the influence of *Octodon degus* on the herbaceous strata. Climatic data were given in Fulk (1975).

Reproductive data were gathered by autopsy of kill-trapped animals and by inspection of live-trapped animals.

Activity was monitored by making frequent 15-minute observations during the daylight hours for one day each month for six consecutive months beginning in May 1973. The number of animals seen in a delineated area around an elevated observation blind was considered a measure of activity. Between observations, air temperature in the shade 5 centimeters above the ground, sunlight intensity, and relative humidity were recorded.

Information on social behavior was gathered by observing a nearby colony of degus from a similar blind. Before the start of observations, animals were live trapped, examined for reproductive condition, weighed, marked for individual recognition by hair clipping,

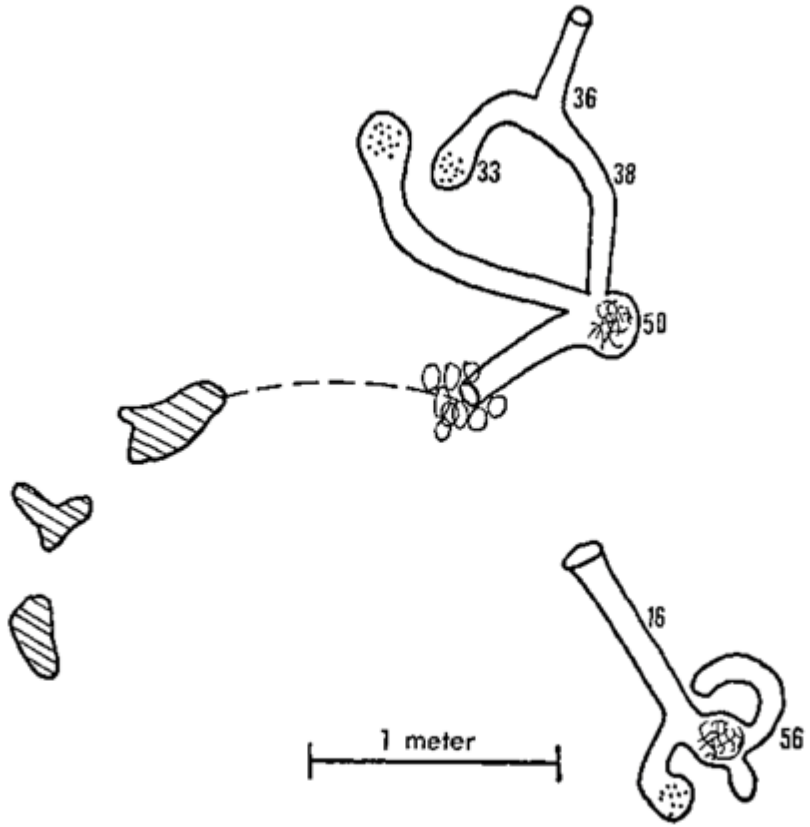


FIG. 4.—Sketch of degu burrows; numbers indicate depth in centimeters; crossed hatched areas, places where grass was cut and taken into nest chamber. See text for details.

Wenig betonte Verhalten

Ethology

Inter-Population Variation in Hoarding Behaviour in Degus, *Octodon degus*

René Quispe*, Camila P. Villavicencio*, Arturo Cortés†‡ & Rodrigo A. Vásquez*

* Instituto de Ecología y Biodiversidad, Departamento de Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile, Santiago, Chile
† Departamento de Biología, Facultad de Ciencias, Universidad de La Serena, La Serena, Chile
‡ Centro de Estudios Avanzados en Zonas Aridas, La Serena, Chile

Correspondence
Rodrigo A. Vásquez, Instituto de Ecología y Biodiversidad, Departamento de Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile, Casilla 653, Santiago, Chile.
E-mail: rvasquez@uchile.cl

Received: July 1, 2008
Initial acceptance: October 6, 2008
Final acceptance: December 16, 2008
(D. Zeh)

doi: 10.1111/j.1439-0310.2009.01621.x

Abstract

Although foraging comprises a set of behaviours that typically vary with resource availability and/or climatic conditions, few studies have analysed how foraging, particularly food hoarding, varies across populations inhabiting different habitats. We carried out an inter-population study on foraging behaviour with the caviomorph rodent *Octodon degus* collected from two geographically separated populations in central Chile, with contrasting climates. One population was located in a mountainous zone (at 2600 m elevation) characterized by a high-altitude climate. The other population was from a low-altitude Mediterranean climate zone (450 m elevation). Under laboratory conditions, we measured population-specific differences in food consumption and hoarding by recording food utilization. We also assessed whether acclimation played a role in behavioural differences, by using two different sets of animals that had been in captivity for (1) 2 wk or (2) 6 mo, under common conditions. The results showed variation in food hoarding between populations. Individuals from the low-altitude population exclusively displayed scatter hoarding behaviour. In contrast, high-altitude animals carried out larder hoarding combined with scatter hoarding (37.4% and 62.6% respectively). There was no intra-population variation between degus with different acclimation periods under captivity, thus inter-population differences in larder hoarding were maintained despite 6 mo of acclimation to a common environment. The geographic variation observed suggests that larder hoarding is favoured under harsher environmental conditions. We discuss some probable causes for this variation. The lack of effect of acclimation suggests that inter-population differences in larder hoarding might be the result of local adaptation or, less likely, it corresponds to an ontogenetically acquired irreversible behaviour.

Introduction

One of the most effective methods to assess the adaptive value of phenotypes has been the quantification of trait variation through comparisons between populations occurring in contrasting ecological conditions (Endler 1986; Foster & Endler 1999). Species inhabiting large geographical areas covering various habitat types must cope with diverse ecological conditions, with large environmental differences across their range (see e.g. Oswald 1998; Foster & Endler 1999; D'Anatro & Lessa 2006; Ferguson & Higdon 2006; Wingfield et al. 2007). Each population may experience selective pressures different from those experienced in populations elsewhere, resulting in differences in phenotypic traits (e.g.

Wenig betonte Verhalten

Ethology

Inter-Population Variation in Hoarding Behaviour in Degus, *Octodon degus*

René Quispe*, Camila P. Villavicencio*, Arturo Cortés†‡ & Rodrigo A. Vásquez*

* Instituto de Ecología y Biodiversidad, Departamento de Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile, Santiago, Chile
† Departamento de Biología, Facultad de Ciencias, Universidad de La Serena, La Serena, Chile
‡ Centro de Estudios Avanzados en Zonas Aridas, La Serena, Chile

Correspondence
Rodrigo A. Vásquez, Instituto de Ecología y Biodiversidad, Departamento de Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile, Casilla 653, Santiago, Chile.
E-mail: rvasquez@uchile.cl

Received: July 1, 2008
Initial acceptance: October 6, 2008
Final acceptance: December 16, 2008
(D. Zeh)

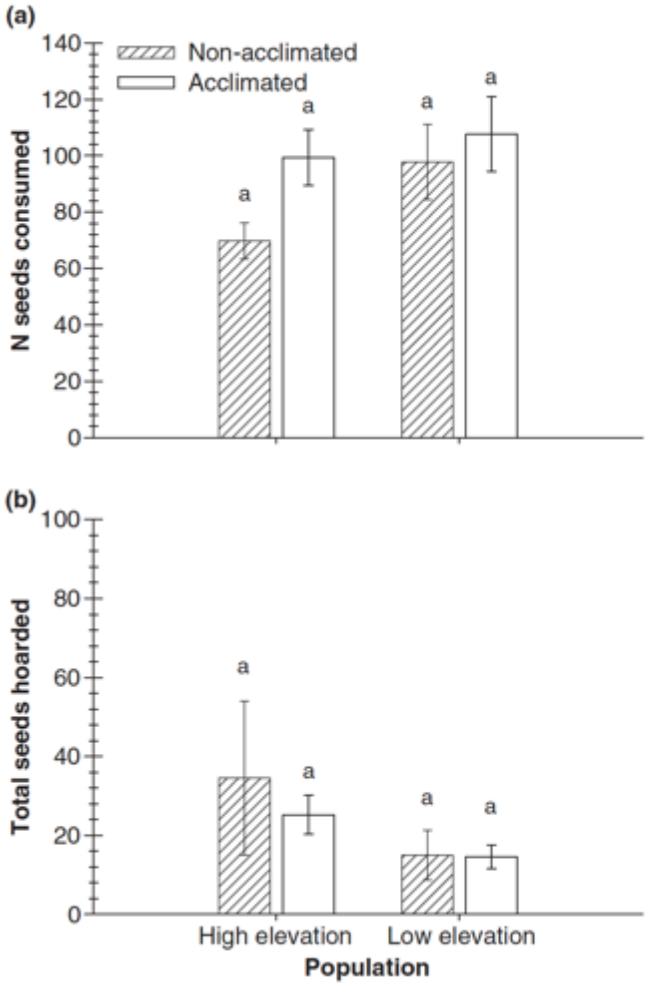
doi: 10.1111/j.1439-0310.2009.01621.x

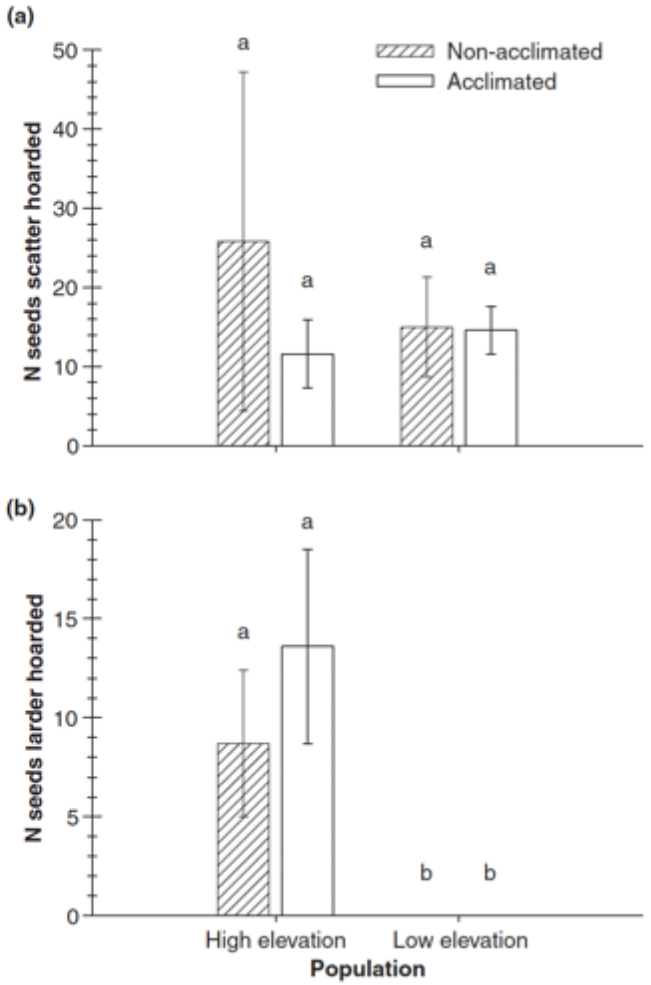
Abstract

Although foraging comprises a set of behaviours that typically vary with resource availability and/or climatic conditions, few studies have analysed how foraging, particularly food hoarding, varies across populations inhabiting different habitats. We carried out an inter-population study on foraging behaviour with the caviomorph rodent *Octodon degus* collected from two geographically separated populations in central Chile, with contrasting climates. One population was located in a mountainous zone (at 2600 m elevation) characterized by a high-altitude climate. The other population was from a low-altitude Mediterranean climate zone (450 m elevation). Under laboratory conditions, we measured population-specific differences in food consumption and hoarding by recording food utilization. We also assessed whether acclimation played a role in behavioural differences, by using two different sets of animals that had been in captivity for (1) 2 wk or (2) 6 mo, under common conditions. The results showed variation in food hoarding between populations. Individuals from the low-altitude population exclusively displayed scatter hoarding behaviour. In contrast, high-altitude animals carried out larder hoarding combined with scatter hoarding (37.4% and 62.6% respectively). There was no intra-population variation between degus with different acclimation periods under captivity, thus inter-population differences in larder hoarding were maintained despite 6 mo of acclimation to a common environment. The geographic variation observed suggests that larder hoarding is favoured under harsher environmental conditions. We discuss some probable causes for this variation. The lack of effect of acclimation suggests that inter-population differences in larder hoarding might be the result of local adaptation or, less likely, it corresponds to an ontogenetically acquired irreversible behaviour.

Introduction

One of the most effective methods to assess the adaptive value of phenotypes has been the quantification of trait variation through comparisons between populations occurring in contrasting ecological conditions (Endler 1986; Foster & Endler 1999). Species inhabiting large geographical areas covering various habitat types must cope with diverse ecological conditions, with large environmental differences across their range (see e.g. Oswald 1998; Foster & Endler 1999; D'Anatro & Lessa 2006; Ferguson & Higdon 2006; Wingfield et al. 2007). Each population may experience selective pressures different from those experienced in populations elsewhere, resulting in differences in phenotypic traits (e.g.





of a total of 200 test seeds

Wenig betonte Verhalten

Ethology

Inter-Population Variation in Hoarding Behaviour in Degus, *Octodon degus*

René Quispe*, Camila P. Villavicencio*, Arturo Cortés†‡ & Rodrigo A. Vásquez*

* Instituto de Ecología y Biodiversidad, Departamento de Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile, Santiago, Chile
† Departamento de Biología, Facultad de Ciencias, Universidad de La Serena, La Serena, Chile
‡ Centro de Estudios Avanzados en Zonas Aridas, La Serena, Chile

Correspondence
Rodrigo A. Vásquez, Instituto de Ecología y Biodiversidad, Departamento de Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile, Casilla 653, Santiago, Chile.
E-mail: rvasquez@uchile.cl

Received: July 1, 2008
Initial acceptance: October 6, 2008
Final acceptance: December 16, 2008
(D. Zeh)

doi: 10.1111/j.1439-0310.2009.01621.x

Abstract

Although foraging comprises a set of behaviours that typically vary with resource availability and/or climatic conditions, few studies have analysed how foraging, particularly food hoarding, varies across populations inhabiting different habitats. We carried out an inter-population study on foraging behaviour with the caviomorph rodent *Octodon degus* collected from two geographically separated populations in central Chile, with contrasting climates. One population was located in a mountainous zone (at 2600 m elevation) characterized by a high-altitude climate. The other population was from a low-altitude Mediterranean climate zone (450 m elevation). Under laboratory conditions, we measured population-specific differences in food consumption and hoarding by recording food utilization. We also assessed whether acclimation played a role in behavioural differences, by using two different sets of animals that had been in captivity for (1) 2 wk or (2) 6 mo, under common conditions. The results showed variation in food hoarding between populations. Individuals from the low-altitude population exclusively displayed scatter hoarding behaviour. In contrast, high-altitude animals carried out larder hoarding combined with scatter hoarding (37.4% and 62.6% respectively). There was no intra-population variation between degus with different acclimation periods under captivity, thus inter-population differences in larder hoarding were maintained despite 6 mo of acclimation to a common environment. The geographic variation observed suggests that larder hoarding is favoured under harsher environmental conditions. We discuss some probable causes for this variation. The lack of effect of acclimation suggests that inter-population differences in larder hoarding might be the result of local adaptation or, less likely, it corresponds to an ontogenetically acquired irreversible behaviour.

Introduction

One of the most effective methods to assess the adaptive value of phenotypes has been the quantification of trait variation through comparisons between populations occurring in contrasting ecological conditions (Endler 1986; Foster & Endler 1999). Species inhabiting large geographical areas covering various habitat types must cope with diverse ecological conditions, with large environmental differences across their range (see e.g. Oswald 1998; Foster & Endler 1999; D'Anatro & Lessa 2006; Ferguson & Higdon 2006; Wingfield et al. 2007). Each population may experience selective pressures different from those experienced in populations elsewhere, resulting in differences in phenotypic traits (e.g.

Nearly all individuals displayed seed hoarding behaviour. Therefore, our results suggest that hoarding behaviour occurs as a fundamental component of foraging activity of this species. Degus appear to allocate a significant amount of energy to hoarding activities during foraging, and animals from both populations often appear to hoard food given the opportunity. This finding is important because there is not previous information about hoarding in degus.

Landschildkröten (*Testudo* spp.)

