Futtermittel für exotische Heimtiere

Diskrepanzen zwischen verdauungsphysiologischen Anpassungen und Nährstoffzusammensetzung

Marcus Clauss

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Gliederung

- Historische Entwicklungen
- Planzenfresser
  - Obst
  - Bunte Mischungen
    - Abwechslung
    - Selektive Futteraufnahme
  - Fütterungspraxis

- Ziervögel – Körnermischungen
- Ziervögel & Reptilien - Futterinsekten

Alles ist Teil einer historischen Entwicklung

Beispiel: Fütterung von Landschildkröten in aufeinanderfolgenden Auflagen des gleichen Lehrbuches

Jahr	Empfehlung

Ritz et al. (2012)

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Jahr	Empfehlung
1980-1993 	80% Obst, 19% Fleisch, 1% Mineralstoffe; Obst: Äpfel, Birnen, Apfelsinen, Bananen, Tomaten, Grünfutter (Frischgras, Klee, Salat); Fleisch: Muskel, Herz – fein geschnitten – auch Fertigfutter für Hunde und Katzen. Bei Mangel an Obst: Haferflocken, Reis, Trockenfutter für Hunde, gedämpfte Kartoffeln

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1999	Blattreiche Grünfutter, Gemüse, Obst (Äpfel, Bananen, Birne, Traube, Kiwi), gelegentlich Feuchtfutter für Hunde und Katzen, Getreideprodukte

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1999	Blattreiche Grünfutter, Gemüse, Obst (Äpfel, Bananen, Birne, Traube, Kiwi), gelegentlich Feuchtfutter für Hunde und Katzen, Getreideprodukte
2004-2009 	Grünfutter (Wildkräuter, geringer Anteil Salat und Gemüse), geringe Mengen Obst (führt zu Fehlgärung und Durchfall), Feuchtfutter für Hunde und Katzen nicht als Hauptbestandteil (verursachen Gicht), Milch- und Getreideprodukte nur in geringen Mengen, Heu immer zur freien Aufnahme, Sepiaschalen/Hühnereischalen

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Typische Sichtweise auf Futtermittel

Fleisch wird aus menschlicher Sicht sehr geschätzt und daher gerne überbetont

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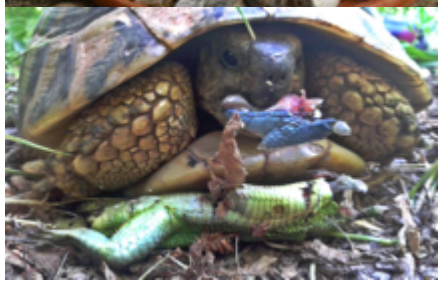

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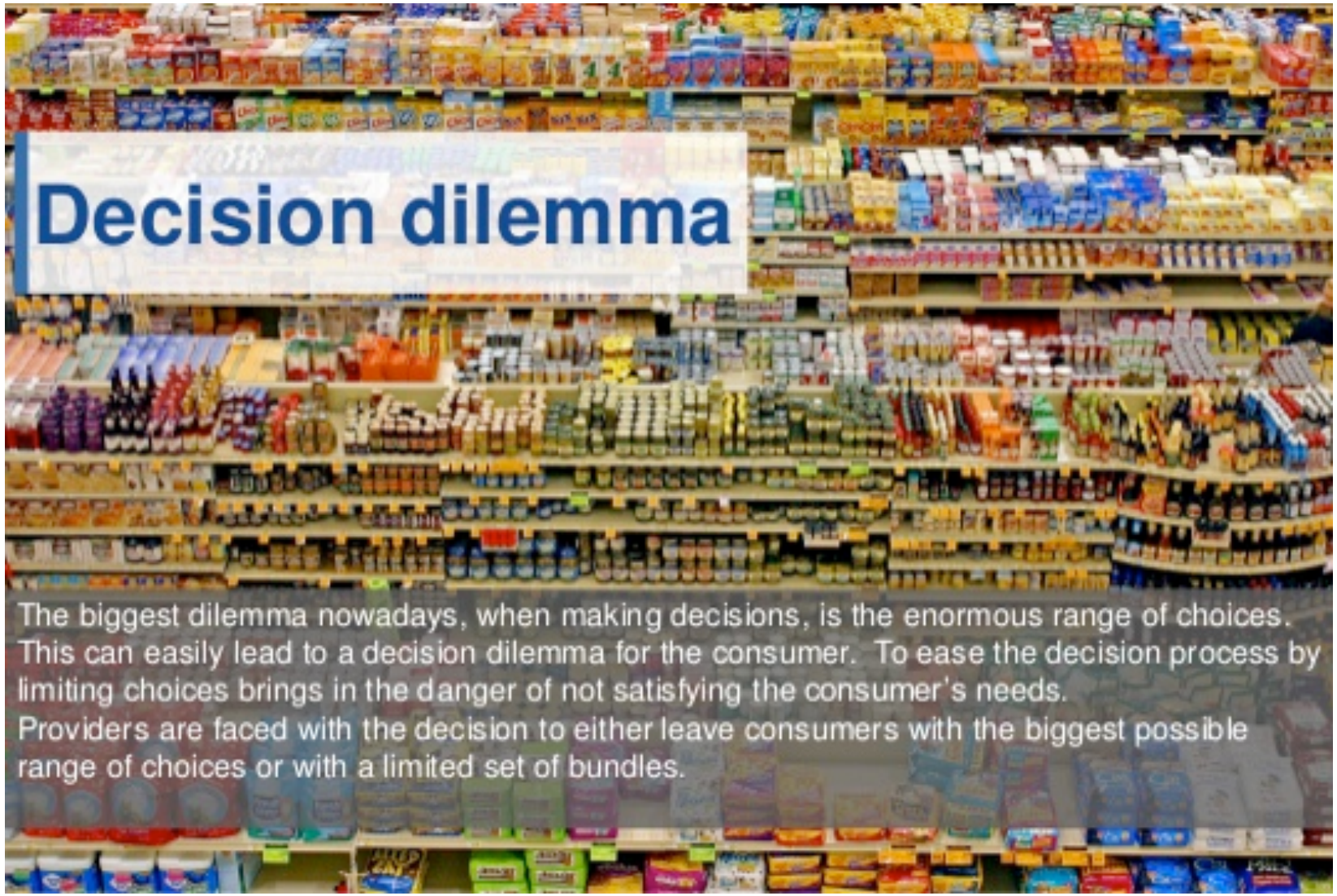
Decision dilemma
The biggest dilemma nowadays, when making decisions, is the enormous range of choices. This can easily lead to a decision dilemma for the consumer. To ease the decision process by limiting choices brings in the danger of not satisfying the consumer's needs.
Providers are faced with the decision to either leave consumers with the biggest possible range of choices or with a limited set of bundles.

Nahrung - Pflanzenfresser

Natürliche Nahrung …

Natürliche Nahrung …

… und erhältliche / verfügbare Futtermittel

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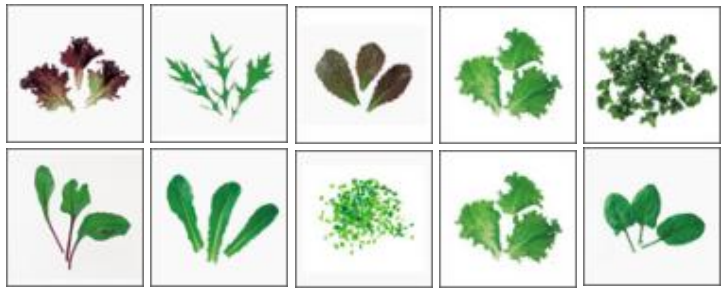

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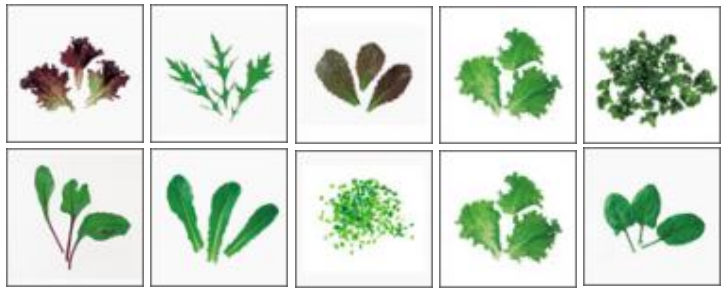


Meerschweinchen: Vitamin C Mangel

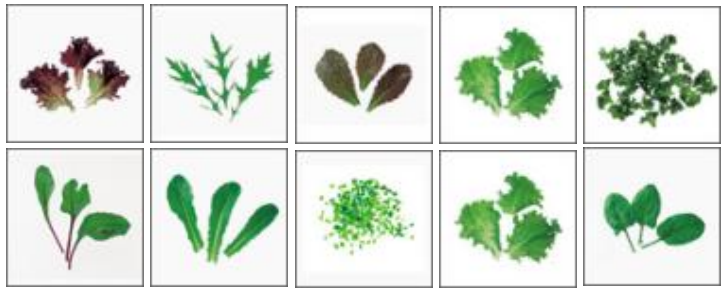
⇒ Grünfutter!

⇒ Mengen (Frischsubstanz), die 20 mg Vit. C lieferen

- ⇒ 1.6 g Hagebutte
- ⇒ 4.4 g Sanddornbeere
- ⇒ 11.3 g Schwarze Johannisbeere
- ⇒ 12 g Petersilie
- ⇒ 15 g Paprika
- ⇒ 57 g Feldsalat
- ⇒ 67 g Löwenzahn
- ⇒ 154 g Kopfsalat