Natürliche Futterwahl: Landschildkröten

African Journal of Herpetology, 2008 57(2): 103-113. ©Herpetological Association of Africa

Original article

Food choice of an Algerian population of the spur-thighed tortoise, *Testudo graeca*

RACHID ROUAG[1], CHAHIRA FERRAH[2], LUCA LUISELLI[3], GHOULEM TIAR[2], SLIM BENYACOUB[2], NADIA ZIANE[2] AND EL HASSAN EL MOUDEN[4]

[1]*Centre universitaire d'El Tarf, 36100 El Tarf, Algérie; Rachid.Rouag@yahoo.fr*
[2]*Département de Biologie, Université Badji Mokhtar, BP 12, El Hadjar, 23000 Annaba, Algérie*
[3]*F.I.Z.V. (Ecology) and Centre of Environmental Studies Demetra s.r.l., via Olona 7, 00198 Roma, Italia; lucamlu@tin.it*
[4]*Faculté des Sciences, Semlalia Département de Biologie, Université Cadi Ayyad, BP 2390, 40000 Marrakech, Maroc*

Abstract.—The diet of an Algerian population of spur-thighed tortoise (*Testudo graeca*) was studied with the aims of exploring: (i) the variation in diet among males, females and juveniles, (ii) the relationships between consumption and relative availability of the plant species, and (iii) which plant tissues, vegetative or reproductive, are eaten by tortoises. We recorded more than forty plant species at the study area, with monocot species ($n = 7$) having a greater percent cover than that of dicot species ($n = 31$ species) or Gymnospermae ($n = 2$). Tortoise diet was studied by categorising 4422 plant and animal fragments in faecal pellets of 20 males, 16 females and eight juveniles. Tortoises ate a wide variety of plant species, including 13 dicots and three monocots, and occasionally invertebrates. The number of fragments for a plant species was correlated with plant species cover, and plant vegetative tissues exceeded plant reproductive tissues in the faeces. Dicots (Fabaceae, Compositae, Primulaceae, and Caryophyllaceae) accounted for over 70% of the diet (faecal fragments). The high dietary (niche) overlap, and null model analysis (RA3 algorithm with 30,000 Monte Carlo simulations), indicate that males, females and juveniles did not partition food resources; all three groups ate the same plant species.

Key words.—Testudinidae, herbivory, north Africa, feeding, faecal pellet analysis.

Most extant reptiles are carnivorous (crocodiles, snakes, lizards, freshwater turtles), with herbivory being unusual (in freshwater turtles), rare (in lizards), exceptionally rare (in crocodiles), or nonexistent (in snakes; Halliday & Adler 2002). Terrestrial chelonians, especially members of the family Testudinidae, are unusual among reptiles in that typically they are herbivorous, with few species being omnivorous or mainly carnivorous (Ernst & Barbour 1989; Hailey *et al.* 2001; Luiselli 2006). Studying foraging ecology may be very instructive for understanding other aspects of life-history and evolution of these reptiles (*e.g.*, Luiselli 2006), and scientists are beginning to carefully analyse the dietary habits of testudinids (*e.g.*, MacDonald & Mushinsky 1988; Jennings 1993; Luiselli 2003; El Mouden *et al.* 2006). Such detailed dietary studies are necessary to help us understand the main patterns of tortoise foraging ecology.

The spur-thighed or Moorish tortoise (*Testudo graeca graeca* Linnaeus, 1758) has a wide dis-

Natürliche Futterwahl: Landschildkröten

African Journal of Herpetology, 2008 57(2): 103-113. ©Herpetological Association of Africa

Original article

Food choice of an Algerian population of the spur-thighed tortoise, *Testudo graeca*

RACHID ROUAG[1], CHAHIRA FERRAH[2], LUCA LUISELLI[3], GHOULEM TIAR[2], SLIM BENYACOUB[2], NADIA ZIANE[2] AND EL HASSAN EL MOUDEN[4]

[1]*Centre universitaire d'El Tarf, 36100 El Tarf, Algérie; Rachid.Rouag@yahoo.fr*
[2]*Département de Biologie, Université Badji Mokhtar, BP 12, El Hadjar, 23000 Annaba, Algérie*
[3]*F.I.Z.V. (Ecology) and Centre of Environmental Studies Demetra s.r.l., via Olona 7, 00198 Roma, Italia; lucamlu@tin.it*
[4]*Faculté des Sciences, Semlalia Département de Biologie, Université Cadi Ayyad, BP 2390, 40000 Marrakech, Maroc*

Abstract.—The diet of an Algerian population of spur-thighed tortoise (*Testudo graeca*) was studied with the aims of exploring: (i) the variation in diet among males, females and juveniles, (ii) the relationships between consumption and relative availability of the plant species, and (iii) which plant tissues, vegetative or reproductive, are eaten by tortoises. We recorded more than forty plant species at the study area, with monocot species ($n = 7$) having a greater percent cover than that of dicot species ($n = 31$ species) or Gymnospermae ($n = 2$). Tortoise diet was studied by categorising 4422 plant and animal fragments in faecal pellets of 20 males, 16 females and eight juveniles. Tortoises ate a wide variety of plant species, including 13 dicots and three monocots, and occasionally invertebrates. The number of fragments for a plant species was correlated with plant species cover, and plant vegetative tissues exceeded plant reproductive tissues in the faeces. Dicots (Fabaceae, Compositae, Primulaceae, and Caryophyllaceae) accounted for over 70% of the diet (faecal fragments). The high dietary (niche) overlap, and null model analysis (RA3 algorithm with 30,000 Monte Carlo simulations), indicate that males, females and juveniles did not partition food resources; all three groups ate the same plant species.

Key words.—Testudinidae, herbivory, north Africa, feeding, faecal pellet analysis.

Most extant reptiles are carnivorous (crocodiles, snakes, lizards, freshwater turtles), with herbivory being unusual (in freshwater turtles), rare (in lizards), exceptionally rare (in crocodiles), or nonexistent (in snakes; Halliday & Adler 2002). Terrestrial chelonians, especially members of the family Testudinidae, are unusual among reptiles in that typically they are herbivorous, with few species being omnivorous or mainly carnivorous (Ernst & Barbour 1989; Hailey *et al.* 2001; Luiselli 2006). Studying foraging ecology may be very instructive for understanding other aspects of life-history and evolution of these reptiles (*e.g.*, Luiselli 2006), and scientists are beginning to carefully analyse the dietary habits of testudinids (*e.g.*, MacDonald & Mushinsky 1988; Jennings 1993; Luiselli 2003; El Mouden *et al.* 2006). Such detailed dietary studies are necessary to help us understand the main patterns of tortoise foraging ecology.

The spur-thighed or Moorish tortoise (*Testudo graeca graeca* Linnaeus, 1758) has a wide dis-

Pflanzenmaterial	~ 97 %
Invertebraten	~ 3 %

Natürliche Futterwahl: Landschildkröten

BIOLOGICA NYSSANA
7 (1) • September 2016: 53-55
DOI: 10.5281/zenodo.159104

Short Communication

Received: 26 December 2015
Revised: 15 February 2016
Accepted: 01 June 2016

A note on scavenging behaviour of adult Hermann's tortoise (*Testudo hermanni*)

Marko Nikolić[1,2]*, Dimitrija Savić[1,2], Maja Ilić[1,2], Dragana Stojadinović[1], Jelka Crnobrnja-Isailović[1,3]

[1]Faculty of Sciences and Mathematics, University of Niš, Višegradska 33, 18000 Niš, Serbia
[2]Biological Society "Dr. Sava Petrović", Visegradska 33, 18000 Niš, Serbia
[3]Institute for Biological Research "Siniša Stanković", University of Belgrade, Despota Stefana 142, 11000 Belgrade, Serbia

** E-mail: zerocool.axl@gmail.com*

***Abstract*:**

Nikolić, M., Savić, D., Ilić, M., Stojadinović, D., Crnobrnja-Isailović, J.: *A note on scavenging behaviour of adult Hermann's tortoise (Testudo hermanni). Biologica Nyssana, 7 (1), September 2016: 53-55.*

Report of the first observation of scavenging behaviour in the population of *Testudo hermanni boettgeri* that has been monitored for six years in the village Kunovica near the city of Niš in Serbia. On 31 May 2015 at 10:18 a.m., the adult tortoise was observed while eating a dead European green lizard (*Lacerta viridis*).

Key words: *Testudo hermanni*, diet, scavenging behavior, Serbia

***Apstrakt*:**

Nikolić, M., Savić, D., Ilić, M., Stojadinović, D., Crnobrnja-Isailović, J.: *Beleška o strvinarskom ponašanju kod adulta šumske kornjače (Testudo hermanni). Biologica Nyssana, 7 (1), Septembar 2016: 53-55.*

Beleška o prvom zapažanju strvinarskog ponašanja u populaciji šumske kornjače *Testudo hermanni boettgeri*, čiji monitoring se sprovodi već šest godina u selu Kunovica, u blizini grada Niša u Srbiji. Adultna kornjača je uočena prilikom hranjenja lešinom zelembača (*Lacerta viridis*) 31. Maja 2015. u 10:18.

Key words: *Testudo hermanni*, ishrana, strvinarsko ponašanje, Srbija

Introduction

Testudinidae is the family of terrestrial chelonians (i.e. tortoises) which are, apart from a few species of lizards, the only terrestrial ectothermic vertebrates with generalized herbivorous or omnivorous feeding habits (Del Vecchio et al., 2011). Luiselli (2006) reviewed general dietary habits of 50 species from the family Testudinidae and 15 species from the families Geoemydidae and Emydidae. Of those, about 66% of terrestrial chelonians were exclusively herbivorous, 33% were omnivorous, and only one species (*Terrapene carolina*) was predominantly carnivorous. Herbivory in tortoises is not obligatory, as many species also feed on different food that

Natürliche Futterwahl: Landschildkröten

BIOLOGICA NYSSANA
7 (1) • September 2016: 53-55
DOI: 10.5281/zenodo.159104

Short Communication

Received: 26 December 2015
Revised: 15 February 2016
Accepted: 01 June 2016

A note on scavenging behaviour of adult Hermann's tortoise (*Testudo hermanni*)

Marko Nikolić[1,2]*, Dimitrija Savić[1,2], Maja Ilić[1,2], Dragana Stojadinović[1], Jelka Crnobrnja-Isailović[1,3]

[1]Faculty of Sciences and Mathematics, University of Niš, Višegradska 33, 18000 Niš, Serbia
[2]Biological Society "Dr. Sava Petrović", Visegradska 33, 18000 Niš, Serbia
[3]Institute for Biological Research "Siniša Stanković", University of Belgrade, Despota Stefana 142, 11000 Belgrade, Serbia

** E-mail: zerocool.axl@gmail.com*

***Abstract*:**

Nikolić, M., Savić, D., Ilić, M., Stojadinović, D., Crnobrnja-Isailović, J.: *A note on scavenging behaviour of adult Hermann's tortoise (Testudo hermanni). Biologica Nyssana, 7 (1), September 2016: 53-55.*

Report of the first observation of scavenging behaviour in the population of *Testudo hermanni boettgeri* that has been monitored for six years in the village Kunovica near the city of Niš in Serbia. On 31 May 2015 at 10:18 a.m., the adult tortoise was observed while eating a dead European green lizard (*Lacerta viridis*).

Key words: *Testudo hermanni*, diet, scavenging behavior, Serbia

***Apstrakt*:**

Nikolić, M., Savić, D., Ilić, M., Stojadinović, D., Crnobrnja-Isailović, J.: *Beleška o strvinarskom ponašanju kod adulta šumske kornjače (Testudo hermanni). Biologica Nyssana, 7 (1), Septembar 2016: 53-55.*

Beleška o prvom zapažanju strvinarskog ponašanja u populaciji šumske kornjače *Testudo hermanni boettgeri*, čiji monitoring se sprovodi već šest godina u selu Kunovica, u blizini grada Niša u Srbiji. Adultna kornjača je uočena prilikom hranjenja lešinom zelembača (*Lacerta viridis*) 31. Maja 2015. u 10:18.

Key words: *Testudo hermanni*, ishrana, strvinarsko ponašanje, Srbija

Introduction

Testudinidae is the family of terrestrial chelonians (i.e. tortoises) which are, apart from a few species of lizards, the only terrestrial ectothermic vertebrates with generalized herbivorous or omnivorous feeding habits (Del Vecchio et al., 2011). Luiselli (2006) reviewed general dietary habits of 50 species from the family Testudinidae and 15 species from the families Geoemydidae and Emydidae. Of those, about 66% of terrestrial chelonians were exclusively herbivorous, 33% were omnivorous, and only one species (*Terrapene carolina*) was predominantly carnivorous. Herbivory in tortoises is not obligatory, as many species also feed on different food that

Natürliche Futterwahl: Landschildkröten

Acta Herpetologica 7(1): 105-110, 2012

Long term observations on the alimentation of wild Eastern Greek Tortoises *Testudo graeca ibera* (Reptilia: Testudines: Testudinidae) in Dobrogea, Romania

Alexandru Iftime[1], Oana Iftime[2]

[1] *"Grigore Antipa" National Museum of Natural History, Kiseleff Bvd. no. 1, Bucharest, Romania. Corresponding author.* E-mail: alexandru_iftime@yahoo.com
[2] *University of Bucharest, Faculty of Biology, Department of Genetics, Aleea Portocalelor 1-3, s6, Bucharest, Romania.*

Submitted on: 2011, 25th September; revised on 15th December; accepted on 2012, 19th January.

Abstract. The wild diet of *Testudo graeca ibera* in Dobrogea, Romania is investigated by direct observation. A clear predominance (over 95%) of plant matter is noticed, with 25 plant species consumed. Moreover the ingestion of animal matter (carrion) as well as calcareous earth was observed.

Keywords. *Testudo graeca*, alimentation, long term observations

The Spur-thighed Tortoise, *Testudo graeca*, including its eastern subspecies, *T. g. ibera*, is well known as a terrarium companion and also as a protected species. Thus, numerous recommendation for the captive diet of *T. graeca* are available, and also data showing it as a generalist vegetarian that also takes occasional small quantities of animal food, i.e. invertebrates and carrion (Buskirk et al., 2001). There are, however, few data about the feeding habits of the wild *T. graeca ibera* populations in the Balkans and Romania (beyond general data such as those of, e.g., Fuhn and Vancea, 1961). There is greater knowledge on the populations in Spain (e.g. Cobo and Andreu, 1988; Andreu et al., 2000; Díaz-Paniagua and Andreu, 2009), the Caucasus (Bannikov et al., 1977) or North Africa (El Mouden et al., 2006; Rouag et al., 2008). The similar species *T. hermanni* is also better known, especially as regards the Western populations (e.g. Nougarède, 1998; Soler et al., 2007; Mazzotti et al., 2007; Muñoz et al., 2009; Budó et al., 2009). Greater knowledge on the type of food consumed is an addittive value for the conservation policies concerning this vulnerable species. This knowledge allows to adjust the care of captive bred populations to the natural condition of the species (cf. Willemsen et al., 2002) and to manage wild populations.

The natural diet of *Testudo* spp. can be investigated into by two methods: direct observation (e.g. Lagarde et al., 2003) and/or the analysis of faecal matter (e.g. Cobo and Andreu, 1988; El Mouden et al., 2006, Díaz-Paniagua and Andreu, 2009; Munoz et

Natürliche Futterwahl: Landschildkröten

Acta Herpetologica 7(1): 105-110, 2012

Long term observations on the alimentation of wild Eastern Greek Tortoises *Testudo graeca ibera* (Reptilia: Testudines: Testudinidae) in Dobrogea, Romania

Alexandru Iftime[1], Oana Iftime[2]

[1] *"Grigore Antipa" National Museum of Natural History, Kiseleff Bvd. no. 1, Bucharest, Romania. Corresponding author.* E-mail: alexandru_iftime@yahoo.com
[2] *University of Bucharest, Faculty of Biology, Department of Genetics, Aleea Portocalelor 1-3, s6, Bucharest, Romania.*

Submitted on: 2011, 25th September; revised on 15th December; accepted on 2012, 19th January.

Abstract. The wild diet of *Testudo graeca ibera* in Dobrogea, Romania is investigated by direct observation. A clear predominance (over 95%) of plant matter is noticed, with 25 plant species consumed. Moreover the ingestion of animal matter (carrion) as well as calcareous earth was observed.

Keywords. *Testudo graeca*, alimentation, long term observations

The Spur-thighed Tortoise, *Testudo graeca*, including its eastern subspecies, *T. g. ibera*, is well known as a terrarium companion and also as a protected species. Thus, numerous recommendation for the captive diet of *T. graeca* are available, and also data showing it as a generalist vegetarian that also takes occasional small quantities of animal food, i.e. invertebrates and carrion (Buskirk et al., 2001). There are, however, few data about the feeding habits of the wild *T. graeca ibera* populations in the Balkans and Romania (beyond general data such as those of, e.g., Fuhn and Vancea, 1961). There is greater knowledge on the populations in Spain (e.g. Cobo and Andreu, 1988; Andreu et al., 2000; Díaz-Paniagua and Andreu, 2009), the Caucasus (Bannikov et al., 1977) or North Africa (El Mouden et al., 2006; Rouag et al., 2008). The similar species *T. hermanni* is also better known, especially as regards the Western populations (e.g. Nougarède, 1998; Soler et al., 2007; Mazzotti et al., 2007; Muñoz et al., 2009; Budó et al., 2009). Greater knowledge on the type of food consumed is an addittive value for the conservation policies concerning this vulnerable species. This knowledge allows to adjust the care of captive bred populations to the natural condition of the species (cf. Willemsen et al., 2002) and to manage wild populations.

The natural diet of *Testudo* spp. can be investigated into by two methods: direct observation (e.g. Lagarde et al., 2003) and/or the analysis of faecal matter (e.g. Cobo and Andreu, 1988; El Mouden et al., 2006, Díaz-Paniagua and Andreu, 2009; Munoz et

Aktivitäts-Budget: Landschildkröten

Activity and home range of *Testudo hermanni* in Northern Italy

Stefano Mazzotti[1], Anna Pisapia[2], Mauro Fasola[2]

[1] Museo di Storia Naturale, Via De Pisis 24, I-44100 Ferrara, Italy
e-mail: conszool@comune.fe.it
[2] Dipartimento Biologia Animale, Università, Piazza Botta 9, I-27100 Pavia, Italy

Abstract. We describe the behavioral adaptations of a population of Hermann's tortoise to the climate of a northern sector of its range, and to a wooded biotope that is uncommon for the species. The activity, the home range, and the thermal relations along the daily and the yearly cycle are described. In contrast to other populations that have bimodal activity peaking in spring and in autumn, the tortoises in our study area had unimodal seasonal activity that can be related to lower summer temperatures. Home range size, 7.4 ha for females and 4.6 ha for males in our study area, was from three to seven times larger than that of all other populations. The large home range, and the low population density of the tortoises in our study area, may be due to food scarcity in the wooded habitat.

Introduction

Reptiles are conditioned by environmental factors, especially temperature that influences their metabolism and activity (Swingland and Fraizer, 1980; Meek and Jayes, 1982; Meek and Avery, 1988; Parmenter and Avery, 1990; Diaz-Paniagua et al., 1995), although most species may also control their body temperature through behavioral and physiological mechanisms (Huey, 1982; Sturbaum, 1982; Gavaud, 1987). Several studies have shown that thermal relations strongly influence the behavior and ecology of Hermann's tortoise *Testudo hermanni* (Hailey et al., 1984; Meek, 1984, 1988; Pulford et al., 1984; Chelazzi and Calzolai, 1986; Panagiota and Valakos, 1992; Carretero et al., 1995; Huot-Daubremont et al., 1996; Huot-Daubremont and Grenot, 1997; Mazzotti and Vallini, 1999). Long-term research on the movement patterns and homing behaviour of Hermann's tortoise (Chelazzi and Francisci, 1979) have shown that these tortoises stay within a stable home range, whose size varies seasonally (Calzolai and Chelazzi, 1991).

Downloaded from Brill.com10/11/2021 01:58:06PM
via University of Zurich

© Koninklijke Brill NV, Leiden, 2002
Also available online - www.brill.nl

Amphibia-Reptilia 23: 305-312

Aktivitäts-Budget: Landschildkröten

Activity and home range of *Testudo hermanni* in Northern Italy

Stefano Mazzotti[1], Anna Pisapia[2], Mauro Fasola[2]

[1] Museo di Storia Naturale, Via De Pisis 24, I-44100 Ferrara, Italy
e-mail: conszool@comune.fe.it
[2] Dipartimento Biologia Animale, Università, Piazza Botta 9, I-27100 Pavia, Italy

Abstract. We describe the behavioral adaptations of a population of Hermann's tortoise to the climate of a northern sector of its range, and to a wooded biotope that is uncommon for the species. The activity, the home range, and the thermal relations along the daily and the yearly cycle are described. In contrast to other populations that have bimodal activity peaking in spring and in autumn, the tortoises in our study area had unimodal seasonal activity that can be related to lower summer temperatures. Home range size, 7.4 ha for females and 4.6 ha for males in our study area, was from three to seven times larger than that of all other populations. The large home range, and the low population density of the tortoises in our study area, may be due to food scarcity in the wooded habitat.

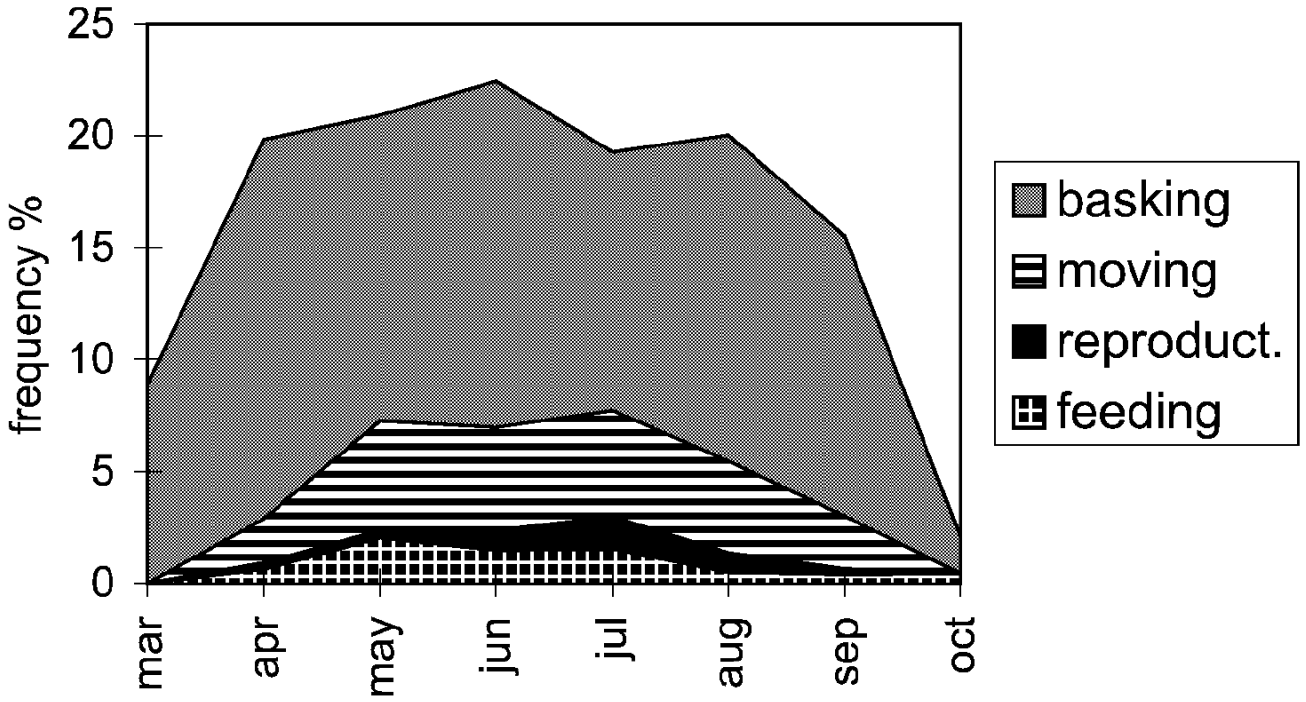
Introduction

Reptiles are conditioned by environmental factors, especially temperature that influences their metabolism and activity (Swingland and Fraizer, 1980; Meek and Jayes, 1982; Meek and Avery, 1988; Parmenter and Avery, 1990; Diaz-Paniagua et al., 1995), although most species may also control their body temperature through behavioral and physiological mechanisms (Huey, 1982; Sturbaum, 1982; Gavaud, 1987). Several studies have shown that thermal relations strongly influence the behavior and ecology of Hermann's tortoise *Testudo hermanni* (Hailey et al., 1984; Meek, 1984, 1988; Pulford et al., 1984; Chelazzi and Calzolai, 1986; Panagiota and Valakos, 1992; Carretero et al., 1995; Huot-Daubremont et al., 1996; Huot-Daubremont and Grenot, 1997; Mazzotti and Vallini, 1999). Long-term research on the movement patterns and homing behaviour of Hermann's tortoise (Chelazzi and Francisci, 1979) have shown that these tortoises stay within a stable home range, whose size varies seasonally (Calzolai and Chelazzi, 1991).

Downloaded from Brill.com10/11/2021 01:58:06PM via University of Zurich

© Koninklijke Brill NV, Leiden, 2002
Also available online - www.brill.nl

Amphibia-Reptilia 23: 305-312



Aktivitäts-Budget: Landschildkröten

Activity and home range of *Testudo hermanni* in Northern Italy

Stefano Mazzotti[1], Anna Pisapia[2], Mauro Fasola[2]

[1] Museo di Storia Naturale, Via De Pisis 24, I-44100 Ferrara, Italy
e-mail: conszool@comune.fe.it
[2] Dipartimento Biologia Animale, Università, Piazza Botta 9, I-27100 Pavia, Italy

Abstract. We describe the behavioral adaptations of a population of Hermann's tortoise to the climate of a northern sector of its range, and to a wooded biotope that is uncommon for the species. The activity, the home range, and the thermal relations along the daily and the yearly cycle are described. In contrast to other populations that have bimodal activity peaking in spring and in autumn, the tortoises in our study area had unimodal seasonal activity that can be related to lower summer temperatures. Home range size, 7.4 ha for females and 4.6 ha for males in our study area, was from three to seven times larger than that of all other populations. The large home range, and the low population density of the tortoises in our study area, may be due to food scarcity in the wooded habitat.

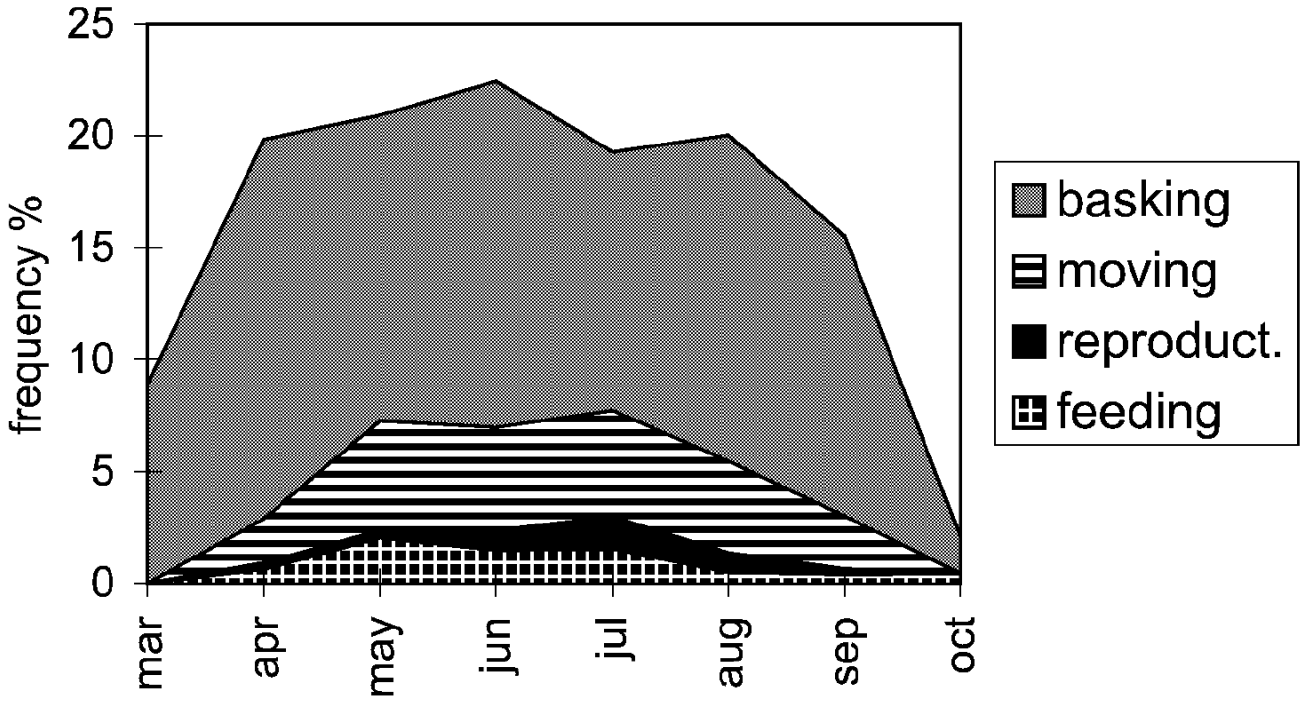
Introduction

Reptiles are conditioned by environmental factors, especially temperature that influences their metabolism and activity (Swingland and Fraizer, 1980; Meek and Jayes, 1982; Meek and Avery, 1988; Parmenter and Avery, 1990; Diaz-Paniagua et al., 1995), although most species may also control their body temperature through behavioral and physiological mechanisms (Huey, 1982; Sturbaum, 1982; Gavaud, 1987). Several studies have shown that thermal relations strongly influence the behavior and ecology of Hermann's tortoise *Testudo hermanni* (Hailey et al., 1984; Meek, 1984, 1988; Pulford et al., 1984; Chelazzi and Calzolai, 1986; Panagiota and Valakos, 1992; Carretero et al., 1995; Huot-Daubremont et al., 1996; Huot-Daubremont and Grenot, 1997; Mazzotti and Vallini, 1999). Long-term research on the movement patterns and homing behaviour of Hermann's tortoise (Chelazzi and Francisci, 1979) have shown that these tortoises stay within a stable home range, whose size varies seasonally (Calzolai and Chelazzi, 1991).

Downloaded from Brill.com10/11/2021 01:58:06PM via University of Zurich

© Koninklijke Brill NV, Leiden, 2002
Also available online - www.brill.nl

Amphibia-Reptilia 23: 305-312



Annahme 12 h-Zeitraum: 14 min Fressen / Tag*

*2 % von 12 = 0.24 h = 14 min

Aktivitäts-Budget: Landschildkröten

ECOGRAPHY 26: 236–242, 2003

Foraging behaviour and diet of an ectothermic herbivore: *Testudo horsfieldi*

Frédéric Lagarde, Xavier Bonnet, Johanna Corbin, Brian Henen, Ken Nagy, Baktjior Mardonov and Guy Naulleau

Lagarde, F., Bonnet, X., Corbin, J., Henen, B., Nagy, K., Mardonov, B. and Naulleau, G. 2003. Foraging behaviour and diet of an ectothermic herbivore: *Testudo horsfieldi*. – Ecography 26: 236–242.

Herbivorous vertebrates of arid regions are frequently faced with inadequate food quality, quantity or both. The time and energy devoted to foraging is vital to balancing their energy budgets. For desert ectotherms, a low metabolism should be advantageous, reducing their total energy requirement, but extreme ambient temperatures can strongly constrain these animals' activity periods. We provide the first data on the activity budgets, foraging behaviour and diet of a highly abundant, desert-dwelling, herbivorous ectotherm, the steppe tortoise *Testudo horsfieldi*. Extreme climatic conditions of Central Asia limit steppe tortoise's activity to only three months per year. They remain inactive most of their "active season" (90%), and spend very little time foraging (< 15 min per day). This suggests that steppe tortoises can satisfy their energy requirements with modest feeding efforts. Interestingly, steppe tortoises avoid feeding on grass species and feed mostly on plant species that are usually highly toxic to mammals. This result suggests that steppe tortoises and ungulates do not compete for food.

F. Lagarde (lagarde@cebc.cnrs.fr), X. Bonnet, J. Corbin and G. Naulleau, Centre d'Etudes Biologiques de Chizé-CNRS, F-79360 Villiers en Bois, France. – B. Henen, Dept of Zoology, Biodiversity and Conservation Biology, Univ. of Western Cape, Belville 7535, South Africa. – K. Nagy, Dept of Organismic Biology, Ecology and Evolution, 621 Young South Drive, Univ. of California, Los Angeles, CA 90095-1606, USA. – B. Mardonov, Samarkand Div. of the Academy of Sciences, 40 Djisakskaya St., Samarkand, 703032, Uzbekistan.

An appreciation of the feeding ecology of a wide diversity of species is central to understanding the general processes of resource acquisition and allocation. Biologists debate the degree of influence of ectothermic and endothermic physiology upon the marked divergence seen in their feeding ecologies. Compared to endotherms, ectotherms are characterised by low metabolic rates, low energy requirements, and low food intakes (Pough 1980, Nagy 1983, Karasov et al. 1986, Zimmerman and Tracy 1989). These traits may represent pre-adaptations (or exaptations, Bradshaw 1997) in ecosystems (e.g., deserts) where food shortages occur frequently and may confer ecological advantages to ectotherms. These features enable ectotherms to have high densities (i.e., individuals per area), high biomasses and production values (Nagy 1983, Bradshaw 1986), relative to comparable-sized endotherms. Conversely, ectotherm sensitivity to environmental conditions, particularly ambient temperature, strongly constrains the periods when ectotherms can be active (Hutchison 1979, Peterson et al. 1993). Typically, the periods favourable for activity are greatly reduced in desert-dwelling animals that are subject to extremely harsh climatic conditions. Strict time-activity budgets can help organisms to satisfy the demands of growth, reproduction and maintenance

Accepted 8 July 2002

Copyright © ECOGRAPHY 2003

ISSN 0906-7590

Aktivitäts-Budget: Landschildkröten

ECOGRAPHY 26: 236–242, 2003

Foraging behaviour and diet of an ectothermic herbivore: *Testudo horsfieldi*

Frédéric Lagarde, Xavier Bonnet, Johanna Corbin, Brian Henen, Ken Nagy, Baktjior Mardonov and Guy Naulleau

Lagarde, F., Bonnet, X., Corbin, J., Henen, B., Nagy, K., Mardonov, B. and Naulleau, G. 2003. Foraging behaviour and diet of an ectothermic herbivore: *Testudo horsfieldi*. – Ecography 26: 236–242.

Herbivorous vertebrates of arid regions are frequently faced with inadequate food quality, quantity or both. The time and energy devoted to foraging is vital to balancing their energy budgets. For desert ectotherms, a low metabolism should be advan
ature
on th
dwell
clima
mont
spend
can s
tortoi
usual
ungulates do not compete for food.