Natürliche Nahrung …

… und erhältliche / verfügbare Futtermittel



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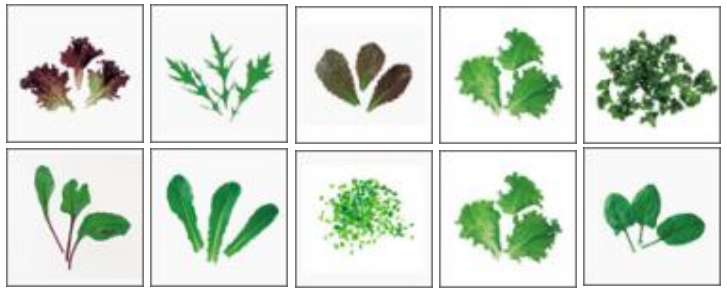
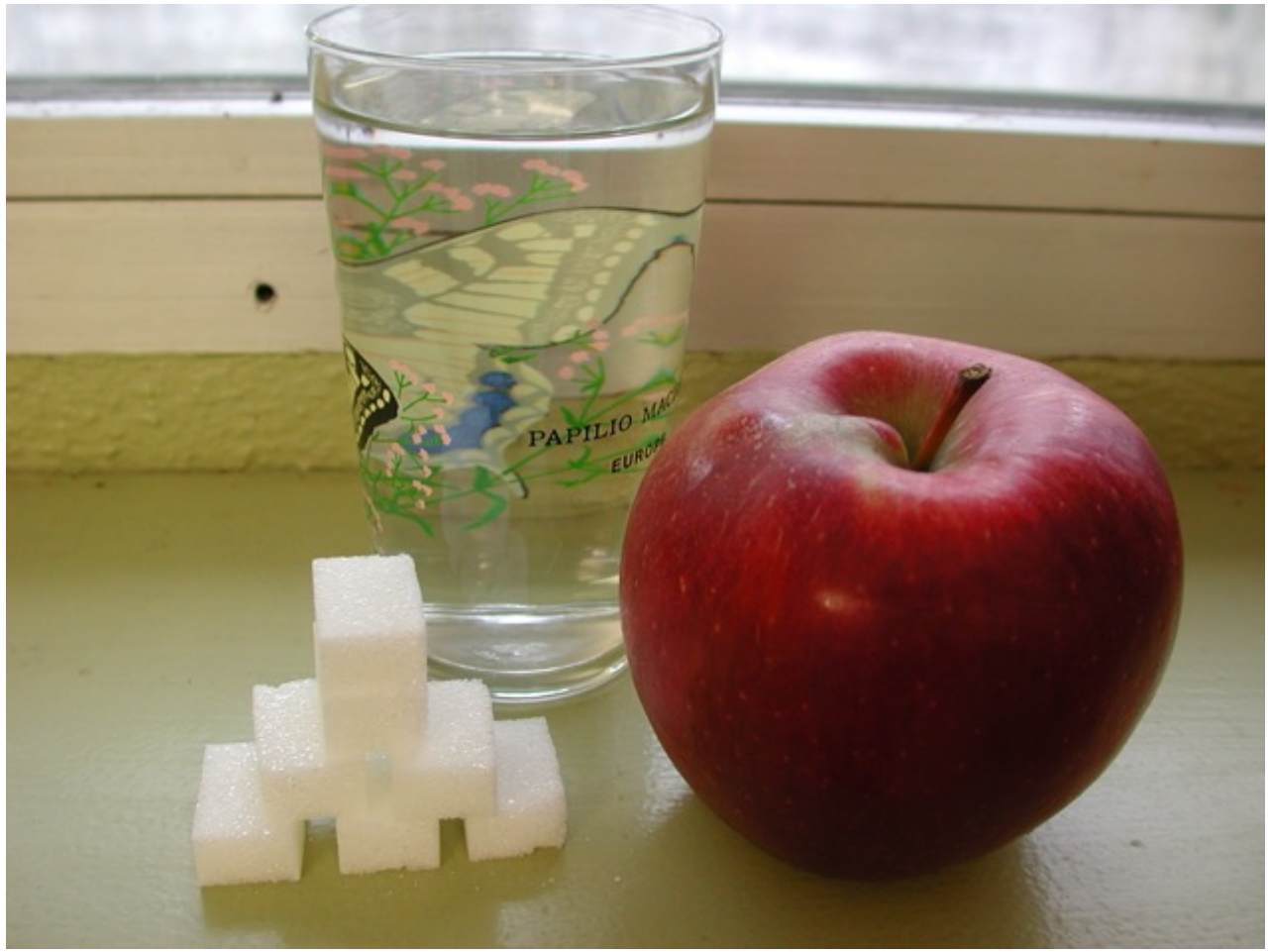


… und erhältliche / verfügbare Futtermittel

Obst

Was ist in einem Apfel?

Kommerzielles Obst = Wasser + Zucker



Wassergehalt 85 %

Zucker in Trockensubstanz 70 %

(d.h. 10.5 % in Frischsubstanz)

... ist gesund ?

... ist gesünder als ...

... ist gesünder als ...

... ist gesünder als ...

Bei Degu und Viscacha kann die Verfütterung von Obst/Karotten allein Diabetes incl. Katarakt auslösen!

Zoo Biology 24:359–373 (2005)

RESEARCH ARTICLE

Structural and Nonstructural Carbohydrate, Fat, and Protein Composition of Commercially Available, Whole Produce

Debra A. Schmidt,[1]* Monty S. Kerley,[1] James H. Porter,[1] and Janet L. Dempsey[2]

[1]*Department of Animal Sciences, University of Missouri, Columbia, Missouri*
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Key words: neutral detergent fiber; acid detergent fiber; pectin; fructan

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	Wasser (% uS)
Apfel	86
Karotte	88
Petersilie	88
Spinat	91

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	Wasser (% uS)	NDF (% TS)
Apfel	86	10
Karotte	88	10
Petersilie	88	21
Spinat	91	20

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	Wasser (% uS)	NDF (% TS)	Pectin (% TS)
Apfel	86	10	0.5
Karotte	88	10	0.7
Petersilie	88	21	1.0
Spinat	91	20	0.6

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Apfel	86	10	0.5
Karotte	88	10	0.7
Petersilie	88	21	1.0
Spinat	91	20	0.6

Pectin wahrscheinlich unterschätzt:
eher Apfel 3.5 % TS
eher Karotte 8 % TS

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	Wasser (% uS)	NDF (% TS)	Pectin (% TS)	Fructan (% TS)
Apfel	86	10	0.5	13
Karotte	88	10	0.7	5
Petersilie	88	21	1.0	0
Spinat	91	20	0.6	0

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	Wasser (% uS)	NDF (% TS)	Pectin (% TS)	Fructan (% TS)	Stärke (% TS)	Zucker (% TS)
Apfel	86	10	0.5	13	5	60
Karotte	88	10	0.7	5	30	39
Petersilie	88	21	1.0	0	29	8
Spinat	91	20	0.6	0	12	1

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Apfel	86	10	0.5	13	5	60	78
Karotte	88	10	0.7	5	30	39	74
Petersilie	88	21	1.0	0	29	8	37
Spinat	91	20	0.6	0	12	1	13

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[2]Nutrition Department, Saint Louis Zoological Park, Saint Louis, Missouri

Previously reported values for produce items often reflect only the human edible portion although animals generally eat the entire item. Produce can comprise a significant proportion of a captive, exotic animal's diet; therefore, nutrient values based on whole items will enable a more accurate diet formulation. Whole produce items, including fruits, vegetables, and leafy green vegetables, were analyzed for dry matter, neutral detergent fiber, acid detergent fiber, crude protein, fat, ash, pectin, fructan, and free sugar concentrations. The free sugars were typed and quantified. As expected, the produce contained low concentrations of neutral-detergent fiber, averaging 13.4% for fruits, 18.8% for vegetables, and 21.5% for leafy green vegetables(other items on a 100% dry matter basis. Fructan was present in most items, but was not a major component of the carbohydrate, protein, fat, and free-sugar concentration. Free-sugar ratios of glucose, fructose, and sucrose varied among items. This information can be used for more accurate formulation of zoological diets. Zoo Biol 24:359–373, 2005. © 2005 Wiley-Liss, Inc.

Key words: neutral detergent fiber; acid detergent fiber; pectin; fructan

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	Wasser (% uS)	NDF (% TS)	Pe (%	eichtverdauliche' Kohlenhydrate (% TS)
Apfel	86	10	0	78
Karotte	88	10	0	74
Petersilie	88	21	1	37
Spinat	91	20	0	13

DWW AnimalWelfareWeb.nl

Sugars and other nutrients in produce (of fruits and vegetables)

All values expressed as g/kg wet weight, unless otherwise stated.

Fruits

Banana *Musa acuminata*

104 gram sugar

Energy MJ	Dry Matter	NDF	ADF	Crude Protein	Fat	Ca	P	Mg	Fe	Vit. A RE	Vit. E α-TE	Vit. C
3.4	234	28.8	6.6	13.3	12.4	0.04	0.27	0.28	0.002	44.2	5.5	0.14

Apple *Malus domestica*

86 gram sugar

Energy MJ	Dry Matter	NDF	ADF	Crude Protein	Fat	Ca	P	Mg	Fe	Vit. A RE	Vit. E α-TE	Vit. C
2.2	143	14.6	8.6	4.3	8.3	0.04	0.17	0.04	0.001	20.8	5.5	0.1

Orange *Citrus x sinensis*

56 gram sugar

Energy MJ	Dry Matter	NDF	ADF	Crude Protein	Fat	Ca	P	Mg	Fe	Vit. A RE	Vit. E α-TE	Vit. C
2.2	130	14.3	9.2	7.8	4.9	0.35	0.22	0.1	0.001	40	5.5	0.5

Kiwi *Actinidia deliciosa*

52 gram sugar

Energy MJ	Dry Matter	NDF	ADF	Crude Protein	Fat	Ca	P	Mg	Fe	Vit. A RE	Vit. E α-TE	Vit. C
2.5	156	25.3	19.7	12.9	8.3	0.32	0.33	0.13	0.003	31.4	5.5	0.65

Papaya *Carica papaya*

27 gram sugar

Energy MJ	Dry Matter	NDF	ADF	Crude Protein	Fat	Ca	P	Mg	Fe	Vit. A RE	Vit. E α-TE	Vit. C
2.1	135	18.5	16.5	18.4	4.7	0.25	0.1	0.22	0.007	197	-	0.55

Vegetables

Carrot *Daucus caurota*

45 gram sugar

Energy MJ	Dry Matter	NDF	ADF	Crude Protein	Fat	Ca	P	Mg	Fe	Vit. A RE	Vit. E α-TE	Vit. C
1.6	115	11.2	10.2	6.8	4	0.36	0.29	0.12	0.004	9170	5.5	0.02

Sweet potato *Ipomoea batatas*

32 gram sugar

Energy MJ	Dry Matter	NDF	ADF	Crude Protein	Fat	Ca	P	Mg	Fe	Vit. A RE	Vit. E α-TE	Vit. C
3.0	197	39.4	9.7	8.3	11	0.45	0.47	0.15	0.009	3730	-	0.26

Celery *Apium graveolens*

14 gram sugar

Energy MJ	Dry Matter	NDF	ADF	Crude Protein	Fat	Ca	P	Mg	Fe	Vit. A RE	Vit. E α-TE	Vit. C
0.9	71	11.1	8.9	12.2	2.1	0.57	0.3	0.08	0.004	14.2	2	0.2

Spinach *Spinacia oleracea*

1 gram sugar

Energy MJ	Dry Matter	NDF	ADF	Crude Protein	Fat	Ca	P	Mg	Fe	Vit. A RE	Vit. E α-TE	Vit. C
1.1	83	16.7	9.7	32.1	6.6	1.29	0.41	0.26	0.05	3490	29	0.52

Endive *Cichorium endivia*

0 gram sugar

Energy MJ	Dry Matter	NDF	ADF	Crude Protein	Fat	Ca	P	Mg	Fe	Vit. A RE	Vit. E α-TE	Vit. C
0.6	62	11	8.9	13	2	0.52	0.28	0.15	0.008	1030	-	0.07

Photos and design, Emile Prins, 2012.
Information used from Danish Food Composition Table and Schmidt *et al.*, (2005).