F. Lagarde (lagarde@cebc.cnrs.fr), X. Bonnet, J. Corbin and G. Naulleau, Centre d'Etudes Biologiques de Chizé-CNRS, F-79360 Villiers en Bois, France. – B. Henen, Dept of Zoology, Biodiversity and Conservation Biology, Univ. of Western Cape, Belville 7535, South Africa. – K. Nagy, Dept of Organismic Biology, Ecology and Evolution, 621 Young South Drive, Univ. of California, Los Angeles, CA 90095-1606, USA. – B. Mardonov, Samarkand Div. of the Academy of Sciences, 40 Djisakskaya St., Samarkand, 703032, Uzbekistan.

An appreciation of the feeding ecology of a wide diversity of species is central to understanding the general processes of resource acquisition and allocation. Biologists debate the degree of influence of ectothermic and endothermic physiology upon the marked divergence seen in their feeding ecologies. Compared to endotherms, ectotherms are characterised by low metabolic rates, low energy requirements, and low food intakes (Pough 1980, Nagy 1983, Karasov et al. 1986, Zimmerman and Tracy 1989). These traits may represent pre-adaptations (or exaptations, Bradshaw 1997) in ecosystems (e.g., deserts) where food shortages occur frequently and may confer ecological advantages to ectotherms. These features enable ectotherms to have high densities (i.e., individuals per area), high biomasses and production values (Nagy 1983, Bradshaw 1986), relative to comparable-sized endotherms. Conversely, ectotherm sensitivity to environmental conditions, particularly ambient temperature, strongly constrains the periods when ectotherms can be active (Hutchison 1979, Peterson et al. 1993). Typically, the periods favourable for activity are greatly reduced in desert-dwelling animals that are subject to extremely harsh climatic conditions. Strict time-activity budgets can help organisms to satisfy the demands of growth, reproduction and maintenance

Accepted 8 July 2002

Copyright © ECOGRAPHY 2003

ISSN 0906-7590

They remain inactive most of their "active season" (90%), and spend very little time foraging (< 15 min per day).

Wellensittich

Natürliche Futterwahl: Wellensittiche

Australian Journal of Ecology (1980) **5**, 47–61

Environment and food of the budgerigar *Melopsittacus undulatus*

EDMUND WYNDHAM
School of Australian Environmental Studies, Griffith University, Nathan, Australia 4111.

Abstract

Budgerigars range and breed over most of the interior of Australia. During a year, budgerigars may experience a maximal change in day length of about 5 h, and temperatures range from well below to above their zone of thermo-neutrality. In the north of the budgerigar's range there is growth of pastures in summer and autumn and in the south there is growth in spring and early summer. In the arid interior, growth is irregular from year-to-year and varies from site-to-site. However, in northern arid regions growth tends to occur in summer and autumn; in southern arid regions in spring and early summer; and over most of the arid regions in most years there is some growth in run-on areas.

In inland mid-eastern Australia budgerigars ate only seeds of ground vegetation. These seeds were from about 0.5 to 2.5 mm in length, weighed between about 0.3 and 1.3 mg and had an energy content of about 18.9 kJ g^{-1}. At a site on Mitchell grass plains Astrebla *spp. were the main seeds eaten. At a site further inland the diet was more diverse: in the hot months of 1973–74 they ate mainly* Boerhavia diffusa, Atriplex *spp. and* Astrebla pectinata, *during the cold months of 1974 mainly* Iseilema *and an unidentified seed, and in spring 1974 mainly* Atriplex *spp. There was no evidence of special dietary requirements for breeding; in particular no requirements of soft, unripened seed or insect food to feed young. Males and females, adults and juveniles, and individuals in the same flock had similar diets.*

Present address: Department of Ecosystem Management, University of New England, Armidale, Australia 2351

Information from the literature and my data suggest there is considerable stability and seasonal regularity in the budgerigar's food supply.

Introduction

The budgerigar *Melopsittacus undulatus* is a small parrot (*ca.* 29 g) that ranges throughout the continent of Australia except for the eastern tablelands and coastal plain, Cape York north of the Mitchell River, northern parts of Arnhem Land and the far south-west of Western Australia (Serventy 1977; Wyndham 1978a). It thus occurs in the arid zone (*sensu* Perry 1967) but also moves into better watered peripheral areas. Breeding records in the literature and submitted to the Royal Australian Ornithological Union (RAOU) Nest Record Scheme suggest it breeds throughout its range (Wyndham 1978a). There is no sub-speciation (Mayr 1951).

The budgerigar has been important in the development of current ideas on the ecology of Australian arid-zone birds (Immelmann 1963; Brereton 1971; Serventy 1971) and the domestic variety has been studied extensively in cages. To date, knowledge of its ecology in the field is based on notes made by early naturalists (Gould 1865; Broinowski 1890; Finlayson, McGilp & Reece 1932; Cayley 1933). Between 1970 and 1974 the present writer did a field study of budgerigars in eastern Australia and from the literature, the RAOU Bird-banding Scheme and the RAOU Nest Record Scheme obtained information on it throughout its range. This paper gives background information on the environment which is necessary for understanding the ecology of the budgerigar and for the design and interpretation of studies of domestic birds.

The food of the budgerigar is of particular interest because, in response to the low and

Natürliche Futterwahl: Wellensittiche

reine Samen-Fresser

keine Angaben zur Nährstoff-Zusammensetzung

Australian Journal of Ecology (1980) **5**, 47–61

Environment and food of the budgerigar
Melopsittacus undulatus

EDMUND WYNDHAM
School of Australian Environmental Studies, Griffith University, Nathan, Australia 4111.

Abstract

Budgerigars range and breed over most of the interior of Australia. During a year, budgerigars may experience a maximal change in day length of about 5 h, and temperatures range from well below to above their zone of thermo-neutrality. In the north of the budgerigar's range there is growth of pastures in summer and autumn and in the south there is growth in spring and early summer. In the arid interior, growth is irregular from year-to-year and varies from site-to-site. However, in northern arid regions growth tends to occur in summer and autumn; in southern arid regions in spring and early summer; and over most of the arid regions in most years there is some growth in run-on areas.

In inland mid-eastern Australia budgerigars ate only seeds of ground vegetation. These seeds were from about 0.5 to 2.5 mm in length, weighed between about 0.3 and 1.3 mg and had an energy content of about 18.9 kJ g^{-1}. At a site on Mitchell grass plains Astrebla *spp. were the main seeds eaten. At a site further inland the diet was more diverse: in the hot months of 1973–74 they ate mainly* Boerhavia diffusa, Atriplex *spp. and* Astrebla pectinata, *during the cold months of 1974 mainly* Iseilema *and an unidentified seed, and in spring 1974 mainly* Atriplex *spp. There was no evidence of special dietary requirements for breeding; in particular no requirements of soft, unripened seed or insect food to feed young. Males and females, adults and juveniles, and individuals in the same flock had similar diets.*

Present address: Department of Ecosystem Management, University of New England, Armidale, Australia 2351

Information from the literature and my data suggest there is considerable stability and seasonal regularity in the budgerigar's food supply.

Introduction

The budgerigar *Melopsittacus undulatus* is a small parrot (*ca.* 29 g) that ranges throughout the continent of Australia except for the eastern tablelands and coastal plain, Cape York north of the Mitchell River, northern parts of Arnhem Land and the far south-west of Western Australia (Serventy 1977; Wyndham 1978a). It thus occurs in the arid zone (*sensu* Perry 1967) but also moves into better watered peripheral areas. Breeding records in the literature and submitted to the Royal Australian Ornithological Union (RAOU) Nest Record Scheme suggest it breeds throughout its range (Wyndham 1978a). There is no sub-speciation (Mayr 1951).

The budgerigar has been important in the development of current ideas on the ecology of Australian arid-zone birds (Immelmann 1963; Brereton 1971; Serventy 1971) and the domestic variety has been studied extensively in cages. To date, knowledge of its ecology in the field is based on notes made by early naturalists (Gould 1865; Broinowski 1890; Finlayson, McGilp & Reece 1932; Cayley 1933). Between 1970 and 1974 the present writer did a field study of budgerigars in eastern Australia and from the literature, the RAOU Bird-banding Scheme and the RAOU Nest Record Scheme obtained information on it throughout its range. This paper gives background information on the environment which is necessary for understanding the ecology of the budgerigar and for the design and interpretation of studies of domestic birds.

The food of the budgerigar is of particular interest because, in response to the low and

Aktivitäts-Budget

DIURNAL CYCLE, BEHAVIOUR AND SOCIAL ORGANIZATION OF THE BUDGERIGAR *MELOPSITTACUS UNDULATUS*

EDMUND WYNDHAM

Received 20 December 1978; accepted 30 March 1979.

SUMMARY

WYNDHAM, E. 1980. Diurnal cycle, behaviour and social organization of the Budgerigar *Melopsittacus undulatus*. Emu 80 : 25-33.

The Budgerigar *Melopsittacus undulatus* was studied in the field in eastern Australia. Flocks occurred throughout the year, during most diurnal activities and at most stages of the life cycle. Daily activity began about sunrise and ceased during dusk. It consisted of feeding in the morning and afternoon and resting and preening in the foliage of trees during the middle of the day. Birds drank intermittently and at no specific time of the day. Different ages and sexes mixed in flocks and there was no obvious hierarchical construction nor high- and low-status groups within flocks or populations. At times, flocks occurred that were composed predominantly of young birds. Eight discrete calls were identified. Slight differences between juveniles and adults, little sexual dimorphism and few discrete calls suggests that the social organization of the Budgerigar is simple compared to that of the Eastern Rosella *Platycercus eximius*. Behaviour of birds in the field is compared to that described from studies of domestic birds in cages.

INTRODUCTION

The Budgerigar *Melopsittacus undulatus* is a small parrot (c. 29 g) that occurs in large numbers in the interior of Australia. Brereton (1963a, b, 1966, 1971a, b) in his pioneer studies of the comparative ecology and social organization of Australian parrots selected the Budgerigar as an example of an arid-adapted species.

Budgerigars adapt readily to captivity and, since their introduction to England in 1840 (Gould 1865), they have become a widespread and common caged bird. As domestic Budgerigars are readily available and easy to maintain and breed in captivity, they have become popular animals for research; in particular, the behaviour and social organization of domestic Budgerigars have been extensively studied (e.g. Brereton 1963b; Brockway 1962, 1964a, b, c, 1965, 1968; Masure and Allee 1934; Trillmich 1976a, b).

The ecology of the Budgerigar in its natural environment is poorly known and is based on the notes of early naturalists (Gould 1865; Broinowski 1890; Finlayson *et al.* 1932; Cayley 1933). This lack of information has restricted comparisons of the ecology of the Budgerigar with that of other parrots and has limited interpretation of the adaptive significance of findings from studies of domestic Budgerigars.

Between 1970 and 1974 I studied the ecology of the Budgerigar in inland mid-eastern Australia (Wyndham 1978a). This paper describes the diurnal cycle, behaviour and social organization of wild Budgerigars and, where appropriate, compares these aspects with the Eastern Rosella *Platycercus eximius* and domestic Budgerigars.

BACKGROUND AND METHODS

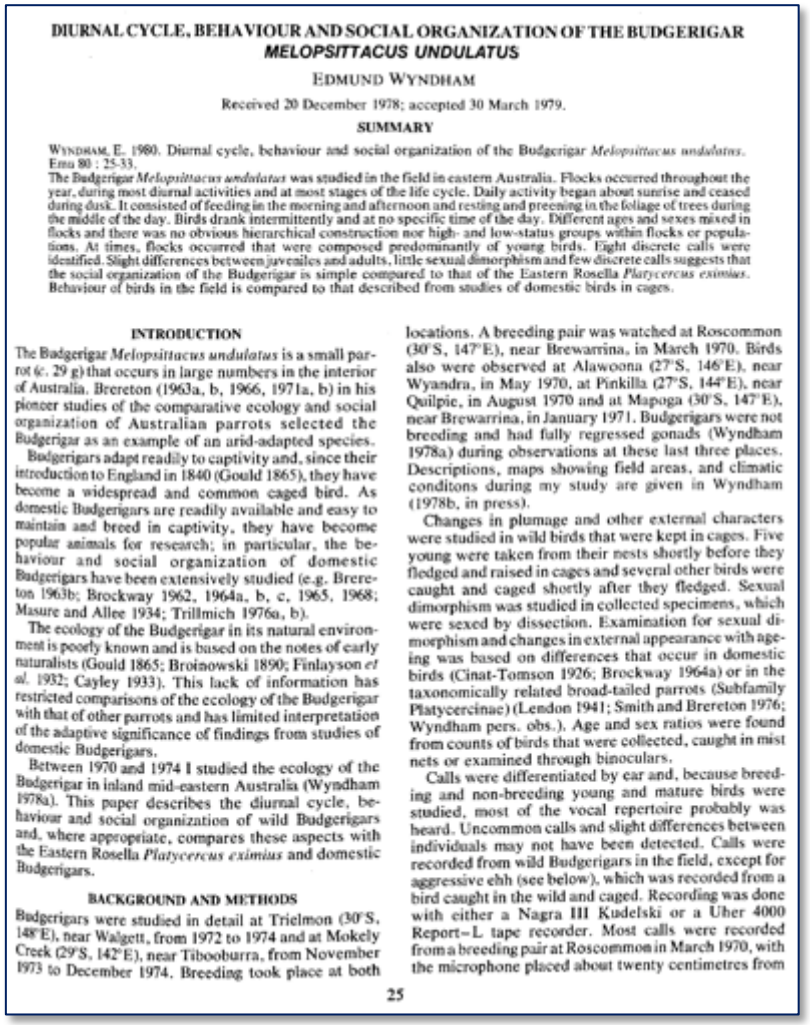
Budgerigars were studied in detail at Trielmon (30°S, 148°E), near Walgett, from 1972 to 1974 and at Mokely Creek (29°S, 142°E), near Tibooburra, from November 1973 to December 1974. Breeding took place at both locations. A breeding pair was watched at Roscommon (30°S, 147°E), near Brewarrina, in March 1970. Birds also were observed at Alawoona (27°S, 146°E), near Wyandra, in May 1970, at Pinkilla (27°S, 144°E), near Quilpie, in August 1970 and at Mapoga (30°S, 147°E), near Brewarrina, in January 1971. Budgerigars were not breeding and had fully regressed gonads (Wyndham 1978a) during observations at these last three places. Descriptions, maps showing field areas, and climatic conditons during my study are given in Wyndham (1978b, in press).

Changes in plumage and other external characters were studied in wild birds that were kept in cages. Five young were taken from their nests shortly before they fledged and raised in cages and several other birds were caught and caged shortly after they fledged. Sexual dimorphism was studied in collected specimens, which were sexed by dissection. Examination for sexual dimorphism and changes in external appearance with ageing was based on differences that occur in domestic birds (Cinat-Tomson 1926; Brockway 1964a) or in the taxonomically related broad-tailed parrots (Subfamily Platycercinae) (Lendon 1941; Smith and Brereton 1976; Wyndham pers. obs.). Age and sex ratios were found from counts of birds that were collected, caught in mist nets or examined through binoculars.

Calls were differentiated by ear and, because breeding and non-breeding young and mature birds were studied, most of the vocal repertoire probably was heard. Uncommon calls and slight differences between individuals may not have been detected. Calls were recorded from wild Budgerigars in the field, except for aggressive ehh (see below), which was recorded from a bird caught in the wild and caged. Recording was done with either a Nagra III Kudelski or a Uher 4000 Report-L tape recorder. Most calls were recorded from a breeding pair at Roscommon in March 1970, with the microphone placed about twenty centimetres from

25

Aktivitäts-Budget



DIURNAL CYCLE, BEHAVIOUR AND SOCIAL ORGANIZATION OF THE BUDGERIGAR *MELOPSITTACUS UNDULATUS*

EDMUND WYNDHAM

Received 20 December 1978; accepted 30 March 1979.

SUMMARY

WYNDHAM, E. 1980. Diurnal cycle, behaviour and social organization of the Budgerigar *Melopsittacus undulatus*. Emu 80 : 25-33.

The Budgerigar *Melopsittacus undulatus* was studied in the field in eastern Australia. Flocks occurred throughout the year, during most diurnal activities and at most stages of the life cycle. Daily activity began about sunrise and ceased during dusk. It consisted of feeding in the morning and afternoon and resting and preening in the foliage of trees during the middle of the day. Birds drank intermittently and at no specific time of the day. Different ages and sexes mixed in flocks and there was no obvious hierarchical construction nor high- and low-status groups within flocks or populations. At times, flocks occurred that were composed predominantly of young birds. Eight discrete calls were identified. Slight differences between juveniles and adults, little sexual dimorphism and few discrete calls suggests that the social organization of the Budgerigar is simple compared to that of the Eastern Rosella *Platycercus eximius*. Behaviour of birds in the field is compared to that described from studies of domestic birds in cages.

INTRODUCTION

The Budgerigar *Melopsittacus undulatus* is a small parrot (c. 29 g) that occurs in large numbers in the interior of Australia. Brereton (1963a, b, 1966, 1971a, b) in his pioneer studies of the comparative ecology and social organization of Australian parrots selected the Budgerigar as an example of an arid-adapted species.

Budgerigars adapt readily to captivity and, since their introduction to England in 1840 (Gould 1865), they have become a widespread and common caged bird. As domestic Budgerigars are readily available and easy to maintain and breed in captivity, they have become popular animals for research; in particular, the behaviour and social organization of domestic Budgerigars have been extensively studied (e.g. Brereton 1963b; Brockway 1962, 1964a, b, c, 1965, 1968; Masure and Allee 1934; Trillmich 1976a, b).

The ecology of the Budgerigar in its natural environment is poorly known and is based on the notes of early naturalists (Gould 1865; Broinowski 1890; Finlayson *et al.* 1932; Cayley 1933). This lack of information has restricted comparisons of the ecology of the Budgerigar with that of other parrots and has limited interpretation of the adaptive significance of findings from studies of domestic Budgerigars.

Between 1970 and 1974 I studied the ecology of the Budgerigar in inland mid-eastern Australia (Wyndham 1978a). This paper describes the diurnal cycle, behaviour and social organization of wild Budgerigars and, where appropriate, compares these aspects with the Eastern Rosella *Platycercus eximius* and domestic Budgerigars.

BACKGROUND AND METHODS

Budgerigars were studied in detail at Trielmon (30°S, 148°E), near Walgett, from 1972 to 1974 and at Mokely Creek (29°S, 142°E), near Tibooburra, from November 1973 to December 1974. Breeding took place at both locations. A breeding pair was watched at Roscommon (30°S, 147°E), near Brewarrina, in March 1970. Birds also were observed at Alawoona (27°S, 146°E), near Wyandra, in May 1970, at Pinkilla (27°S, 144°E), near Quilpie, in August 1970 and at Mapoga (30°S, 147°E), near Brewarrina, in January 1971. Budgerigars were not breeding and had fully regressed gonads (Wyndham 1978a) during observations at these last three places. Descriptions, maps showing field areas, and climatic conditons during my study are given in Wyndham (1978b, in press).

Changes in plumage and other external characters were studied in wild birds that were kept in cages. Five young were taken from their nests shortly before they fledged and raised in cages and several other birds were caught and caged shortly after they fledged. Sexual dimorphism was studied in collected specimens, which were sexed by dissection. Examination for sexual dimorphism and changes in external appearance with ageing was based on differences that occur in domestic birds (Cinat-Tomson 1926; Brockway 1964a) or in the taxonomically related broad-tailed parrots (Subfamily Platycercinae) (Lendon 1941; Smith and Brereton 1976; Wyndham pers. obs.). Age and sex ratios were found from counts of birds that were collected, caught in mist nets or examined through binoculars.

Calls were differentiated by ear and, because breeding and non-breeding young and mature birds were studied, most of the vocal repertoire probably was heard. Uncommon calls and slight differences between individuals may not have been detected. Calls were recorded from wild Budgerigars in the field, except for aggressive ehh (see below), which was recorded from a bird caught in the wild and caged. Recording was done with either a Nagra III Kudelski or a Uher 4000 Report-L tape recorder. Most calls were recorded from a breeding pair at Roscommon in March 1970, with the microphone placed about twenty centimetres from

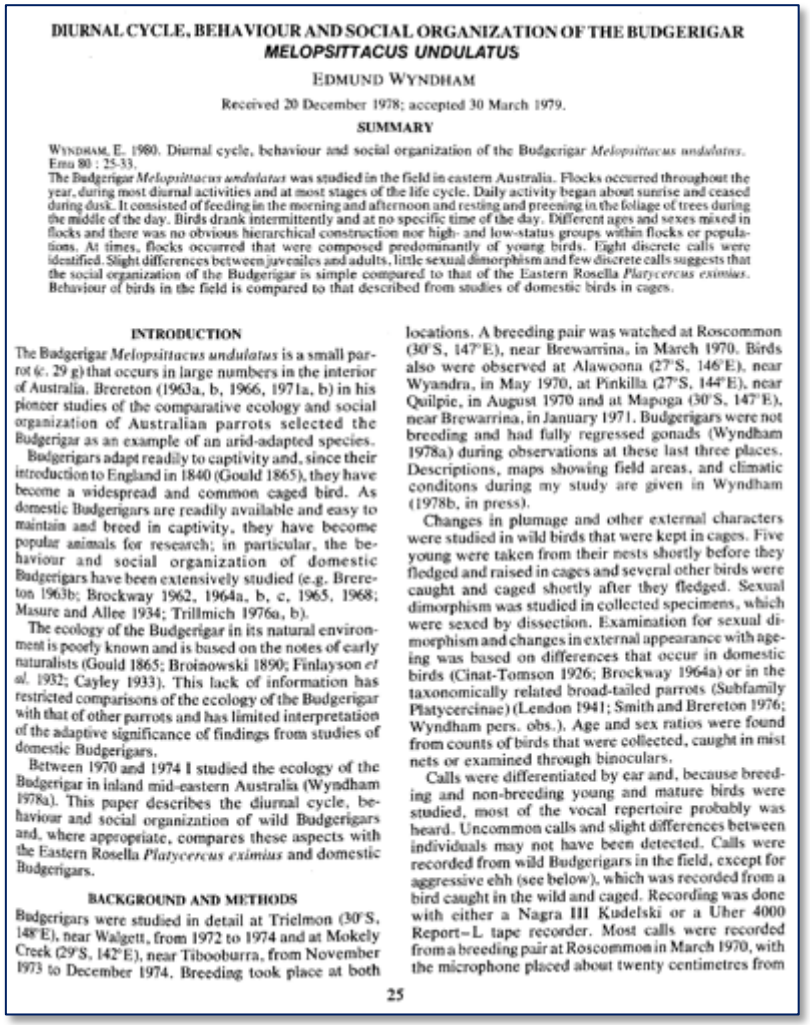
25

Distanz Nistplatz – Fressplatz > 1 km

2 Fress-Perioden (Vormittag / Nachmittag)

Fressen am Boden und an Gras-Stengeln

Aktivitäts-Budget



DIURNAL CYCLE, BEHAVIOUR AND SOCIAL ORGANIZATION OF THE BUDGERIGAR *MELOPSITTACUS UNDULATUS*

EDMUND WYNDHAM

Received 20 December 1978; accepted 30 March 1979.

SUMMARY

WYNDHAM, E. 1980. Diurnal cycle, behaviour and social organization of the Budgerigar *Melopsittacus undulatus*. Emu 80 : 25-33.

The Budgerigar *Melopsittacus undulatus* was studied in the field in eastern Australia. Flocks occurred throughout the year, during most diurnal activities and at most stages of the life cycle. Daily activity began about sunrise and ceased during dusk. It consisted of feeding in the morning and afternoon and resting and preening in the foliage of trees during the middle of the day. Birds drank intermittently and at no specific time of the day. Different ages and sexes mixed in flocks and there was no obvious hierarchical construction nor high- and low-status groups within flocks or populations. At times, flocks occurred that were composed predominantly of young birds. Eight discrete calls were identified. Slight differences between juveniles and adults, little sexual dimorphism and few discrete calls suggests that the social organization of the Budgerigar is simple compared to that of the Eastern Rosella *Platycercus eximius*. Behaviour of birds in the field is compared to that described from studies of domestic birds in cages.

INTRODUCTION

The Budgerigar *Melopsittacus undulatus* is a small parrot (c. 29 g) that occurs in large numbers in the interior of Australia. Brereton (1963a, b, 1966, 1971a, b) in his pioneer studies of the comparative ecology and social organization of Australian parrots selected the Budgerigar as an example of an arid-adapted species.

Budgerigars adapt readily to captivity and, since their introduction to England in 1840 (Gould 1865), they have become a widespread and common caged bird. As domestic Budgerigars are readily available and easy to maintain and breed in captivity, they have become popular animals for research; in particular, the behaviour and social organization of domestic Budgerigars have been extensively studied (e.g. Brereton 1963b; Brockway 1962, 1964a, b, c, 1965, 1968; Masure and Allee 1934; Trillmich 1976a, b).

The ecology of the Budgerigar in its natural environment is poorly known and is based on the notes of early naturalists (Gould 1865; Broinowski 1890; Finlayson *et al.* 1932; Cayley 1933). This lack of information has restricted comparisons of the ecology of the Budgerigar with that of other parrots and has limited interpretation of the adaptive significance of findings from studies of domestic Budgerigars.

Between 1970 and 1974 I studied the ecology of the Budgerigar in inland mid-eastern Australia (Wyndham 1978a). This paper describes the diurnal cycle, behaviour and social organization of wild Budgerigars and, where appropriate, compares these aspects with the Eastern Rosella *Platycercus eximius* and domestic Budgerigars.

BACKGROUND AND METHODS

Budgerigars were studied in detail at Trielmon (30°S, 148°E), near Walgett, from 1972 to 1974 and at Mokely Creek (29°S, 142°E), near Tibooburra, from November 1973 to December 1974. Breeding took place at both locations. A breeding pair was watched at Roscommon (30°S, 147°E), near Brewarrina, in March 1970. Birds also were observed at Alawoona (27°S, 146°E), near Wyandra, in May 1970, at Pinkilla (27°S, 144°E), near Quilpie, in August 1970 and at Mapoga (30°S, 147°E), near Brewarrina, in January 1971. Budgerigars were not breeding and had fully regressed gonads (Wyndham 1978a) during observations at these last three places. Descriptions, maps showing field areas, and climatic conditons during my study are given in Wyndham (1978b, in press).

Changes in plumage and other external characters were studied in wild birds that were kept in cages. Five young were taken from their nests shortly before they fledged and raised in cages and several other birds were caught and caged shortly after they fledged. Sexual dimorphism was studied in collected specimens, which were sexed by dissection. Examination for sexual dimorphism and changes in external appearance with ageing was based on differences that occur in domestic birds (Cinat-Tomson 1926; Brockway 1964a) or in the taxonomically related broad-tailed parrots (Subfamily Platycercinae) (Lendon 1941; Smith and Brereton 1976; Wyndham pers. obs.). Age and sex ratios were found from counts of birds that were collected, caught in mist nets or examined through binoculars.

Calls were differentiated by ear and, because breeding and non-breeding young and mature birds were studied, most of the vocal repertoire probably was heard. Uncommon calls and slight differences between individuals may not have been detected. Calls were recorded from wild Budgerigars in the field, except for aggressive ehh (see below), which was recorded from a bird caught in the wild and caged. Recording was done with either a Nagra III Kudelski or a Uher 4000 Report-L tape recorder. Most calls were recorded from a breeding pair at Roscommon in March 1970, with the microphone placed about twenty centimetres from

25

Distanz Nistplatz – Fressplatz > 1 km

2 Fress-Perioden (Vormittag / Nachmittag)

Fressen am Boden und an Gras-Stengeln

When feeding, the birds moved across the ground and climbed up and down tussocks of grass.

Aktivitäts-Budget

DIURNAL CYCLE, BEHAVIOUR AND SOCIAL ORGANIZATION OF THE BUDGERIGAR *MELOPSITTACUS UNDULATUS*

EDMUND WYNDHAM

Received 20 December 1978; accepted 30 March 1979.

SUMMARY

WYNDHAM, E. 1980. Diurnal cycle, behaviour and social organization of the Budgerigar *Melopsittacus undulatus*. Emu 80 : 25-33.

The Budgerigar *Melopsittacus undulatus* was studied in the field in eastern Australia. Flocks occurred throughout the year, during most diurnal activities and at most stages of the life cycle. Daily activity began about sunrise and ceased during dusk. It consisted of feeding in the morning and afternoon and resting and preening in the foliage of trees during the middle of the day. Birds drank intermittently and at no specific time of the day. Different ages and sexes mixed in flocks and there was no obvious hierarchical construction nor high- and low-status groups within flocks or populations. At times, flocks occurred that were composed predominantly of young birds. Eight discrete calls were identified. Slight differences between juveniles and adults, little sexual dimorphism and few discrete calls suggests that the social organization of the Budgerigar is simple compared to that of the Eastern Rosella *Platycercus eximius*. Behaviour of birds in the field is compared to that described from studies of domestic birds in cages.

INTRODUCTION

The Budgerigar *Melopsittacus undulatus* is a small parrot (c. 29 g) that occurs in large numbers in the interior of Australia. Brereton (1963a, b, 1966, 1971a, b) in his pioneer studies of the comparative ecology and social organization of Australian parrots selected the Budgerigar as an example of an arid-adapted species.

Budgerigars adapt readily to captivity and, since their introduction to England in 1840 (Gould 1865), they have become a widespread and common caged bird. As domestic Budgerigars are readily available and easy to maintain and breed in captivity, they have become popular animals for research; in particular, the behaviour and social organization of domestic Budgerigars have been extensively studied (e.g. Brereton 1963b; Brockway 1962, 1964a, b, c, 1965, 1968; Masure and Allee 1934; Trillmich 1976a, b).

The ecology of the Budgerigar in its natural environment is poorly known and is based on the notes of early naturalists (Gould 1865; Broinowski 1890; Finlayson *et al.* 1932; Cayley 1933). This lack of information has restricted comparisons of the ecology of the Budgerigar with that of other parrots and has limited interpretation of the adaptive significance of findings from studies of domestic Budgerigars.

Between 1970 and 1974 I studied the ecology of the Budgerigar in inland mid-eastern Australia (Wyndham 1978a). This paper describes the diurnal cycle, behaviour and social organization of wild Budgerigars and, where appropriate, compares these aspects with the Eastern Rosella *Platycercus eximius* and domestic Budgerigars.

BACKGROUND AND METHODS

Budgerigars were studied in detail at Trielmon (30°S, 148°E), near Walgett, from 1972 to 1974 and at Mokely Creek (29°S, 142°E), near Tibooburra, from November 1973 to December 1974. Breeding took place at both locations. A breeding pair was watched at Roscommon (30°S, 147°E), near Brewarrina, in March 1970. Birds also were observed at Alawoona (27°S, 146°E), near Wyandra, in May 1970, at Pinkilla (27°S, 144°E), near Quilpie, in August 1970 and at Mapoga (30°S, 147°E), near Brewarrina, in January 1971. Budgerigars were not breeding and had fully regressed gonads (Wyndham 1978a) during observations at these last three places. Descriptions, maps showing field areas, and climatic conditons during my study are given in Wyndham (1978b, in press).

Changes in plumage and other external characters were studied in wild birds that were kept in cages. Five young were taken from their nests shortly before they fledged and raised in cages and several other birds were caught and caged shortly after they fledged. Sexual dimorphism was studied in collected specimens, which were sexed by dissection. Examination for sexual dimorphism and changes in external appearance with ageing was based on differences that occur in domestic birds (Cinat-Tomson 1926; Brockway 1964a) or in the taxonomically related broad-tailed parrots (Subfamily Platycercinae) (Lendon 1941; Smith and Brereton 1976; Wyndham pers. obs.). Age and sex ratios were found from counts of birds that were collected, caught in mist nets or examined through binoculars.

Calls were differentiated by ear and, because breeding and non-breeding young and mature birds were studied, most of the vocal repertoire probably was heard. Uncommon calls and slight differences between individuals may not have been detected. Calls were recorded from wild Budgerigars in the field, except for aggressive ehh (see below), which was recorded from a bird caught in the wild and caged. Recording was done with either a Nagra III Kudelski or a Uher 4000 Report-L tape recorder. Most calls were recorded from a breeding pair at Roscommon in March 1970, with the microphone placed about twenty centimetres from

25

Distanz Nistplatz – Fressplatz > 1 km

2 Fress-Perioden (Vormittag / Nachmittag)

Fressen am Boden und an Gras-Stengeln

When feeding, the birds moved across the ground and climbed up and down tussocks of grass.

Aktivitäts-Budget

DIURNAL CYCLE, BEHAVIOUR AND SOCIAL ORGANIZATION OF THE BUDGERIGAR *MELOPSITTACUS UNDULATUS*

EDMUND WYNDHAM

Received 20 December 1978; accepted 30 March 1979.

SUMMARY

WYNDHAM, E. 1980. Diurnal cycle, behaviour and social organization of the Budgerigar *Melopsittacus undulatus*. Emu 80 : 25-33.

The Budgerigar *Melopsittacus undulatus* was studied in the field in eastern Australia. Flocks occurred throughout the year, during most diurnal activities and at most stages of the life cycle. Daily activity began about sunrise and ceased during dusk. It consisted of feeding in the morning and afternoon and resting and preening in the foliage of trees during the middle of the day. Birds drank intermittently and at no specific time of the day. Different ages and sexes mixed in flocks and there was no obvious hierarchical construction nor high- and low-status groups within flocks or populations. At times, flocks occurred that were composed predominantly of young birds. Eight discrete calls were identified. Slight differences between juveniles and adults, little sexual dimorphism and few discrete calls suggests that the social organization of the Budgerigar is simple compared to that of the Eastern Rosella *Platycercus eximius*. Behaviour of birds in the field is compared to that described from studies of domestic birds in cages.

INTRODUCTION

The Budgerigar *Melopsittacus undulatus* is a small parrot (c. 29 g) that occurs in large numbers in the interior of Australia. Brereton (1963a, b, 1966, 1971a, b) in his pioneer studies of the comparative ecology and social organization of Australian parrots selected the Budgerigar as an example of an arid-adapted species.