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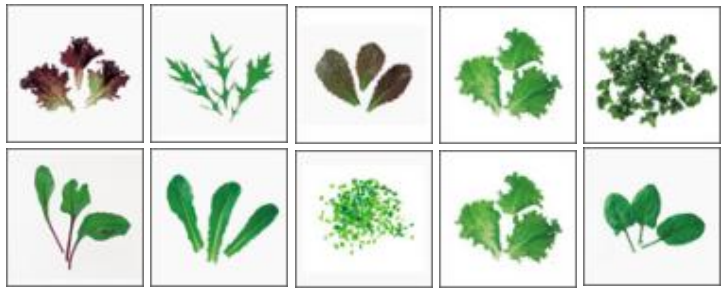
Calcium-Versorgung

Obst, buntes Gemüse, Getreide – enthalten sehr wenig Calcium

… und erhältliche / verfügbare Futtermittel



… und erhältliche / verfügbare Futtermittel

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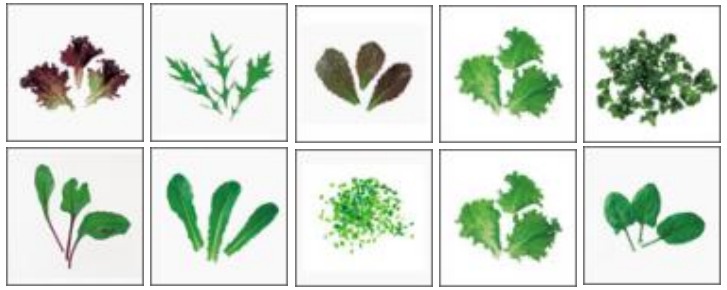

‘Bunte Mischungen’

‘Bunte Mischungen’

Konzept:
besser und schlechter geeignete Bestandteile mischen
wegen hoher Akzeptanz (durch Tier und BesitzerInnen)
und hinsichtlich fehlender Nährstoffe ausbalancieren

Beurteilung von Mischfutter

Beurteilung von Mischfutter

Protein 17.5 %

Beurteilung von Mischfutter

Protein	17.5 %
Rohfaser	8.5 %

Beurteilung von Mischfutter

Protein	17.5 %
Rohfaser	8.5 %
Rohasche	10.0 %

Beurteilung von Mischfutter

Protein	17.5 %
Rohfaser	8.5 %
Rohasche	10.0 %
Rohfett	2.5 %

Beurteilung von Mischfutter

Protein	17.5 %
Rohfaser	8.5 %
Rohasche	10.0 %
Rohfett	2.5 %
Feuchte	10.0 %

Beurteilung von Mischfutter

Protein	17.5 %
Rohfaser	8.5 %
Rohasche	10.0 %
Rohfett	2.5 %
Feuchte	10.0 %
---	---
Total	48.5 %

Beurteilung von Mischfutter

Protein	17.5 %
Rohfaser	8.5 %
Rohasche	10.0 %
Rohfett	2.5 %
Feuchte	10.0 %
---	---
Total	48.5 %

Was sind die anderen 51.5 %?

Beurteilung von Mischfutter

Protein	17.5 %
Rohfaser	8.5 %
Rohasche	10.0 %
Rohfett	2.5 %
Feuchte	10.0 %
---	---
Total	48.5 %

Was sind die anderen 51.5 %?

“Stärke & Zucker” /
“lösliche Faser”

Beurteilung von Mischfutter

Protein	17.5 %
Rohfaser	8.5 %
Rohasche	10.0 %
Rohfett	2.5 %
Feuchte	10.0 %
---	---
Total	48.5 %
N-freie Extraktstoffe (NfE)	51.5 %

"Stärke & Zucker" /
"lösliche Faser"

Prinzip bunte Mischung

Prinzip bunte Mischung

verschiedene Bestandteile mit hoher Energiedichte (hohe Akzeptanz) mit unterschiedlicher Farbe und Form

Prinzip bunte Mischung

mit Mineralstoffen angereicherte Bestandteile zum Ausbalancieren der gesamten Mischung

verschiedene Bestandteile mit hoher Energiedichte (hohe Akzeptanz) mit unterschiedlicher Farbe und Form

Prinzip bunte Mischung

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verschiedene Bestandteile mit hoher Energiedichte (hohe Akzeptanz) mit unterschiedlicher Farbe und Form

Prinzip bunte Mischung

mit Mineralstoffen angereicherte Bestandteile zum Ausbalancieren der gesamten Mischung

verschiedene Bestandteile mit hoher Energiedichte (hohe Akzeptanz) mit unterschiedlicher Farbe und Form

stenglige Bestandteile für Fasergehalt und ‘natürliches Aussehen’

500 g Art-Nr.: 07045
1,5 kg Art-Nr.: 07240

Grüne Küche Meerschweinchen

Mischfuttermittel zur Verwendung als Hauptfutter. Zusammensetzung: Heu Quad-Bits (Wiesengräser wie Lieschgras, Knaulgras, Spitzwegerich, Rotklee, Wiesenschwingel, Wiesenrispe), Kräuter Quad-Bits (Wiesenheu, Kamille, Thymian, Brennnessel, Kümmel, Schafgarbe), Topinambur, Löwenzahn, Brennnessel, Karotten, Fenchel, Spitzwegerich, Pastinaken; Inhaltsstoffe: Rohprotein 10,2%, Rohfett 4,5%, Rohfaser 24,4%, Rohasche 7,8%;

Green Cuisine guinea pigs

Mixed feed for use as main food. Ingredients: hay Quad-Bits (meadow grass and plants as timothy, cocksfoot, ribwort, red clover, meadow fescue, smooth meadow grass), herb Quad-Bits (meadow hay, chamomile, thyme, nettle, caraway, yarrow), Jerusalem artichoke, dandelion, nettle, carrots, fennel, ribwort, parsnips; Content: crude protein: 10.2%, crude fat 4.5%, crude fibre 24.4%, crude ash 7.8%;

500 g Art-Nr.: 07045
1,5 kg Art-Nr.: 07240

Grüne Küche Meerschweinchen

Mischfuttermittel zur Verwendung als Hauptfutter. Zusammensetzung: Heu Quad-Bits (Wiesengräser wie Lieschgras, Knaulgras, Spitzwegerich, Rotklee, Wiesenschwingel, Wiesenrispe), Kräuter Quad-Bits (Wiesenheu, Kamille, Thymian, Brennnessel, Kümmel, Schafgarbe), Topinambur, Löwenzahn, Brennnessel, Karotten, Fenchel, Spitzwegerich, Pastinaken; Inhaltsstoffe: Rohprotein 10,2%, Rohfett 4,5%, Rohfaser 24,4%, Rohasche 7,8%;

Green Cuisine guinea pigs

Mixed feed for use as main food. Ingredients: hay Quad-Bits (meadow gra timothy, cocksfoot, ribwort, red clover, meadow fescue, hay, chamomile, thyme, nettle, caraway, yarrow), rib-wort, parsnips; Content: crude protein: 1

NfE = 100-10-10.2-4.5-24.4-7.8

= 43.1 %

Wellness-Food für Meerschweinchen

JR FARM Wellness-Food für Meerschweinchen - das Wohlfühlfutter mit 4 % Reis, ohne künstliche Farbstoffe. Über 20 verschiedene Einzelkomponenten, darunter ausgesuchte Kräuter wie Brennnessel und Pfefferminze, wertvoller Koriander und reine Spirulina-Algen, machen diese leicht verdauliche Vollwertmischung zum Geschmackserlebnis für alle Meerschweinchen. Wellness pur mit extra Vitamin C und nur 2,6% Fett!

Mischfuttermittel zur Verwendung als Hauptfutter für Meerschweinchen. Zusammensetzung: Pflanzliche Nebenerzeugnisse, Getreide, Gemüse (3% Koriander), Früchte, Algen (0,25% reine Spirulina), pflanzliche Eiweißextrakte, Mineralstoffe; Inhaltsstoffe: Rohprotein: 12,7%, Rohfett: 2,6%, Rohfaser: 10,2%, Rohasche: 3,8%; Zusatzstoffe/kg: Vit. A 20.000 i.E., Vit. C 200mg, Vit. D3 2.000 i.E., Vit. E 200mg

600g
Art-Nr.: 04797

Wellness-Food for guinea pigs

JR FARM Wellness-Food for guinea pigs – the goodness food with 4% rice and no artificial colouring. Over 20 different individual ingredients, including select herbs such as stinging nettle and peppermint, coriander and pure Spirulina, make this easily digestible Super-Premium complete mix the ultimate taste experience for all guinea pigs. Wellness pure with lots of added Vitamin C and only 2.6% fat!

Mixed feed to be used as main food for guinea pigs. Ingredients: derivatives of vegetable origin, cereals, vegetables (3% coriander), fruits, algae (0.25% Spirulina), vegetable protein extracts, minerals; Content: crude protein 12.7%, crude fat 2.6%, crude fibre 10.2%, crude ash 3.8%; Additives/kg: Vit. A 20,000 UI., Vit. D3 2,000 UI., Vit. E 200 mg (alpha-tocopherol acetate), Vit. C 200mg

Wellness-Food für Meerschweinchen

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NfE = 100-10-12.7-2.6-10.2-3.8

= 60.7 %

‘Abwechslung’

Ausgewogene oder abwechslungsreiche Ernährung?

Ausgewogen: alle Nährstoffe im richtigen Verhältnis

Abwechslung: im Idealfall verschiedene Futtermittel, die aber alle - jedes für sich - die Nährstoffe im richtigen Verhältnis enthalten

Ausgewogene oder abwechslungsreiche Ernährung?

Achtung:

Der „Beschäftigungswert“ bzw. der Zugewinn an „Wohlergehen“ für das Tier von einer „abwechslungsreichen“ Ernährung ist meines Wissens nicht untersucht, geschweige belegt.
Viel wichtiger sind Nährstoff-Gehalte (Energiedichte), Darreichungsform, Darreichungs-Zeitpunkt, Darreichungs-Häufigkeit, Gehege-Gestaltung.

Die Annahme eines Mehrwerts aufgrund unterschiedlicher Geschmäcker und optischer Eindrücke ist zunächst einmal eine menschliche Sichtweise.

Abwechslungsreiche Ernährung ...

Abwechslungsreiche Ernährung ...

Samuel Clauss (2005) Int J Desper Parents Res 1: 2-7

Abwechslungsreiche Ernährung ...

- unterschiedliche Farbe!
- unterschiedliche Form!
- unterschiedliche Konsistenz!
- unterschiedlicher Geschmack!
- unterschiedliche Verpackung!
- unterschiedlicher Preis!