Budgerigars adapt readily to captivity and, since their introduction to England in 1840 (Gould 1865), they have become a widespread and common caged bird. As domestic Budgerigars are readily available and easy to maintain and breed in captivity, they have become popular animals for research; in particular, the behaviour and social organization of domestic Budgerigars have been extensively studied (e.g. Brereton 1963b; Brockway 1962, 1964a, b, c, 1965, 1968; Masure and Allee 1934; Trillmich 1976a, b).

The ecology of the Budgerigar in its natural environment is poorly known and is based on the notes of early naturalists (Gould 1865; Broinowski 1890; Finlayson *et al.* 1932; Cayley 1933). This lack of information has restricted comparisons of the ecology of the Budgerigar with that of other parrots and has limited interpretation of the adaptive significance of findings from studies of domestic Budgerigars.

Between 1970 and 1974 I studied the ecology of the Budgerigar in inland mid-eastern Australia (Wyndham 1978a). This paper describes the diurnal cycle, behaviour and social organization of wild Budgerigars and, where appropriate, compares these aspects with the Eastern Rosella *Platycercus eximius* and domestic Budgerigars.

BACKGROUND AND METHODS

Budgerigars were studied in detail at Trielmon (30°S, 148°E), near Walgett, from 1972 to 1974 and at Mokely Creek (29°S, 142°E), near Tibooburra, from November 1973 to December 1974. Breeding took place at both locations. A breeding pair was watched at Roscommon (30°S, 147°E), near Brewarrina, in March 1970. Birds also were observed at Alawoona (27°S, 146°E), near Wyandra, in May 1970, at Pinkilla (27°S, 144°E), near Quilpie, in August 1970 and at Mapoga (30°S, 147°E), near Brewarrina, in January 1971. Budgerigars were not breeding and had fully regressed gonads (Wyndham 1978a) during observations at these last three places. Descriptions, maps showing field areas, and climatic conditons during my study are given in Wyndham (1978b, in press).

Changes in plumage and other external characters were studied in wild birds that were kept in cages. Five young were taken from their nests shortly before they fledged and raised in cages and several other birds were caught and caged shortly after they fledged. Sexual dimorphism was studied in collected specimens, which were sexed by dissection. Examination for sexual dimorphism and changes in external appearance with ageing was based on differences that occur in domestic birds (Cinat-Tomson 1926; Brockway 1964a) or in the taxonomically related broad-tailed parrots (Subfamily Platycercinae) (Lendon 1941; Smith and Brereton 1976; Wyndham pers. obs.). Age and sex ratios were found from counts of birds that were collected, caught in mist nets or examined through binoculars.

Calls were differentiated by ear and, because breeding and non-breeding young and mature birds were studied, most of the vocal repertoire probably was heard. Uncommon calls and slight differences between individuals may not have been detected. Calls were recorded from wild Budgerigars in the field, except for aggressive ehh (see below), which was recorded from a bird caught in the wild and caged. Recording was done with either a Nagra III Kudelski or a Uher 4000 Report-L tape recorder. Most calls were recorded from a breeding pair at Roscommon in March 1970, with the microphone placed about twenty centimetres from

25

Distanz Nistplatz – Fressplatz > 1 km

2 Fress-Perioden (Vormittag / Nachmittag)

Fressen am Boden und an Gras-Stengeln

When feeding, the birds moved across the ground and climbed up and down tussocks of grass.

Aktivitäts-Budget

DIURNAL CYCLE, BEHAVIOUR AND SOCIAL ORGANIZATION OF THE BUDGERIGAR *MELOPSITTACUS UNDULATUS*

EDMUND WYNDHAM

Received 20 December 1978; accepted 30 March 1979.

SUMMARY

WYNDHAM, E. 1980. Diurnal cycle, behaviour and social organization of the Budgerigar *Melopsittacus undulatus*. Emu 80 : 25-33.

The Budgerigar *Melopsittacus undulatus* was studied in the field in eastern Australia. Flocks occurred throughout the year, during most diurnal activities and at most stages of the life cycle. Daily activity began about sunrise and ceased during dusk. It consisted of feeding in the morning and afternoon and resting and preening in the foliage of trees during the middle of the day. Birds drank intermittently and at no specific time of the day. Different ages and sexes mixed in flocks and there was no obvious hierarchical construction nor high- and low-status groups within flocks or populations. At times, flocks occurred that were composed predominantly of young birds. Eight discrete calls were identified. Slight differences between juveniles and adults, little sexual dimorphism and few discrete calls suggests that the social organization of the Budgerigar is simple compared to that of the Eastern Rosella *Platycercus eximius*. Behaviour of birds in the field is compared to that described from studies of domestic birds in cages.

INTRODUCTION

The Budgerigar *Melopsittacus undulatus* is a small parrot (c. 29 g) that occurs in large numbers in the interior of Australia. Brereton (1963a, b, 1966, 1971a, b) in his pioneer studies of the comparative ecology and social organization of Australian parrots selected the Budgerigar as an example of an arid-adapted species.

Budgerigars adapt readily to captivity and, since their introduction to England in 1840 (Gould 1865), they have become a widespread and common caged bird. As domestic Budgerigars are readily available and easy to maintain and breed in captivity, they have become popular animals for research; in particular, the behaviour and social organization of domestic Budgerigars have been extensively studied (e.g. Brereton 1963b; Brockway 1962, 1964a, b, c, 1965, 1968; Masure and Allee 1934; Trillmich 1976a, b).

The ecology of the Budgerigar in its natural environment is poorly known and is based on the notes of early naturalists (Gould 1865; Broinowski 1890; Finlayson *et al.* 1932; Cayley 1933). This lack of information has restricted comparisons of the ecology of the Budgerigar with that of other parrots and has limited interpretation of the adaptive significance of findings from studies of domestic Budgerigars.

Between 1970 and 1974 I studied the ecology of the Budgerigar in inland mid-eastern Australia (Wyndham 1978a). This paper describes the diurnal cycle, behaviour and social organization of wild Budgerigars and, where appropriate, compares these aspects with the Eastern Rosella *Platycercus eximius* and domestic Budgerigars.

BACKGROUND AND METHODS

Budgerigars were studied in detail at Trielmon (30°S, 148°E), near Walgett, from 1972 to 1974 and at Mokely Creek (29°S, 142°E), near Tibooburra, from November 1973 to December 1974. Breeding took place at both locations. A breeding pair was watched at Roscommon (30°S, 147°E), near Brewarrina, in March 1970. Birds also were observed at Alawoona (27°S, 146°E), near Wyandra, in May 1970, at Pinkilla (27°S, 144°E), near Quilpie, in August 1970 and at Mapoga (30°S, 147°E), near Brewarrina, in January 1971. Budgerigars were not breeding and had fully regressed gonads (Wyndham 1978a) during observations at these last three places. Descriptions, maps showing field areas, and climatic conditons during my study are given in Wyndham (1978b, in press).

Changes in plumage and other external characters were studied in wild birds that were kept in cages. Five young were taken from their nests shortly before they fledged and raised in cages and several other birds were caught and caged shortly after they fledged. Sexual dimorphism was studied in collected specimens, which were sexed by dissection. Examination for sexual dimorphism and changes in external appearance with ageing was based on differences that occur in domestic birds (Cinat-Tomson 1926; Brockway 1964a) or in the taxonomically related broad-tailed parrots (Subfamily Platycercinae) (Lendon 1941; Smith and Brereton 1976; Wyndham pers. obs.). Age and sex ratios were found from counts of birds that were collected, caught in mist nets or examined through binoculars.

Calls were differentiated by ear and, because breeding and non-breeding young and mature birds were studied, most of the vocal repertoire probably was heard. Uncommon calls and slight differences between individuals may not have been detected. Calls were recorded from wild Budgerigars in the field, except for aggressive ehh (see below), which was recorded from a bird caught in the wild and caged. Recording was done with either a Nagra III Kudelski or a Uher 4000 Report-L tape recorder. Most calls were recorded from a breeding pair at Roscommon in March 1970, with the microphone placed about twenty centimetres from

25

Distanz Nistplatz – Fressplatz > 1 km

2 Fress-Perioden (Vormittag / Nachmittag)

Fressen am Boden und an Gras-Stengeln

When feeding, the birds moved across the ground and climbed up and down tussocks of grass.

As the sun set and its rays moved off the trees, flocks rose up in spectacular display flights, during which they called loudly and turned and swirled at high speed above the trees. At the end of these flights they flew off on a fairly straight course for the roosting site.

Aktivitäts-Budget

DIURNAL CYCLE, BEHAVIOUR AND SOCIAL ORGANIZATION OF THE BUDGERIGAR *MELOPSITTACUS UNDULATUS*

EDMUND WYNDHAM

Received 20 December 1978; accepted 30 March 1979.

SUMMARY

WYNDHAM, E. 1980. Diurnal cycle, behaviour and social organization of the Budgerigar *Melopsittacus undulatus*. Emu 80 : 25-33.

The Budgerigar *Melopsittacus undulatus* was studied in the field in eastern Australia. Flocks occurred throughout the year, during most diurnal activities and at most stages of the life cycle. Daily activity began about sunrise and ceased during dusk. It consisted of feeding in the morning and afternoon and resting and preening in the foliage of trees during the middle of the day. Birds drank intermittently and at no specific time of the day. Different ages and sexes mixed in flocks and there was no obvious hierarchical construction nor high- and low-status groups within flocks or populations. At times, flocks occurred that were composed predominantly of young birds. Eight discrete calls were identified. Slight differences between juveniles and adults, little sexual dimorphism and few discrete calls suggests that the social organization of the Budgerigar is simple compared to that of the Eastern Rosella *Platycercus eximius*. Behaviour of birds in the field is compared to that described from studies of domestic birds in cages.

INTRODUCTION

The Budgerigar *Melopsittacus undulatus* is a small parrot (c. 29 g) that occurs in large numbers in the interior of Australia. Brereton (1963a, b, 1966, 1971a, b) in his pioneer studies of the comparative ecology and social organization of Australian parrots selected the Budgerigar as an example of an arid-adapted species.

Budgerigars adapt readily to captivity and, since their introduction to England in 1840 (Gould 1865), they have become a widespread and common caged bird. As domestic Budgerigars are readily available and easy to maintain and breed in captivity, they have become popular animals for research; in particular, the behaviour and social organization of domestic Budgerigars have been extensively studied (e.g. Brereton 1963b; Brockway 1962, 1964a, b, c, 1965, 1968; Masure and Allee 1934; Trillmich 1976a, b).

The ecology of the Budgerigar in its natural environment is poorly known and is based on the notes of early naturalists (Gould 1865; Broinowski 1890; Finlayson *et al.* 1932; Cayley 1933). This lack of information has restricted comparisons of the ecology of the Budgerigar with that of other parrots and has limited interpretation of the adaptive significance of findings from studies of domestic Budgerigars.

Between 1970 and 1974 I studied the ecology of the Budgerigar in inland mid-eastern Australia (Wyndham 1978a). This paper describes the diurnal cycle, behaviour and social organization of wild Budgerigars and, where appropriate, compares these aspects with the Eastern Rosella *Platycercus eximius* and domestic Budgerigars.

BACKGROUND AND METHODS

Budgerigars were studied in detail at Trielmon (30°S, 148°E), near Walgett, from 1972 to 1974 and at Mokely Creek (29°S, 142°E), near Tibooburra, from November 1973 to December 1974. Breeding took place at both locations. A breeding pair was watched at Roscommon (30°S, 147°E), near Brewarrina, in March 1970. Birds also were observed at Alawoona (27°S, 146°E), near Wyandra, in May 1970, at Pinkilla (27°S, 144°E), near Quilpie, in August 1970 and at Mapoga (30°S, 147°E), near Brewarrina, in January 1971. Budgerigars were not breeding and had fully regressed gonads (Wyndham 1978a) during observations at these last three places. Descriptions, maps showing field areas, and climatic conditons during my study are given in Wyndham (1978b, in press).

Changes in plumage and other external characters were studied in wild birds that were kept in cages. Five young were taken from their nests shortly before they fledged and raised in cages and several other birds were caught and caged shortly after they fledged. Sexual dimorphism was studied in collected specimens, which were sexed by dissection. Examination for sexual dimorphism and changes in external appearance with ageing was based on differences that occur in domestic birds (Cinat-Tomson 1926; Brockway 1964a) or in the taxonomically related broad-tailed parrots (Subfamily Platycercinae) (Lendon 1941; Smith and Brereton 1976; Wyndham pers. obs.). Age and sex ratios were found from counts of birds that were collected, caught in mist nets or examined through binoculars.

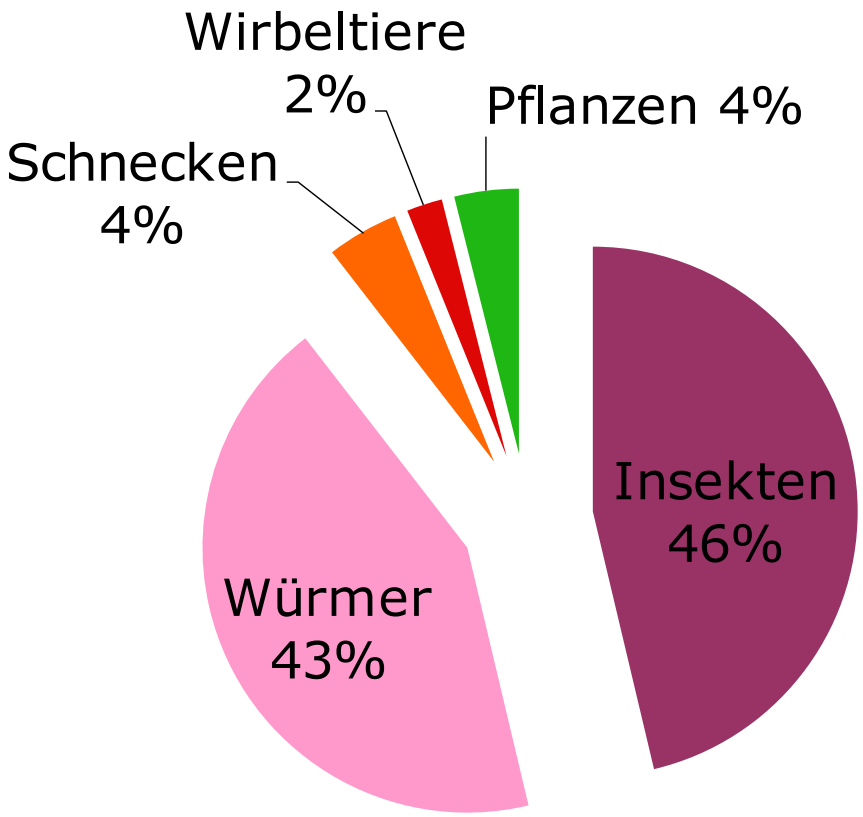
Calls were differentiated by ear and, because breeding and non-breeding young and mature birds were studied, most of the vocal repertoire probably was heard. Uncommon calls and slight differences between individuals may not have been detected. Calls were recorded from wild Budgerigars in the field, except for aggressive ehh (see below), which was recorded from a bird caught in the wild and caged. Recording was done with either a Nagra III Kudelski or a Uher 4000 Report-L tape recorder. Most calls were recorded from a breeding pair at Roscommon in March 1970, with the microphone placed about twenty centimetres from

25

As the sun set and its rays moved off the trees, flocks rose up in spectacular display flights, during which they called loudly and turned and swirled at high speed above the trees. At the end of these flights they flew off on a fairly straight course for the roosting site.

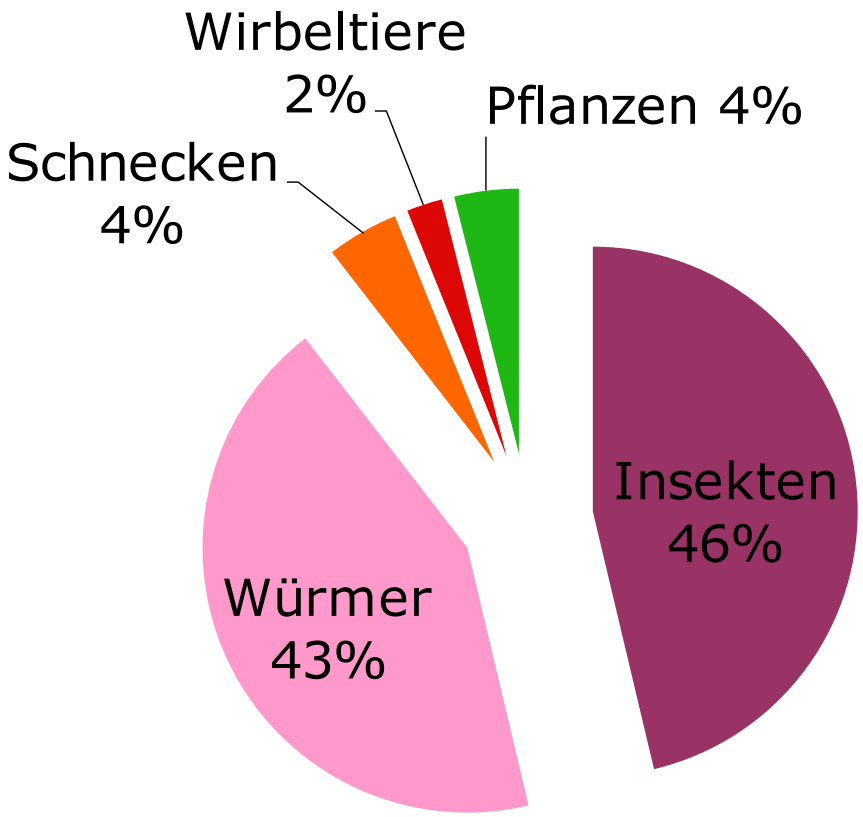
Igel

Natürliche Futterwahl: Igel



Struck & Meyer (1998)

Natürliche Futterwahl: Igel



Struck & Meyer (1998)

© petshop/pet

Zusammensetzung Bäckereierzeugnisse, Getreide, Nüsse (6% Erdnuss), Öle und Fette (3% Lebertran, 3% Sonnenblumenöl, 2% Sojaöl), Weich- und Krebstiere (5% Garnelen, 3% Krebse), Früchte (5% Rosinen), Zucker, Fleisch und tierische Nebenerzeugnisse (3% Trockenfleisch), Mineralstoffe, 1% Bienenhonig, Gemüse, Insekten (0,75% Fliegen), pflanzliche Eiweißextrakte, Fisch- und Nebenerzeugnisse, Hefen, konserviert mit EWG – Zusatzstoffen

Igelfutter im Vergleich

Igelfutter im Vergleich

Vitakraft Menü

Adresse
Vitakraft
D-28295 Bremen
www.vitakraft.com

Aufdruck auf der Vorderseite der Alu-Schale
„Hauptfutter für Igel", „Gibt Lebenskraft", „Tierschutz – artgerecht"

Zusammensetzung (laut Aufdruck auf der Rückseite der Schale)
Fleisch u. tierische Nebenerzeugnisse; Fisch u. Fischnebenerzeugnisse; pflanzliche Nebenerzeugnisse; Mineralstoffe; Inulin

Analyse

Rohprotein:	8,5 %
Rohfett:	5,1 %
Kohlenhydrate:	3,8 %
Rohfaser:	0,6 %
Rohasche:	2,0 %
Feuchtigkeit:	80,0 %

Eine Schale (100 g) enthält 473,8 kJ = 113 kcal

Beurteilung des Produkts (100-g-Schale)
Die drei Igelfeuchtfutter-Sorten „Vitakraft-Menü", „Multifit Igelfutter" und „Spike´s Hedgehog Food Meaty Feast" werden in Österreich von der C&D Foods Austria GmbH hergestellt. Die Herstellerfirma ist eine 100-prozentige Tochter der irischen C&D Foods, die sich zu großen Anteilen im Besitz des irischen Rindfleischkönigs Larry Goodman befindet.
Das Vitakraft-Produkt ist als „Hauptfutter" ausgewiesen, „Multifit Igelfutter" führt die Bezeichnung „Mischfuttermittel", und „Spike´s Hedgehog Food Meaty Feast" firmiert als „Ergänzungsfuttermittel" („Complementary food").
Die drei Sorten wiesen nur marginale Unterschiede in der Textur und Färbung auf, sind aber aus ernährungsphysiologischer Sicht in Bezug auf die Zutaten und Nährstoffprofile als eigentlich identisch einzustufen.
Unterschiede zu Katzenfutterfeuchtfutter, wie es im unteren Preissegment als Eigenmarken von Supermarkt- oder Drogerieketten zum Kilopreis von drei bis vier Euro angeboten wird, sind nicht erkennbar. Die Zutaten bestehen im Wesentlichen aus Abfällen der Geflügelschlachtung und Fischverarbeitung. Mit dem Zusatz von Wasser wurde hier, wie bei Feuchtfutter für Fleischfresser leider überall üblich, nicht gespart.
In allen Proben aller drei Sorten waren kleine Knochensplitter von Hühnern nachweisbar. Die österreichische Herstellerfirma hat nach unserer Beschwerde Abhilfe zugesagt.

Igelfutter im Vergleich

Tabelle 4.2 Vergleich der Nährstoffgehalte von 7 Igelfeuchtfuttersorten mit natürlicher Igelnahrung und Katzenfeuchtfutter

	Natürliche Igelnahrung	Feuchtfutter		
	Mittelwert (nach Struck/ Meyer, 1998)	Empfehlung	Katzenfeucht-futter Pastete*	Igelfeuchtfutter (7 Sorten)** von/bis (Mittelwert)
Rohprotein in %	15,7	mind. 10	10,0	8,0–9,5 (9,08)
Rohfett in %	4,1	mind. 5	7,5	4,5–7,0 (5,43)
Kohlenhydrate in %	1,9	max. 5	0,1	1,1–3,8 (2,45)
Wasser in %	73,0	max. 78	80,0	80,0–82,5 (81,33)
Rohfaser in %	2,7	max. 3	0,4	0,2–0,6 (0,43)
Rohasche in %	2,4	max. 3	2,0	2,0–2,5 (2,13)

Igelfutter im Vergleich

Tabelle 5.2.1 Nährstoffe in 22 Igeltrockenfutter-Sorten nach Herstellerangaben
Die Trockensubstanz (TS) wurde aus der Originalsubstanz (OS) berechnet.

Name	Bezeichnung des Herstellers	Rohprotein % in der TS	Rohfett % in der TS	NfE % in der TS[1]	Rohfaser % in der TS	Rohasche % in der TS
Natürliche Igelnahrung Mittelwert[2]		58,0	15,0	7,0	10,0[3]	9,0
Beaphar Igelfutter	Alleinfutter	39,7	19,3	25,0	3,9	8,6
Claus Igel-Mahlzeit[4]	Alleinfutter	37,8	33,3	21,0	3,3	2,2
Dehner Natura Igel-Spezialfutter[4]	Alleinfutter	37,8	33,3	21,0	3,3	2,2
Vitakraft Igelfutter	Alleinfutter	33,3	20,0	35,1	2,8	9,4

Aktivitäts-Budget: natürliches Habitat

ACTA THERIOLOGICA
Vol. 21, 30: 401—424, 1976

The Food of the Hedgehog in England

D. W. YALDEN

Yalden D. W., 1976: The food of the hedgehog in England. Acta theriol., 21, 30: 401—424 [With 4 Tables & 1 Fig.].

The contents of 177 hedgehog (*Erinaceus europaeus* Linnaeus, 1758) stomachs were analysed to ascertain the diet. The results are expressed in terms of percentage occurrence, percentage prey animals eaten, and percentage weight of prey eaten. On the weight basis, caterpillars, scarabeoid beetles and earthworms are the most important prey providing 55% of the food. Vertebrate prey is relatively unimportant, contributing perhaps 15% of the diet. So far as possible, the prey animals are identified to generic or specific level.

[Dept. Zool., Manchester Univ., Manchester, England]

1. INTRODUCTION

Although there is a considerable amount of general information available on the food of the hedgehog, *Erinaceus europaeus*, there has been very little systematic work. Kalabukhov (1928) analysed the droppings or stomachs of 24 *Erinaceus roumanicus* (= *E. europaeus roumanicus* Barret-Hamilton, 1900) and 11 *Hemiechinus auritus* (Gmelin, 1770) from the Ukraine and North Caucasus, collected throughout the summer. Shilova-Krassova (1952) analysed 262 droppings of *E. europaeus* from oak and pine forests in the Ukraine and southern Russia, nearly all collected in spring. In China, Liu (1937) analysed the stomach contents of 47 *E. europaeus dealbatus* (Swinhoe, 1870) from suburban areas, all collected in August. The fullest analyses, in terms of numbers and time-spread are those by Brockie (1959) and Campbell (1973 a, b) on the introduced *E. europaeus* in New Zealand; they examined material collected in a number of localities and at all times of the year. Brockie examined 10 stomachs and 90 droppings, while Campbell examined 60 stomachs and 230 droppings. Apparently the only systematic analysis of the food of hedgehogs in Western Europe is the limited study by Kruuk (1964) of 33 droppings collected between March and June in the vicinity of the black headed-gull (*Larus ridibundus*) colony at Ravenglass, Cumberland. Dimelow (1963) used captive hedgehogs in feeding trials with a wide range of invertebrates. Hedgehogs have also been used, in experimental situations less directly

An interesting sidelight from this is that only 18 of the stomachs examined contained over 10 g of food, and most contained less than 5 g. Shilova-Krassova (1952) found the food consumption of some experimental hedgehogs to be about 100 *Melolontha hippocastani* per day; that would be about 100 g per day. Kruuk (1964) carried out similar tests using chicks of *Larus ridibundus*, and suggested an average food consumption of 71 g per day, while Morris (1967) recommends a figure of 57 g por day for laboratory stock. The maximum amount found in any stomach was 32 g and that stomach was tightly filled. It would seem from this that the hedgehog must effectively fill its stomach twice each night, and that it must have a rather high rate of digestion.

Aktivitäts-Budget: natürliches Habitat

ACTA THERIOLOGICA
Vol. 21, 30: 401—424, 1976

The Food of the Hedgehog in England

D. W. YALDEN

Yalden D. W., 1976: The food of the hedgehog in England. Acta theriol., 21, 30: 401—424 [With 4 Tables & 1 Fig.].

The contents of 177 hedgehog (*Erinaceus europaeus* Linnaeus, 1758) stomachs were analysed to ascertain the diet. The results are expressed in terms of percentage occurrence, percentage prey animals eaten, and percentage weight of prey eaten. On the weight basis, caterpillars, scarabeoid beetles and earthworms are the most important prey providing 55% of the food. Vertebrate prey is relatively unimportant, contributing perhaps 15% of the diet. So far as possible, the prey animals are identified to generic or specific level.

[Dept. Zool., Manchester Univ., Manchester, England]

1. INTRODUCTION

Although there is a considerable amount of general information available on the food of the hedgehog, *Erinaceus europaeus*, there has been very little systematic work. Kalabukhov (1928) analysed the droppings or stomachs of 24 *Erinaceus roumanicus* (= *E. europaeus roumanicus* Barret-Hamilton, 1900) and 11 *Hemiechinus auritus* (Gmelin, 1770) from the Ukraine and North Caucasus, collected throughout the summer. Shilova-Krassova (1952) analysed 262 droppings of *E. europaeus* from oak and pine forests in the Ukraine and southern Russia, nearly all collected in spring. In China, Liu (1937) analysed the stomach contents of 47 *E. europaeus dealbatus* (Swinhoe, 1870) from suburban areas, all collected in August. The fullest analyses, in terms of numbers and time-spread are those by Brockie (1959) and Campbell (1973 a, b) on the introduced *E. europaeus* in New Zealand; they examined material collected in a number of localities and at all times of the year. Brockie examined 10 stomachs and 90 droppings, while Campbell examined 60 stomachs and 230 droppings. Apparently the only systematic analysis of the food of hedgehogs in Western Europe is the limited study by Kruuk (1964) of 33 droppings collected between March and June in the vicinity of the black headed-gull (*Larus ridibundus*) colony at Ravenglass, Cumberland. Dimelow (1963) used captive hedgehogs in feeding trials with a wide range of invertebrates. Hedgehogs have also been used, in experimental situations less directly

An interesting sidelight from this is that only 18 of the stomachs examined contained over 10 g of food, and most contained less than 5 g. Shilova-Krassova (1952) found the food consumption of some experimental hedgehogs to be about 100 *Melolontha hippocastani* per day; that would be about 100 g per day. Kruuk (1964) carried out similar tests using chicks of *Larus ridibundus*, and suggested an average food consumption of 71 g per day, while Morris (1967) recommends a figure of 57 g por day for laboratory stock. The maximum amount found in any stomach was 32 g and that stomach was tightly filled. It would seem from this that the hedgehog must effectively fill its stomach twice each night, and that it must have a rather high rate of digestion.

Aktivitäts-Budget: natürliches Habitat

Acta Theriologica 51 (4): 363–371, 2006.
PL ISSN 0001–7051

Habitat use and behaviour of European hedgehog *Erinaceus europaeus* in a Danish rural area

Anja B. RIBER

Riber A. B. 2006. Habitat use and behaviour of European hedgehog *Erinaceus europaeus* in a Danish rural area. Acta Theriologica 51: 363–371.

Hedgehogs *Erinaceus europaeus* Linnaeus, 1758 were radio-tagged and monitored during the summer of 2001 in a Danish rural area with the objective of quantifying home ranges, nightly distances travelled, habitat use, activity patterns, day-nesting habits, and body-weight changes of the five males and five females being recorded. Males had larger home-range sizes and travelled longer nightly distances than females. The two most common habitat types within the home ranges of the hedgehogs were deciduous forest and arable land, whereas the two most frequently used habitat types were deciduous forest and grassland. No differences between the sexes were found in the proportions of different habitat types within the home ranges or in habitat use. Non-random habitat use was found; forested areas and edge habitats seemed preferred to open areas. The most frequently used day-nesting habitat was deciduous forest. Foraging was by far the most time-consuming nightly activity for both sexes. Males lost weight during the study period (May–July), whereas females gained weight. A peak in the frequency of sexual behaviour was found from late-June to mid-July. The high level of male ranging activity and the weight loss of males are interpreted as a consequence of the promiscuous mating system of hedgehogs.

Section of Ethology, Department of Large Animal Sciences, The Royal Veterinary and Agricultural University, DK-1870, Frederiksberg C, Denmark, e-mail: abrj@kvl.dk

Key words: body weight, day-nesting habits, home range, movements, sexual behaviour

Introduction

European hedgehogs *Europaeus erinaceus* Linnaeus, 1758 are small secretive nocturnal animals that spend the day in well hidden day-nests. Such characteristics complicate monitoring of the behaviour of free-ranging individuals, contributing to poor understanding of certain aspects of their behavioural ecology. For instance, knowledge of the activity patterns of hedgehog is still limited in spite of the wide distribution of hedgehog in Western Europe and New Zealand. The continuously improving radio-telemetry technology has, however, made comprehensive studies of such animals possible, although the cost of the equipment and the time-consuming form of the method usually still limit the number of study animals involved (eg Morris 1988, Huijser 2000).

Aktivitäts-Budget: natürliches Habitat

Acta Theriologica 51 (4): 363–371, 2006.
PL ISSN 0001–7051

Habitat use and behaviour of European hedgehog *Erinaceus europaeus* in a Danish rural area

Anja B. RIBER

Riber A. B. 2006. Habitat use and behaviour of European hedgehog *Erinaceus europaeus* in a Danish rural area. Acta Theriologica 51: 363–371.

Hedgehogs *Erinaceus europaeus* Linnaeus, 1758 were radio-tagged and monitored during the summer of 2001 in a Danish rural area with the objective of quantifying home ranges, nightly distances travelled, habitat use, activity patterns, day-nesting habits, and body-weight changes of the five males and five females being recorded. Males had larger home-range sizes and travelled longer nightly distances than females. The two most common habitat types within the home ranges of the hedgehogs were deciduous forest and arable land, whereas the two most frequently used habitat types were deciduous forest and grassland. No differences between the sexes were found in the proportions of different habitat types within the home ranges or in habitat use. Non-random habitat use was found; forested areas and edge habitats seemed preferred to open areas. The most frequently used day-nesting habitat was deciduous forest. Foraging was by far the most time-consuming nightly activity for both sexes. Males lost weight during the study period (May–July), whereas females gained weight. A peak in the frequency of sexual behaviour was found from late-June to mid-July. The high level of male ranging activity and the weight loss of males are interpreted as a consequence of the promiscuous mating system of hedgehogs.

Section of Ethology, Department of Large Animal Sciences, The Royal Veterinary and Agricultural University, DK-1870, Frederiksberg C, Denmark, e-mail: abrj@kvl.dk

Key words: body weight, day-nesting habits, home range, movements, sexual behaviour

Introduction

European hedgehogs *Europaeus erinaceus* Linnaeus, 1758 are small secretive nocturnal animals that spend the day in well hidden day-nests. Such characteristics complicate monitoring of the behaviour of free-ranging individuals, contributing to poor understanding of certain aspects of their behavioural ecology. For instance, knowledge of the activity patterns of hedgehog is still limited in spite of the wide distribution of hedgehog in Western Europe and New Zealand. The continuously improving radio-telemetry technology has, however, made comprehensive studies of such animals possible, although the cost of the equipment and the time-consuming form of the method usually still limit the number of study animals involved (eg Morris 1988, Huijser 2000).

1-2 km / Nacht zurückgelegt

dabei ca. 4 h mit Fressen verbracht

Aktivitäts-Budget: Innen-Haltung

14 PROCEEDINGS OF THE NEW ZEALAND ECOLOGICAL SOCIETY, VOL. 22, 1975

FEEDING RHYTHMS OF CAGED HEDGEHOGS (*ERINACEUS EUROPAEUS* L.)

P. A. CAMPBELL

Lincoln College, Canterbury

SUMMARY: The feeding behaviour of four adult caged hedgehogs was studied for a period of 22 weeks. The maximum feeding activity of all four animals occurred between 1900 and 2200 hours, and two of them showed a second, but minor, peak of activity about 0300 hours. Individual feeds were of short duration with the first feed each evening tending to exceed the mean. Variations in behaviour between individuals were considered to be a function of their differing body weights, or to be related to the size of the sample. The feeding behaviour of the caged animals was similar to that reported from comparable field studies.