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Zucker

Samuel Clauss (2005) Int J Desper Parents Res 1: 2-7

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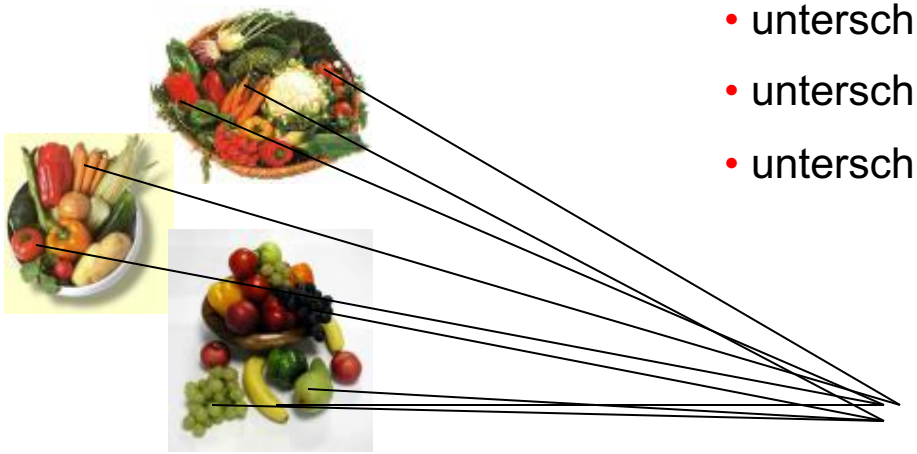

Zucker

Abwechslungsreiche Ernährung ...

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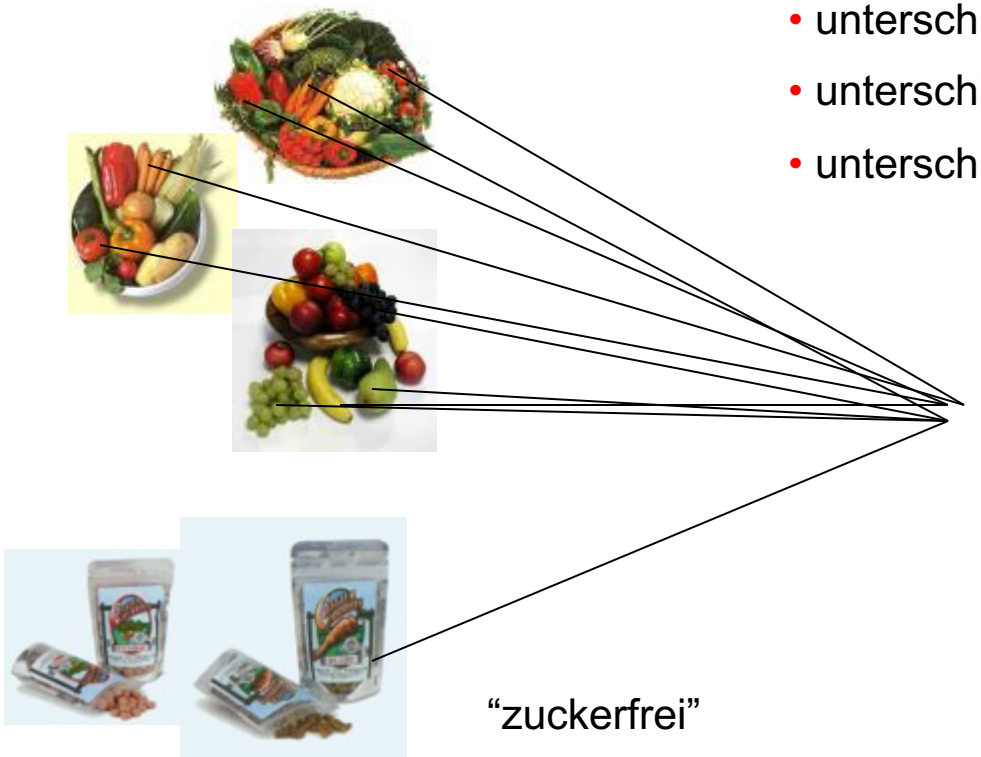
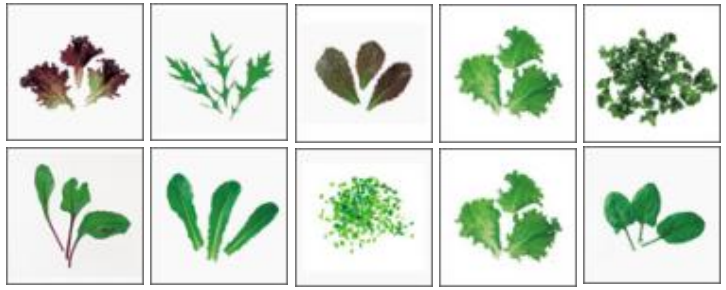


Zucker

“zuckerfrei”

Adäquate Abwechslung für Pflanzenfresser ist möglich !

(es sieht halt nur grün aus)



University of Zurich[UZH]

Clinic for Zoo Animals, Exotic Pets and Wildlife

Futtermischungen: ein generelles Problem

Ausgewogene Ernährung ...?

Ausgewogene Ernährung ...?

=

Calcium deficiency, diet and dental disease in pet rabbits

F. M. Harcourt-Brown

Veterinary Record (1996) **139,** 567-571

Calcium deficiency, diet and dental disease in pet rabbits

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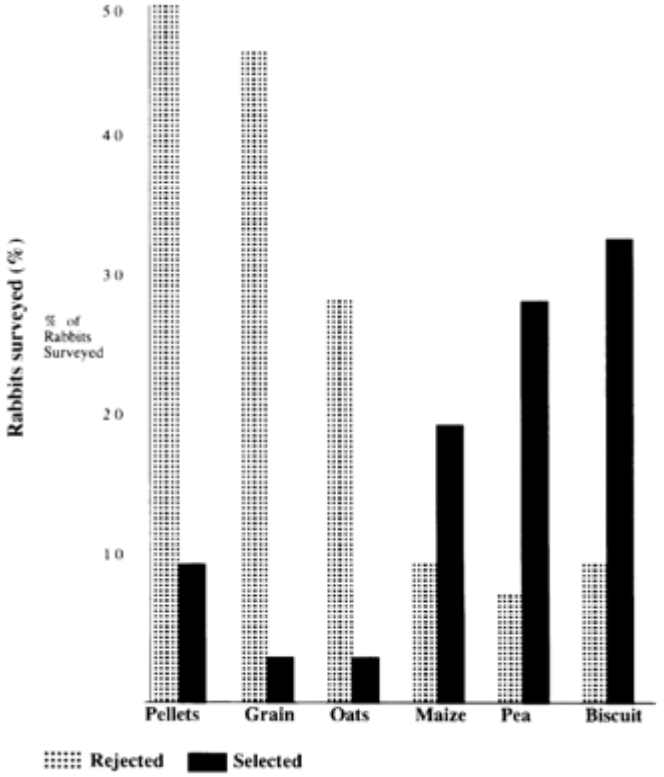


FIG 5: Results of owner questionnaire: food preferences of pet rabbits

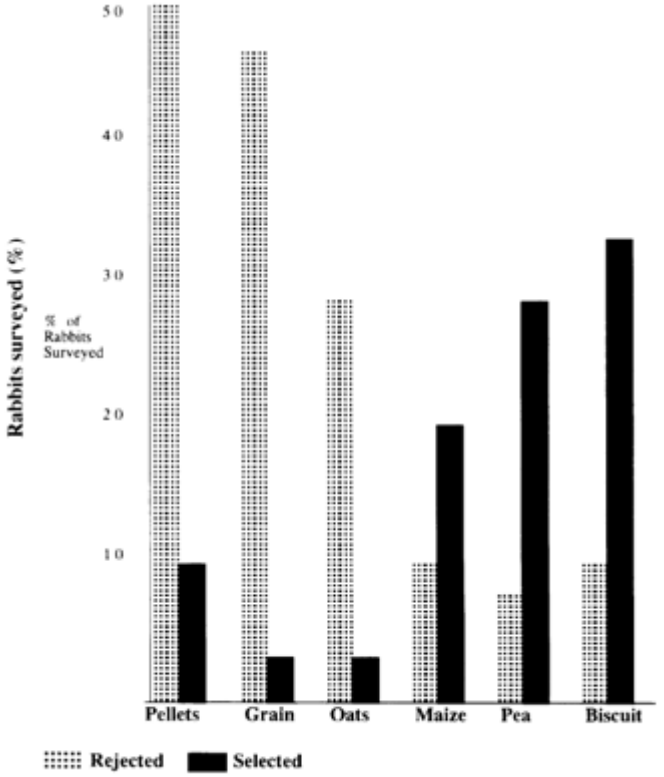
Calcium deficiency, diet and dental disease in pet rabbits

F. M. Harcourt-Brown

Veterinary Record (1996) **139,** 567-571

TABLE 1: Mean calcium (Ca) and phosphorus (P) contents (%) of three rabbit foods

Sample		Food A	Food A (no pellets or grain)
1	Ca	0·70	
	P	0·35	
2	Ca	0·63	
	P	0·41	
3	Ca	0·65	
	P	0·41	



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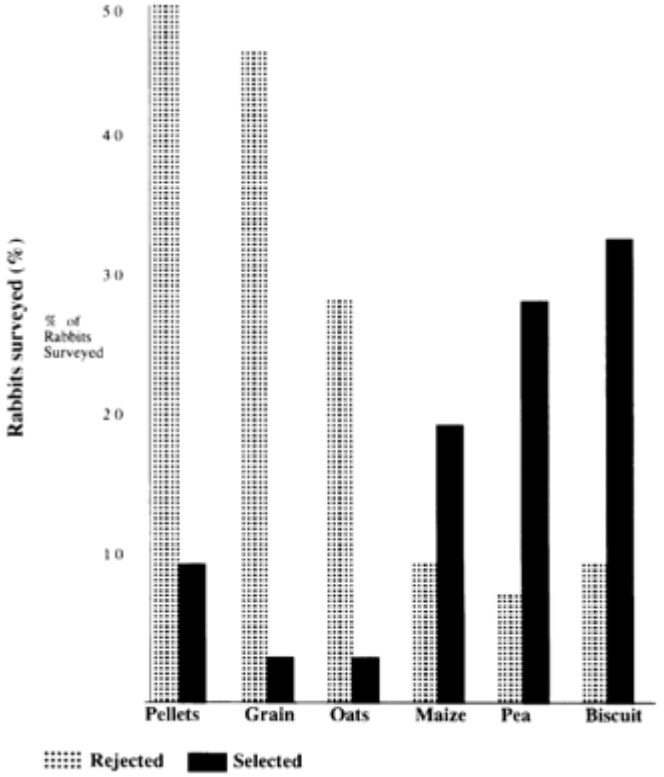
	P	0·35	**0·28**
2	Ca	0·63	**0·28***
	P	0·41	**0·34**
3	Ca	0·65	0·39*
	P	0·41	0·29



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Sample		Food A	Food A (no pellets or grain)	Food B	Food B (no pellets or grain)
1	Ca	0·70	**0·26***	0·56	
	P	0·35	**0·28**	0·39	
2	Ca	0·63	**0·28***	0·51	
	P	0·41	**0·34**	0·39	
3	Ca	0·65	0·39*	0·49	
	P	0·41	0·29	0·39	

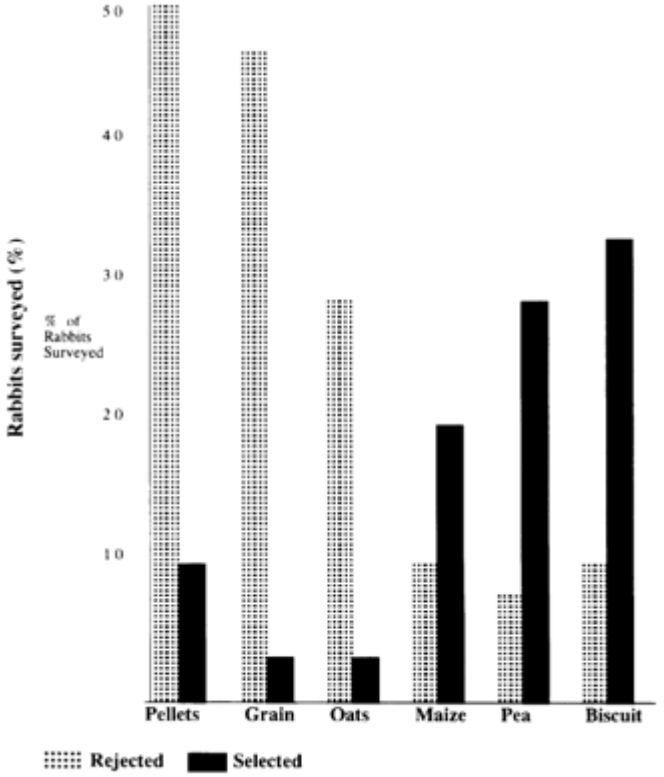

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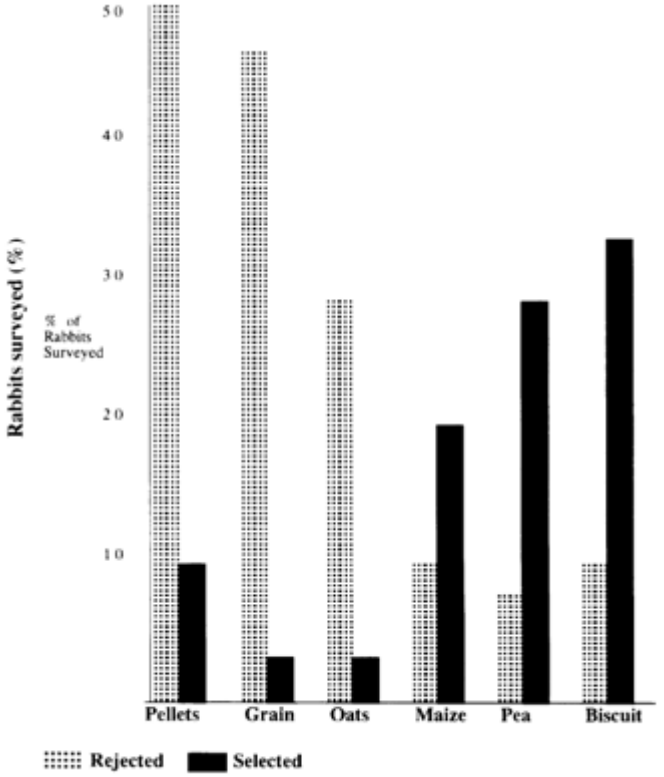
TABLE 1: Mean calcium (Ca) and phosphorus (P) contents (%) of three rabbit foods

Sample		Food A	Food A (no pellets or grain)	Food B	Food B (no pellets or grain)
1	Ca	0·70	**0·26***	0·56	0·46
	P	0·35	**0·28**	0·39	0·30
2	Ca	0·63	**0·28***	0·51	0·38
	P	0·41	**0·34**	0·39	0·32
3	Ca	0·65	0·39*	0·49	0·48
	P	0·41	0·29	0·39	0·32



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Calcium deficiency, diet and dental disease in pet rabbits

F. M. Harcourt-Brown

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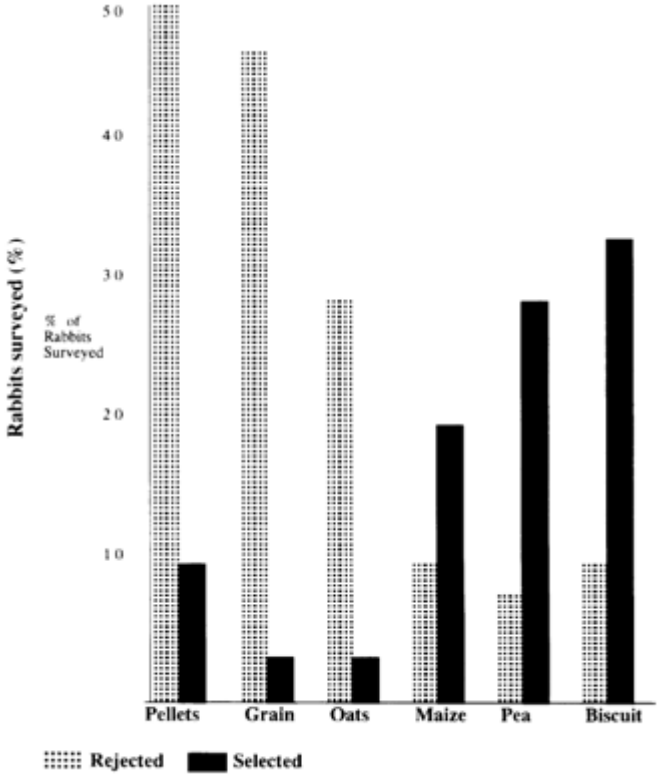
TABLE 1: Mean calcium (Ca) and phosphorus (P) contents (%) of three rabbit foods

Sample		Food A	Food A (no pellets or grain)	Food B	Food B (no pellets or grain)	Food C	Food C (no pellets or grain)
1	Ca	0·70	**0·26***	0·56	0·46	0·79	
	P	0·35	**0·28**	0·39	0·30	0·32	
2	Ca	0·63	**0·28***	0·51	0·38	0·87	
	P	0·41	**0·34**	0·39	0·32	0·36	
3	Ca	0·65	0·39*	0·49	0·48	0·98	
	P	0·41	0·29	0·39	0·32	0·36	



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F. M. Harcourt-Brown

Veterinary Record (1996) **139,** 567-571

TABLE 1: Mean calcium (Ca) and phosphorus (P) contents (%) of three rabbit foods

Sample		Food A	Food A (no pellets or grain)	Food B	Food B (no pellets or grain)	Food C	Food C (no pellets or grain)
1	Ca	0·70	**0·26***	0·56	0·46	0·79	**0·16†**
	P	0·35	**0·28**	0·39	0·30	0·32	**0·26**
2	Ca	0·63	**0·28***	0·51	0·38	0·87	**0·11†**
	P	0·41	**0·34**	0·39	0·32	0·36	**0·27**
3	Ca	0·65	0·39*	0·49	0·48	0·98	**0·14†**
	P	0·41	0·29	0·39	0·32	0·36	**0·29**

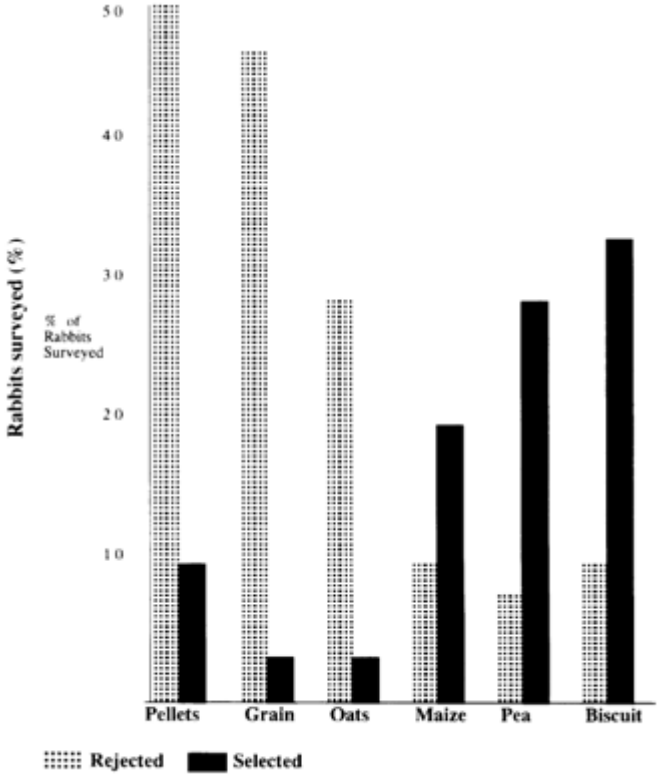

FIG 5: Results of owner questionnaire: food preferences of pet rabbits

Survey of the husbandry, health and welfare of 102 pet rabbits

S. M. Mullan, D. C. J. Main

Veterinary Record (2006)
159, 103-109

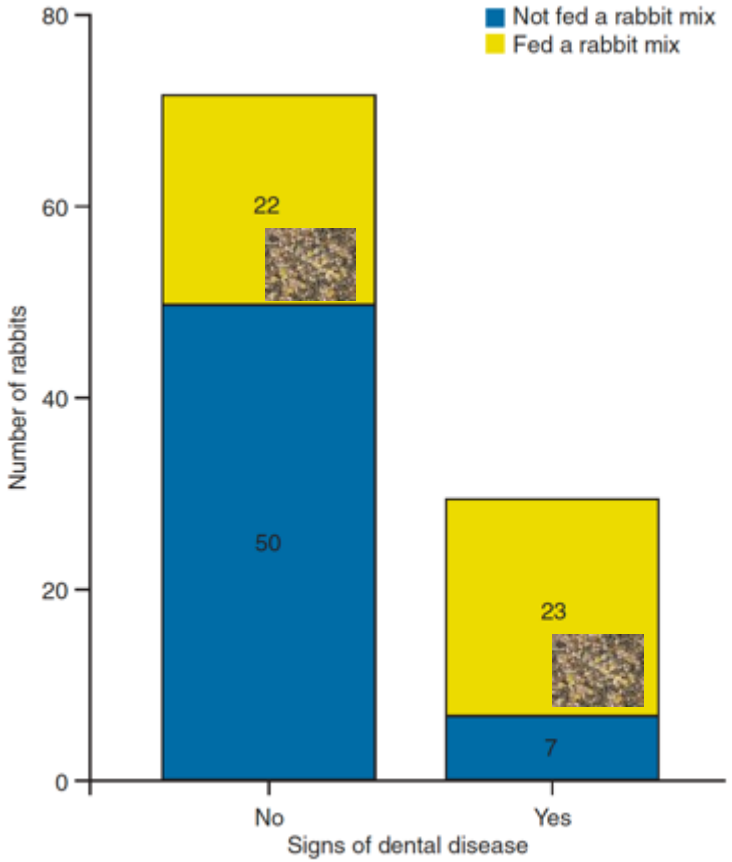

FIG 3: Association between the prevalence of dental disease in the 102 rabbits and feeding a rabbit mix