INTRODUCTION

Herter (1938), Burton (1969) and Campbell (1973) have shown that hedgehogs in their natural habitats have a definable feeding rhythm. Observations of caged hedgehogs (Kristoffersson 1964 and Otway 1965) have shown comparable feeding rhythms, but these studies were of only 6 and 14 days duration respectively. The present study was an attempt to determine if hedgehogs retained their natural feeding rhythm when fed under laboratory conditions for an extended period.

METHODS

Four adult hedgehogs taken from pasturelands near Lincoln were fed under laboratory conditions for 22 weeks. The animals were housed in a temperature controlled room (18 ± 2°C) to prevent hibernation and lessen the risk of pneumonia, a major mortality factor of caged hedgehogs (Campbell 1973). To avoid possible effects from the abrupt change in habitat the first 9 weeks were used to condition the animals to captivity, and the remainder for a feeding trial. Each animal was housed in a separate 120 x 30 x 30 cm cage that had a nest box partly filled with shredded paper at one end. The entrance to the nest box was covered by a light-proof curtain. A food tray, which was too narrow for a feeding hedgehog to stand in, was located against the opposite end of the cage, and a pressure pad connected to a four-pen event recorder was placed in front of it (Fig. 1). The pressure pad did not operate unless weight was applied near the contact end. The event recorder operated continually, but movement of the

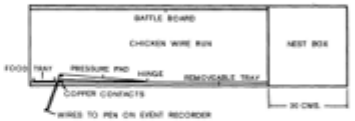


FIGURE 1. *Diagramatic lateral view of a test cage.*

paper tape was restricted to between 1800 and 0700 hours daily.

The only lighting in the room throughout the 13 week feeding trial was daylight from an east-facing window shaded by a baffle. A selenium photocell, which could be read from outside the room was used to record light intensities. During the conditioning period only, the animals were observed with the aid of a shaded red photographic safety lamp.

A daily diet of 300 g of a 1:1:3 volume mixture of cooked mince, bread and milk was provided. Small quantities of mineral salts, cod-liver oil and liver were added regularly.

As the variances were different the modified t-test (Snedecor and Cochran 1967) was used to test data for significance.

RESULTS AND DISCUSSION

The animals did not react to the red light used to assist observations made during the conditioning period. On first emerging from their nests each night the animals normally groomed themselves, then evacuated. Behaviour beyond this point was variable but they would usually complete at least one

Aktivitäts-Budget: Innen-Haltung

14 PROCEEDINGS OF THE NEW ZEALAND ECOLOGICAL SOCIETY, VOL. 22, 1975

FEEDING RHYTHMS OF CAGED HEDGEHOGS (*ERINACEUS EUROPAEUS* L.)

P. A. CAMPBELL

Lincoln College, Canterbury

SUMMARY: The feeding behaviour of four adult caged hedgehogs was studied for a period of 22 weeks. The maximum feeding activity of all four animals occurred between 1900 and 2200 hours, and two of them showed a second, but minor, peak of activity about 0300 hours. Individual feeds were of short duration with the first feed each evening tending to exceed the mean. Variations in behaviour between individuals were considered to be a function of their differing body weights, or to be related to the size of the sample. The feeding behaviour of the caged animals was similar to that reported from comparable field studies.

INTRODUCTION

Herter (1938), Burton (1969) and Campbell (1973) have shown that hedgehogs in their natural habitats have a definable feeding rhythm. Observations of caged hedgehogs (Kristoffersson 1964 and Otway 1965) have shown comparable feeding rhythms, but these studies were of only 6 and 14 days duration respectively. The present study was an attempt to determine if hedgehogs retained their natural feeding rhythm when fed under laboratory conditions for an extended period.

METHODS

Four adult hedgehogs taken from pasturelands near Lincoln were fed under laboratory conditions for 22 weeks. The animals were housed in a temperature controlled room (18 ± 2°C) to prevent hibernation and lessen the risk of pneumonia, a major mortality factor of caged hedgehogs (Campbell 1973). To avoid possible effects from the abrupt change in habitat the first 9 weeks were used to condition the animals to captivity, and the remainder for a feeding trial. Each animal was housed in a separate 120 x 30 x 30 cm cage that had a nest box partly filled with shredded paper at one end. The entrance to the nest box was covered by a light-proof curtain. A food tray, which was too narrow for a feeding hedgehog to stand in, was located against the opposite end of the cage, and a pressure pad connected to a four-pen event recorder was placed in front of it (Fig. 1). The pressure pad did not operate unless weight was applied near the contact end. The event recorder operated continually, but movement of the

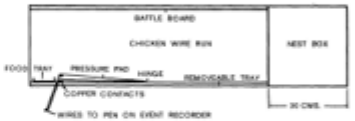


FIGURE 1. *Diagramatic lateral view of a test cage.*

paper tape was restricted to between 1800 and 0700 hours daily.

The only lighting in the room throughout the 13 week feeding trial was daylight from an east-facing window shaded by a baffle. A selenium photocell, which could be read from outside the room was used to record light intensities. During the conditioning period only, the animals were observed with the aid of a shaded red photographic safety lamp.

A daily diet of 300 g of a 1:1:3 volume mixture of cooked mince, bread and milk was provided. Small quantities of mineral salts, cod-liver oil and liver were added regularly.

As the variances were different the modified t-test (Snedecor and Cochran 1967) was used to test data for significance.

RESULTS AND DISCUSSION

The animals did not react to the red light used to assist observations made during the conditioning period. On first emerging from their nests each night the animals normally groomed themselves, then evacuated. Behaviour beyond this point was variable but they would usually complete at least one

zwischen 7 und 15 “Mahlzeiten” pro Nacht

Aktivitäts-Budget: Innen-Haltung

14 PROCEEDINGS OF THE NEW ZEALAND ECOLOGICAL SOCIETY, VOL. 22, 1975

FEEDING RHYTHMS OF CAGED HEDGEHOGS (*ERINACEUS EUROPAEUS* L.)

P. A. CAMPBELL

Lincoln College, Canterbury

SUMMARY: The feeding behaviour of four adult caged hedgehogs was studied for a period of 22 weeks. The maximum feeding activity of all four animals occurred between 1900 and 2200 hours, and two of them showed a second, but minor, peak of activity about 0300 hours. Individual feeds were of short duration with the first feed each evening tending to exceed the mean. Variations in behaviour between individuals were considered to be a function of their differing body weights, or to be related to the size of the sample. The feeding behaviour of the caged animals was similar to that reported from comparable field studies.

INTRODUCTION

Herter (1938), Burton (1969) and Campbell (1973) have shown that hedgehogs in their natural habitats have a definable feeding rhythm. Observations of caged hedgehogs (Kristoffersson 1964 and Otway 1965) have shown comparable feeding rhythms, but these studies were of only 6 and 14 days duration respectively. The present study was an attempt to determine if hedgehogs retained their natural feeding rhythm when fed under laboratory conditions for an extended period.

METHODS

Four adult hedgehogs taken from pasturelands near Lincoln were fed under laboratory conditions for 22 weeks. The animals were housed in a temperature controlled room (18 ± 2°C) to prevent hibernation and lessen the risk of pneumonia, a major mortality factor of caged hedgehogs (Campbell 1973). To avoid possible effects from the abrupt change in habitat the first 9 weeks were used to condition the animals to captivity, and the remainder for a feeding trial. Each animal was housed in a separate 120 x 30 x 30 cm cage that had a nest box partly filled with shredded paper at one end. The entrance to the nest box was covered by a light-proof curtain. A food tray, which was too narrow for a feeding hedgehog to stand in, was located against the opposite end of the cage, and a pressure pad connected to a four-pen event recorder was placed in front of it (Fig. 1). The pressure pad did not operate unless weight was applied near the contact end. The event recorder operated continually, but movement of the

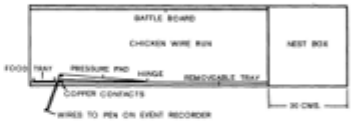


FIGURE 1. *Diagramatic lateral view of a test cage.*

paper tape was restricted to between 1800 and 0700 hours daily.

The only lighting in the room throughout the 13 week feeding trial was daylight from an east-facing window shaded by a baffle. A selenium photocell, which could be read from outside the room was used to record light intensities. During the conditioning period only, the animals were observed with the aid of a shaded red photographic safety lamp.

A daily diet of 300 g of a 1:1:3 volume mixture of cooked mince, bread and milk was provided. Small quantities of mineral salts, cod-liver oil and liver were added regularly.

As the variances were different the modified t-test (Snedecor and Cochran 1967) was used to test data for significance.

RESULTS AND DISCUSSION

The animals did not react to the red light used to assist observations made during the conditioning period. On first emerging from their nests each night the animals normally groomed themselves, then evacuated. Behaviour beyond this point was variable but they would usually complete at least one

zwischen 7 und 15 “Mahlzeiten” pro Nacht

mit einer Dauer von 100-200 Sekunden

Aktivitäts-Budget: Innen-Haltung

14 PROCEEDINGS OF THE NEW ZEALAND ECOLOGICAL SOCIETY, VOL. 22, 1975

FEEDING RHYTHMS OF CAGED HEDGEHOGS (*ERINACEUS EUROPAEUS* L.)

P. A. CAMPBELL

Lincoln College, Canterbury

SUMMARY: The feeding behaviour of four adult caged hedgehogs was studied for a period of 22 weeks. The maximum feeding activity of all four animals occurred between 1900 and 2200 hours, and two of them showed a second, but minor, peak of activity about 0300 hours. Individual feeds were of short duration with the first feed each evening tending to exceed the mean. Variations in behaviour between individuals were considered to be a function of their differing body weights, or to be related to the size of the sample. The feeding behaviour of the caged animals was similar to that reported from comparable field studies.

INTRODUCTION

Herter (1938), Burton (1969) and Campbell (1973) have shown that hedgehogs in their natural habitats have a definable feeding rhythm. Observations of caged hedgehogs (Kristoffersson 1964 and Otway 1965) have shown comparable feeding rhythms, but these studies were of only 6 and 14 days duration respectively. The present study was an attempt to determine if hedgehogs retained their natural feeding rhythm when fed under laboratory conditions for an extended period.

METHODS

Four adult hedgehogs taken from pasturelands near Lincoln were fed under laboratory conditions for 22 weeks. The animals were housed in a temperature controlled room (18 ± 2°C) to prevent hibernation and lessen the risk of pneumonia, a major mortality factor of caged hedgehogs (Campbell 1973). To avoid possible effects from the abrupt change in habitat the first 9 weeks were used to condition the animals to captivity, and the remainder for a feeding trial. Each animal was housed in a separate 120 x 30 x 30 cm cage that had a nest box partly filled with shredded paper at one end. The entrance to the nest box was covered by a light-proof curtain. A food tray, which was too narrow for a feeding hedgehog to stand in, was located against the opposite end of the cage, and a pressure pad connected to a four-pen event recorder was placed in front of it (Fig. 1). The pressure pad did not operate unless weight was applied near the contact end. The event recorder operated continually, but movement of the

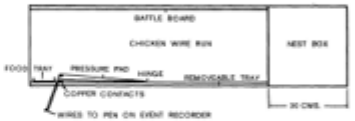


FIGURE 1. *Diagramatic lateral view of a test cage.*

paper tape was restricted to between 1800 and 0700 hours daily.

The only lighting in the room throughout the 13 week feeding trial was daylight from an east-facing window shaded by a baffle. A selenium photocell, which could be read from outside the room was used to record light intensities. During the conditioning period only, the animals were observed with the aid of a shaded red photographic safety lamp.

A daily diet of 300 g of a 1:1:3 volume mixture of cooked mince, bread and milk was provided. Small quantities of mineral salts, cod-liver oil and liver were added regularly.

As the variances were different the modified t-test (Snedecor and Cochran 1967) was used to test data for significance.

RESULTS AND DISCUSSION

The animals did not react to the red light used to assist observations made during the conditioning period. On first emerging from their nests each night the animals normally groomed themselves, then evacuated. Behaviour beyond this point was variable but they would usually complete at least one

zwischen 7 und 15 “Mahlzeiten” pro Nacht

mit einer Dauer von 100-200 Sekunden

ergibt 22-27 Minuten pro Nacht

Aktivitäts-Budget: Innen-Haltung

THE BEHAVIOUR OF THE HEDGEHOG (*ERINACEUS EUROPAEUS* L.) IN THE ROUTINE OF LIFE IN CAPTIVITY

BY

E. J. DIMELOW

*Department of Zoology, The University, Reading**

[Accepted 9th October, 1962]

An account is given of the grooming and nest building of the hedgehog. In addition its activity while being exercised is described and its behavioural responses to other hedgehogs or to human beings.

CONTENTS

INTRODUCTION

Some aspects of hedgehog behaviour were observed in detail. They are reported here to supplement previous observation (Herter, 1938 ; Lindemann, 1951) which is incomplete in part though very extensive.

Remler (1926) observed that hedgehogs make nests under fallen stumps. He watched a wild hedgehog collecting leaves one after the other for its nest, selecting only dry ones. In captivity hedgehogs build nests of a variety of materials and the procedure involved is usually more complex than that described briefly by Remler.

Hedgehogs were kept in captivity mainly in order that they might perform food preference tests involving the use of terrestrial worms, arthropods, molluscs The behaviour of these hedgehogs is described in the routine of their life in captivity so that the degree to which their behaviour was influenced by humans can be assessed in some measure and the tests viewed in their proper setting. It is hoped that these limited observations may have some significance in relation to the behaviour of hedgehogs in their natural state.

HEDGEHOGS UNDER OBSERVATION

Nine hedgehogs (A—1 below) were kept in captivity at different times over a period of three years. Seven of the hedgehogs (A—G) were caught in the

*Present address: Department of Biology, Mount Allison University, Sackville, N.B., Canada.

Aktivitäts-Budget: Innen-Haltung

THE BEHAVIOUR OF THE HEDGEHOG (*ERINACEUS EUROPAEUS* L.) IN THE ROUTINE OF LIFE IN CAPTIVITY

BY

E. J. DIMELOW

*Department of Zoology, The University, Reading**

[Accepted 9th October, 1962]

An account is given of the grooming and nest building of the hedgehog. In addition its activity while being exercised is described and its behavioural responses to other hedgehogs or to human beings.

CONTENTS

Some as
reported he
1951) which
Remler
He watched
selecting on
materials a
cribed brief
Hedgeh
food prefere
The behavi
captivity so
can be assessed in some measure and the tests viewed in their proper setting. It is hoped that these limited observations may have some significance in relation to the behaviour of hedgehogs in their natural state.

HEDGEHOGS UNDER OBSERVATION

Nine hedgehogs (A—1 below) were kept in captivity at different times over a period of three years. Seven of the hedgehogs (A—G) were caught in the

*Present address: Department of Biology, Mount Allison University, Sackville, N.B., Canada.

As an alternative to running for a time in fixed circles of different diameter or in concentric circles of diminishing or increasing diameter, D and F might "waltz". In this case either would spin round once on his axis at one definite point in the process of running round in a circle of about one and a half metres in diameter. D and F also ran backwards and forwards in a straight line along one wall or the side of a box.

Fazit / Ausblick

Dringende Notwendigkeit für ‘artgerechte Fütterung’

L. Mit der Fütterung sind die arttypischen Merkmale der Nahrungsaufnahme (räumlich und zeitlich variierendes Futterangebot, Futterbeschaffung, Futterbearbeitung und Dauer der Futteraufnahme) zu simulieren.

Dringende Notwendigkeit für ‘artgerechte Fütterung’

L. Mit der Fütterung sind die arttypischen Merkmale der Nahrungsaufnahme (räumlich und zeitlich variierendes Futterangebot, Futterbeschaffung, Futterbearbeitung und Dauer der Futteraufnahme) zu simulieren.

Die Fütterung ist ein wesentlicher Faktor, um das Verhaltensbudget eines Tieres einzustellen.

Dringende Notwendigkeit für ‘artgerechte Fütterung’

L. Mit der Fütterung sind die arttypischen Merkmale der Nahrungsaufnahme (räumlich und zeitlich variierendes Futterangebot, Futterbeschaffung, Futterbearbeitung und Dauer der Futteraufnahme) zu simulieren.

Die Fütterung ist ein wesentlicher Faktor, um das Verhaltensbudget eines Tieres einzustellen.

Fütterung nur als Erfüllung physiologischen Bedarfs an Nährstoffen und Energie zu betrachten, ist eine Herangehensweise, die (noch nicht einmal) in der Nutztierhaltung adäquat ist.

Dringende Notwendigkeit für ‘artgerechte Fütterung’

L. Mit der Fütterung sind die arttypischen Merkmale der Nahrungsaufnahme (räumlich und zeitlich variierendes Futterangebot, Futterbeschaffung, Futterbearbeitung und Dauer der Futteraufnahme) zu simulieren.

Die Fütterung ist ein wesentlicher Faktor, um das Verhaltensbudget eines Tieres einzustellen.

Fütterung nur als Erfüllung physiologischen Bedarfs an Nährstoffen und Energie zu betrachten, ist eine Herangehensweise, die (noch nicht einmal) in der Nutztierhaltung adäquat ist.

Es braucht einen Katalog von Angaben, wieviel Zeit pro Tag ein Individuum einer Tierart mit der Futteraufnahme (und mit anderen Tätigkeiten) verbringen sollte.

Vielen Dank für Ihre Aufmerksamkeit!