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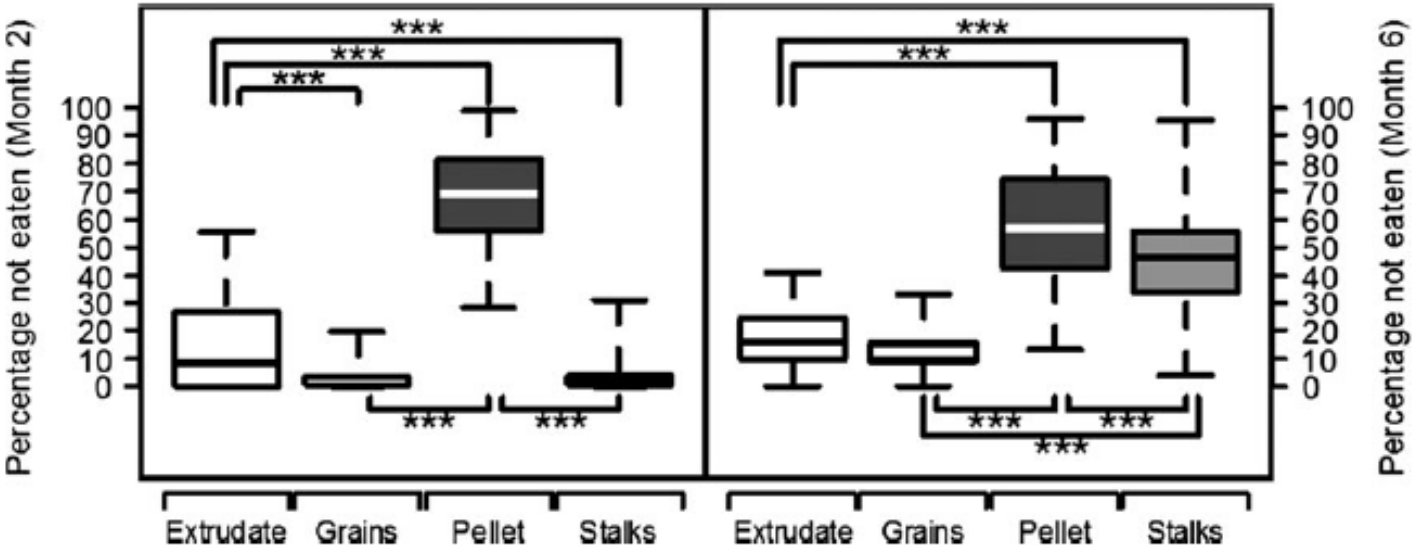
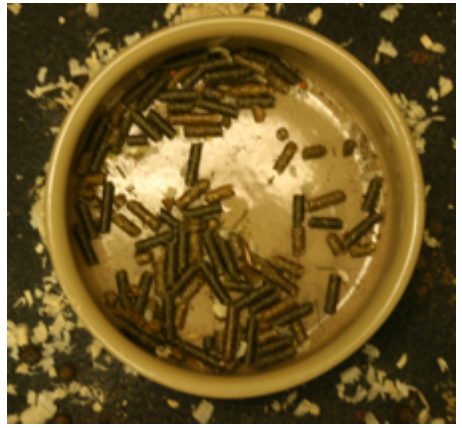




Ausgewogene Ernährung !

Ausgewogene Ernährung !

KLIBA NAFAG

3410

Kaninchen und Meerschweinchen
Lapin et cobaye
Rabbit and guinea pig

Haltung
Entretien
Maintenance

Inhaltsstoffe | Substances | Major Nutrients

Trockensubstanz | Matière sèche | Dry matter	89.0 %
Rohprotein | Protéines brutes | Crude protein	13.5 %
Rohfett | Graisses brutes | Crude fat	3.5 %
Rohfaser | Fibres brutes | Crude fiber	16.6 %
Rohasche | Cendres brutes | Crude ash	7.4 %
NfE | ENA | NFE	48.0 %
Bruttoenergie | Energie brute | Gross energy	15.6 MJ/kg
Umsetzbare Energie | Energie métabolisable | Metabol. energy	8.8 MJ/kg
Stärke | Amidon | Starch	18.0 %

Aminosäuren | Acides aminés | Amino acids

Arginin | Arginine | Arginine	0.66 %
Lysin | Lysine | Lysine	0.88 %
Methionin | Méthionine | Methionine	0.33 %
Methionin + Cystin | Méthionine + cystine | Methionine + cystine	0.56 %
Tryptophan | Tryptophane | Tryptophan	0.20 %
Threonin | Thréonine | Threonine	0.62 %

Mengenelemente | Macro-éléments | Major mineral elements

Calcium| Calcium | Calcium	0.80 %
Phosphor | Phosphore | Phosphorus	0.54 %
Magnesium | Magnésium | Magnesium	0.18 %
Natrium | Sodium | Sodium	0.31 %
Kalium | Potassium | Potassium	0.90 %
Chlor | Chlore | Chlorine	0.45 %

Spurenelemente | Oligo-éléments | Trace elements

Eisen | Fer| Iron	452 mg/kg
Zink | Zinc | Zinc	58 mg/kg
Kupfer | Cuivre | Copper	17 mg/kg
Jod | Iode | Iodine	1.2 mg/kg
Mangan | Manganèse | Manganese	70 mg/kg
Selen | Sélénium | Selenium	0.36 mg/kg

Vitamine | Vitamines | Vitamins

Vitamin A | Vitamine A | Vitamin A	17'000 IE|UI|IU/kg
Vitamin D_3 | Vitamine D_3 | Vitamin D_3	1000 IE|UI|IU/kg
Vitamin E | Vitamine E | Vitamin E	190 mg/kg
Vitamin K_3 | Vitamine K_3 | Vitamin K_3	4 mg/kg
Vitamin B_1 | Vitamine B_1 | Vitamin B_1	21 mg/kg
Vitamin B_2 | Vitamine B_2 | Vitamin B_2	12 mg/kg
Vitamin B_6 | Vitamine B_6 | Vitamin B_6	11 mg/kg
Vitamin B_{12} | Vitamine B_{12} | Vitamin B_{12}	0.04 mg/kg
Nicotinsäure | Acide nicotinique | Nicotinic acid	57 mg/kg
Pantothensäure | Acide pantothénique | Pantothenic acid	35 mg/kg
Folsäure | Acide folique | Folic acid	6 mg/kg
Biotin | Biotine | Biotin	0.2 mg/kg
Cholin | Choline | Choline	2'000 mg/kg
Vitamin C | Vitamine C | Vitamin C	500 mg/kg

Rohstoffe | Ingrédients | Ingredients

Pflanzliche Nebenprodukte, Getreide, pflanzliche Eiweissextrakte, Mineralstoffe, Öle und Fette

Sous-produits d'origine végétale, céréales, extraits de protéines végétales, substances minérales, huiles et graisses

Vegetable byproducts, cereals, vegetable protein extracts, mineral nutrients, oils and fats

Bemerkungen | Remarques | Remarks

- Alleinfuttermittel für Kaninchen und Meerschweinchen
- Angegebene Gehalte sind berechnete Mittelwerte bezogen auf lufttrockene Substanz
- Aliment complet pour lapins et cobayes
- Les teneurs indiquées sont des valeurs moyennes se rapportant à la matière séchée à l'air
- Complete food for rabbits and guinea pigs
- Given values are calculated averages in air-dry feed

Bestellform | Conditionnements | Delivery form

Pellets 4.5 mm rund | Pellets ronds 4.5 mm | Pellets 4.5 mm round

3410.PS.S15:
15 kg in Papiersäcken
15 kg en sacs en papier
15 kg in paper bags

04/2020

KLIBA NAFAG | GRANOVIT AG | CH-4303 Kaiseraugst | Tel. +41 61 816 16 16 | Fax +41 61 816 18 00 | www.kliba-nafag.ch

(Beispiel)

Ausgewogene Ernährung !

Fütterungspraxis

Wie werden Kaninchen (und andere Heimsäuger) in der Praxis gefüttert?

Zucht- und Mastkaninchen

Zucht:	**Rfa**	**NDF**	**RP**
Marke	**% TS**	**% TS**	**% TS**
Hasfit	18	41	18
onOvo	13	34	18
Provimi Kliba	15	37	17
UFA	16	38	17
alle Marken:	15	38	17

Mast:	**Rfa**	**NDF**	**RP**
Marke	**% TS**	**% TS**	**% TS**
Hasfit	15	37	17
onOvo	15	37	17
Provimi Kliba	16	39	16
UFA	15	37	16
alle Marken:	15	38	16

Wildkaninchen:

	Rfa	**NDF**	**RP**
Region	**% TS**	**% TS**	**% TS**
Holland*	28.6	58.8	20.0
Mitteleuropa°:			
Frühling:	25.0	53.1	19.5
Sommer:	30.0	61.0	12.5

*Wallage-Drees & Deinum, 1986
° :Thomson & King, 1994

Heimkaninchen

Entwicklung von Heimtierfutter:

		Rfa % TS	NDF % TS	RP % TS
Eric Schweizer AG:	**Erscheinungsjahr°**			
Kaninchenfutter (Standard)	1982	8	26	13
Kaninchenwürfel 4mm (Pressfutter)	1987	10	29	17
Supreme Qualitätsmischung	2000	14	36	14
New Generation (Extrudat)	2006	21	47	16
Vitakraft AG:				
Menü Thymian (Mischfutter)	ca.1980	10	29	11
VITA Special Regular (Pressfutter)	2000	16	38	14
Emotion Beauty (Extrudat,Gemüse,Pellets)	2007	14	35	14
Emotion Sensitive (Extrudat,Gemüse,Pellets)		17	40	14

	Rfa % TS	NDF % TS	RP % TS
Durchschnittswerte von Rfa, NDF und RP in zehn aktuellen Futtermitteln*:	15	37	14

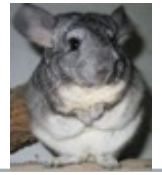
° gemäss Schätzung der Herstellerfirma

*: Activia Natur Pur; Bunny Grüner Traum; Cuni Nature; JR Farm Premium; MUCKI Menü plus; NatureSelect Kanin Müsli Menü; PreAlpin Lepo Bits; Tima Premium Müsli;Vitakraft Emotion Beauty; Witte Molen classic

Wildkaninchen:

Region	Rfa % TS	NDF % TS	RP % TS
Holland*	28.6	58.8	20.0
Mitteleuropa°:			
Frühling:	25.0	53.1	19.5
Sommer:	30.0	61.0	12.5

*Wallage-Drees & Deinum, 1986
° :Thomson & King, 1994



Chinchillas

Futter	Marke	RF	NDF	RP
"Chinchilla-Pellets"	JR Farm	14.5	37	18
"Qualitäts-Mischung für Chinchilla“	Schweizer	16	39	16
"Emotion Beauty Chinchilla"	Vitakraft	18	42	12
"Chinchilla Deluxe"	Oxbow Company	18-23	42-50	min. 16
"KnabberHügel Kräuter"	Bunny	21	47	14.5

Angaben in % TS

⇨ natürliche NDF Aufnahme: 41%

Degus

Futter	Marke	RF	NDF	RP
"Selective Degu"	Schweizer	10	29	16
"Degu-Spezial"	JR Farm	14.1	36	13.8
"Emotion Beauty Degu"	Vitakraft	15.5	38	13.5

Angaben in % TS

⇨ natürliche NDF Aufnahme: Sommer: 61%; Winter 37%

Meerschweinchen

Futter	Marke	RF	NDF	RP
"Meerschweinchenfutter"	Coop	6.5	24	12.5
"Meerschweinchenfutter"	Schweizer	8.2	27	12.7
“Premium compete mix"	Vitobel	9.5	29	12
"Meerschweinchenfutter Classic"	JR Farm	11.4	32	10.9
"Selective Guinea Pig"	Schweizer	15	37	16
"Vita Special Meerschweinchen Regular"	Vitakraft	15.5	38	13
"Schlemmerwiese basis"	Bunny	20	45	14.5
"Cavy Cuisine"	Oxbow Company	max. 28	58	mind. 14

Angaben in % TS

⇨ natürliche NDF Aufnahme: Lolium: 53%; Cynodon: 55%

Meerschweinchen

Marke: Schweizer AG

Futter	RF	NDF	RP
"Nager-Supermischung"	6.1	23	10.8
"Meerschweinchenfutter"	8.2	27	12.7
"Meerschweinchenfutter Super"	8.2	27	12.8
"Qualitäts-Mischung für M."	10	29	15
"Gerty Guinea Pic Original"	10	29	15
"Selective Guinea Pig"	15	37	16
"Natur"	16.2	39	16.1
"New Generation für M."	19.4	44	15.7

Alle Angaben in % TS

Marke: Vitakraft AG

Futter	RF	NDF	RP
"Life Meerschweinchen"	10	29	12
"Emotion Beauty Meerschweinchen"	13.5	35	14
"Emotion Longhair Meerschweinchen"	15	37	14.5
"Vita Special Meerschweinchen Regular"	15.5	38	13
"Emotion Balance MS"	16	39	14.5
"Vita Special Meerschweinchen Best Age"	16.5	40	13


JR FARM
Spitzwegerich


JR FARM
Petersilienstiele


JR FARM
Löwenzahn-Wiese

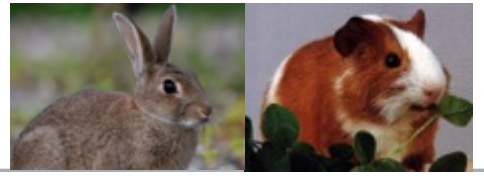

JR FARM
Spitzwegerich


Grainless
Mix
Alleinfutter für Meerschweinchen


JR FARM
Petersilienstiele


Grainless
Complete
Alleinfutter für Meerschweinchen


JR FARM
Löwenzahn-Wiese




JR FARM
Spitzwegerich


Grainless
Mix
Alleinfutter für Meerschweinchen


JR FARM
Petersilienstiele


Grainless
Complete
Alleinfutter für Meerschweinchen


JR FARM
Löwenzahn-Wiese


AROMA PACK
OPTIMAL FRESHNESS
VERSELE-LAGA
Cuni
Nature
RE-BALANCE
No Grains
SENSITIVE CONTROL
Light Formula
DIET CONTROL
Anti Hairball
DIGEST CONTROL
ODOUR CONTROL
NO PELLETS
ORYCTOLAGUS CUNICULUS


JR FARM
Spitzwegerich


JR FARM
Petersilienstiele


JR FARM
Löwenzahn-Wiese


Grainless
Mix
Alleinfutter für Meerschweinchen


Grainless
Complete
Alleinfutter für Meerschweinchen


JR FARM
Super-Nagerfutter


JR FARM
Spitzwegerich


Grainless
Mix
Alleinfutter für Meerschweinchen


Karottenflocken


JR FARM
Petersilienstiele

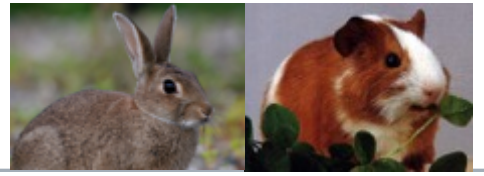

JR FARM
Super-Nagerfutter


JR FARM
Bananen-Chips


JR FARM
Löwenzahn-Wiese


Grainless
Complete
Alleinfutter für Meerschweinchen


JR FARM
Obst-Salat




JR FARM
Spitzwegerich


JR FARM
Petersilienstiele


JR FARM
Löwenzahn-Wiese


Grainless
Mix
Alleinfutter für Meerschweinchen


Grainless
Complete
Alleinfutter für Meerschweinchen


JR FARM
Super-Nagerfutter

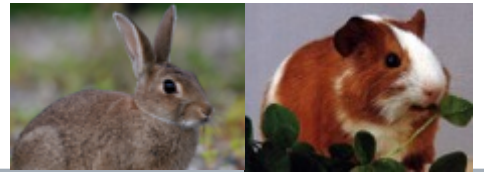

JR FARM
Karottenflocken


JR FARM
Bananen-Chips


JR FARM
Obst-Salat


JR FARM
Drops gemischt


JR FARM




4 Sorten
mit Joghurt, Gemüse, Waldfrucht, Honig
PERFECTO
NAGER
zur Belohnung & als Zwischenmahlzeit
Joghurt-Drops
Gemüse-Drops
Waldfrucht-Drops
Honig-Drops
Leckerer Nager Drops - Mix

Trends im Heimtierbereich - Entwicklung von Misch-/Alleinfutter

- Tendenz zur Entwicklung von Mischfuttern oder Pellets mit erhöhtem Rohfasergehalt ohne Getreide
- Schwerpunkt in der Entwicklung: Extrudate und Pellets:

  ⇨ Selektion von zu stärke- und fetthaltigen Bestandteilen (Getreide/Samen) in konventionellen Mischfuttern verunmöglicht
- In den neueren Futtermitteln v.a. Extrudate: Alle Bestandteile mit gleicher Zusammensetzung, für den Halter aber aufgrund der verschiedenen Farben und Formen visuell ansprechender als Pellets

aber: Rohfaser früher	Rohfaser heute	Rohfaser Freiland
8-10 % TS	17-20 % TS	30 % TS

⇨ unbedingt Heu füttern und Mischfutter limitieren, um den Rohfasergehalt zu erhöhen

Ziervögel – ähnliche Entwicklungen

Ziervögel – Körnermischungen

Ziervogel-Futter: reine Samen-Mischungen

Ziervogel-Futter: reine Samen-Mischungen

Tab. VI.11.3: **Einfluss des Schälens/ Entspelzens auf die Energie- und Nährstoffaufnahme**

Nährstoff	Lokalisation	Nährstoffgehalte	Aufnahme über „Kerne"
Rp	Kern	+++	↑
Rfe			
Stärke[1]			
Energie			
P			
Rfa	Schale	+++	↓
Ca			
Na			

[1] Stärkereiche Saaten/Samen.

Ziervogel-Futter: reine Samen-Mischungen

<u>Stärkereiche Samen</u>

Hirse
Mais
Glanz
Hafer
Buchweizen

Ziervogel-Futter: reine Samen-Mischungen

Stärkereiche Samen

Hirse
Mais
Glanz
Hafer
Buchweizen

Fettreiche Samen

Erdnuss
Sonnenblumenkerne
Kürbiskerne
Nüsse
Hanf

Ziervogel-Futter: reine Samen-Mischungen

Stärkereiche Samen

Hirse
Mais
Glanz
Hafer
Buchweizen

Fettreiche Samen

Erdnuss
Sonnenblumenkerne
Kürbiskerne
Nüsse
Hanf

Defizit in Calcium

Ziervogel-Futter: reine Samen-Mischungen

Stärkereiche Samen

Hirse
Mais
Glanz
Hafer
Buchweizen

Fettreiche Samen

Erdnuss
Sonnenblumenkerne
Kürbiskerne
Nüsse
Hanf

Defizit in Calcium

Ziervogel-Futter: reine Samen-Mischungen

Stärkereiche Samen

Hirse
Mais
Glanz
Hafer
Buchweizen

Fettreiche Samen

Erdnuss
Sonnenblumenkerne
Kürbiskerne
Nüsse
Hanf

Defizit in Calcium, Defizit in Carotin / Vitamin A

Carotin in Sämereien

	ß-Carotin µg/g TS	~ Vitamin A IE/kg TS
Sonnenblumensaat	< 0.1	< 167
Kardi	< 0.1	< 167
Erdnuss	< 0.1	< 167
Hafer	< 0.1	< 167
Kürbissaat	0.1	167
Hanfsaat	0.22	367
Maiskorn	1.33	1884

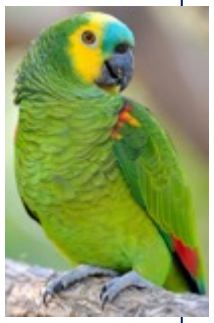
Bedarf geschätzt als 6000-8000 IE/kg TS

Ziervogel-Futter: reine Samen-Mischungen

Journal of Avian Medicine and Surgery 26(3):149–160, 2012

Nutritional Levels of Diets Fed to Captive Amazon Parrots: Does Mixing Seed, Produce, and Pellets Provide a Healthy Diet?

Donald J. Brightsmith, MS, PhD



Abstract: Poor nutrition is a serious problem in captive psittacine birds. Seed-based diets are known to contain excess fat, low calcium : phosphorus ratios, and other nutrient deficiencies, whereas many consider nutritionally superior, formulated diets to be monotonous. As a result, many bird owners feed a mixture of seed, produce, and formulated diet. However, the nutritional contents of such mixed diets have rarely been evaluated. In this study, we describe the nutrient contents of diets consumed by 7 adult (>6 years old), captive Amazon parrots offered produce (50% fresh weight), formulated diet (25%), and seed (25%). Diets consumed were deficient in calcium, sodium, and iron and contained more than the recommended amount of fat. In addition, the birds chose foods that exacerbated these imbalances. Birds offered low-seed diets (60% pellet, 22% produce, 18% seed, wet weight) consumed diets with more fat than recommended but acceptable levels of calcium and all other nutrients measured, as well as acceptable calcium : phosphorus ratios. This suggests that small quantities of seeds may not result in nutritionally imbalanced diets. Birds fed 75% formulated diet and 25% produce consumed diets within the recommendations for nearly all measured nutrients, demonstrating that owners of psittacine birds should be encouraged to supplement manufactured diets with low energy-density, fresh produce items to provide stimulation and foraging opportunities without fear of causing major nutritional imbalances.

Key words: nutrition, seed, formulated diet, produce, avian, Amazon parrot, *Amazona* species

Introduction

Inadequate nutrition and the diseases it causes remain serious problems in avian medicine.[1,2] The poor nutritional state of psittacine birds presenting to veterinary clinics is likely the result of several factors: a general lack of research on the nutritional requirements of captive parrots; insufficient knowledge, on the parts of both owners and veterinarians, of psittacine nutrition; a reluctance by owners to convert their birds to nutritionally superior diets; and the nutritional imbalances of many "mixed" diets.[3–6] Most recommendations for psittacine nutrition can be traced back to studies of domestic poultry supplemented by work on captive budgerigars (*Melopsittacus undulatus*) and cockatiels (*Nymphicus hollandicus*).[7–9] However, poultry and parrots are not closely related and differ both developmentally and ecologically. As a result, current diet recommendations are likely suboptimal for many captive parrots.

It is not just a lack of basic nutritional knowledge that is at the root of the psittacine nutritional-health problems. Many owners are apparently unaware of the basic principles of avian nutrition and continue to feed their large parrots seed-based diets.[4,10] This problem is exacerbated by the marketing of seed-based diets by bird food manufacturers claiming that such diets are complete, balanced, and healthy.[11,12] Relative to the nutritional needs of psittacine birds, seed-based diets contain excess fat, low calcium : phosphorus (Ca : P) ratios, and insufficient levels of calcium, phosphorus, sodium, zinc, iron, lysine, and vitamin A.[3,10,13] Nutritionally superior, formulated diets are widely available from many manufacturers. This suggests that educating

From the Schubot Exotic Bird Health Center, Department of Veterinary Pathobiology, College of Veterinary Medicine and Biomedical Sciences, Texas A&M University, 4467 TAMU, College Station, TX 77843, USA.

Diet components	Offered, g per 100 g of seed mix
Safflower seeds	27.3 ± 2.6
Sunflower seeds	23.4 ± 6.8
Buckwheat	23.0 ± 2.1
Oats	10.1 ± 1.8
Oat groats	8.6 ± 3.1
Squash seeds	4.0 ± 2.2
Other seeds[a]	1.5 ± 0.9
Refuse[b]	1.1 ± 0.6

Ziervogel-Futter: reine Samen-Mischungen

Journal of Avian Medicine and Surgery 26(3):149–160, 2012

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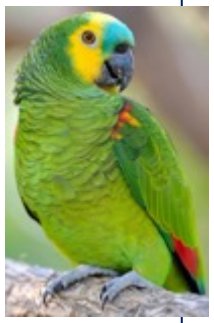

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Diet components	Offered, g per 100 g of seed mix	Consumed, %
Safflower seeds	27.3 ± 2.6	84 ± 19
Sunflower seeds	23.4 ± 6.8	98 ± 2
Buckwheat	23.0 ± 2.1	10 ± 18
Oats	10.1 ± 1.8	8 ± 13
Oat groats	8.6 ± 3.1	4 ± 11
Squash seeds	4.0 ± 2.2	80 ± 31
Other seeds[a]	1.5 ± 0.9	ND
Refuse[b]	1.1 ± 0.6	ND

Ziervogel-Futter: reine Samen-Mischungen

MINERAL INTAKE IN AFRICAN GREY PARROTS (*PSITTACUS E ERITHACUS*) FED A SEED MIXTURE OR EXTRUDED PELLETS *AD LIBITUM,* AND ITS EFFECTS ON EXCRETA CHARACTERISTICS.

Isabelle D. Kalmar[1]*
Guy Werquin[2]
Geert P.J. Janssens[1]

[1]Laboratory of Animal Nutrition, Faculty of Veterinary Medicine, Ghent University, 9820 Merelbeke; [2]Versele-Laga Ltd., 9800 Deinze, Belgium

Introduction

-seed diets encompass several nutritional constraints when fed to parrots. First, the part of seeds is strongly imbalanced in calcium to phosphorus (Ca:P) ratio and is nt in several essential amino acids and vitamins (Harrison, 1998). Next, seed mixtures h in energy and fat content, which is further increased by the typical feeding behavior ots. Data of Werquin *et al.* (2005) showed an average of 16.4 ± 0.9 MJ ME/kg and 6.3 % fat in commercial seed mixtures (n=30); the edible, dehulled fraction containing 2.9 MJ ME/kg and 31.7 ± 13.1 % fat. In comparison, diets for chickens for fattening contain 12 to 13 MJ ME/kg and considerably less than 10% fat (NRC, 1994). ver, when provided a multi-component seed diet, parrots display a strong tendency to mainly oilseeds such as sunflower seeds or pumpkin seeds, which results in a distinct t profile between offered diet and actually ingested portion (Kalmar *et al.*, accepted). er, in spite of profound nutritional constraints, captive parrots are still commonly fed ixtures. A high prevalence of malnutrition related diseases in captive parrots is thus prising.

diets, in contrast to seed mixtures, offer the advantage that they can be formulated to eet nutritional guidelines; moreover its content is not biased by selective feeding. Then nutritive value is not the only issue in dietary strategies. Feed cost, for instance, is higher in pellet diets compared to seed mixtures. Another important constraint against feeding pellets instead of seeds is a supposed reduction in time spent by feed intake, resulting in boredom, overfeeding and behavioral disturbances. However, Wolf *et al.* (2002) demonstrated similar time budgets for feeding behavior when parrots are fed pellets compared to seed mixtures. Another drawback against pellet diets is the initial reluctance of parrots against new food items. Nevertheless, several conversion strategies have been demonstrated to be safe and successful (Ghysels, 1997). Excreta characteristics also constitute a consideration in the evaluation of a diet. Excreta firmness is sometimes lower when fed pellets compared to seed mixtures. This can be due to an increase in excreta moisture content or by lower water binding capacity. A generally higher sodium content in pellet diets might possibly increase excreta moisture content, as demonstrated in laying hens (Smith *et al.*, 2000); whereas artificial particle size reduction in the manufacturing of pellets might negatively influence excreta water holding capacity (Kalmar *et al.*, 2007). Excreta acidity is also a trait of importance, as a low intestinal pH can contribute to protection against acid-intolerant pathogens (Naughton and Jensen, 2001).

The present trial was aimed to evaluate the effect of selective feeding and seed dehusking on mineral intake and dietary cation anion difference (DCAD) in parrots fed a seed mixture *ad*

Table 1: Nutrient content and energy density of test diets and consumed fraction of the offered seed mixture (as fed).

		Seed Mixture
		offered
Crude Protein	(%)	14.0
Ether Extract	(%)	14.6
Crude Fiber	(%)	16.0
Crude Ash	(%)	5.6
N-Free Extract	(%)	44.5

Ziervogel-Futter: reine Samen-Mischungen

MINERAL INTAKE IN AFRICAN GREY PARROTS (*PSITTACUS E ERITHACUS*) FED A SEED MIXTURE OR EXTRUDED PELLETS *AD LIBITUM,* AND ITS EFFECTS ON EXCRETA CHARACTERISTICS.

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Table 1: Nutrient content and energy density of test diets and consumed fraction of the offered seed mixture (as fed).

		Seed Mixture	
		offered	consumed
Crude Protein	(%)	14.0	26.9 ± 3.4
Ether Extract	(%)	14.6	42.2 ± 3.4
Crude Fiber	(%)	16.0	7.1 ± 0.6
Crude Ash	(%)	5.6	3.2 ± 0.7
N-Free Extract	(%)	44.5	20.9 ± 2.9

Ziervogel-Futter: Samen-Extrudat-Mischungen

<u>Stärkereiche Samen</u>

Hirse
Mais
Glanz
Hafer
Buchweizen

<u>Fettreiche Samen</u>

Erdnuss
Sonnenblumenkerne
Kürbiskerne
Nüsse
Hanf

<u>Extrudat</u>

Mineralversorgung

Ziervogel-Futter: Samen-Extrudat-Mischungen

Nutrition of Caged Birds

Formulated Diets Versus Seed Mixtures for Psittacines[1,2]

DUANE E. ULLREY,[3] MARY E. ALLEN[4] AND DAVID J. BAER[5]

Comparative Nutrition Group, Department of Animal Science, Michigan State University, East Lansing, MI 48824

ABSTRACT Psittacines are often classified as seed despite studies that have established great di- in food habits in the wild. While seeds are con- , so are flowers, buds, leaves, fruits and cam- Some psittacines consume parts of >80 species ses, forbs, shrubs and trees. In addition, insects e important. Although there are few controlled s of the requirements of psittacines, it is probable ost nutrient needs are comparable to those of ticated precocial birds that have been thoroughly d. Commercial seed mixes for psittacines com- contain corn, sunflower, safflower, pumpkin and n seeds, wheat, peanuts, millet, oat groats and heat, although other seeds may be present. Be- hulls/shells comprise 18–69% of these seeds ey are removed before swallowing, a significant tion of typical seed mixtures is waste. Some of eds also are very high in fat and promote obesity. on nutrient deficiencies of decorticated seeds in- lysine, calcium, available phosphorus, sodium, nese, zinc, iron, iodine, selenium, vitamins A, D, K, riboflavin, pantothenic acid, available niacin, n B-12 and choline. Attempts to correct these encies by incorporating pellets into seed mixes ually thwarted by rejection of the pellets and dis- tionate consumption of items that are more favored. An extruded diet formulated to meet ojected nutrient needs of psittacines was fed with and vegetables to eight species of psittacines for ledging percentage was increased to 90% from e 66% observed during the previous 2 y when these psittacines were fed seeds, fruits and vegetables. Although this extruded diet was well accepted in a mixture of fruits and vegetables and met nutrient needs, analyses have shown that not all commercial formulated diets are of equal merit. J. Nutr. 121: S193–S205, 1991.

INDEXING KEY WORDS:

• *symposium* • *birds* • *psittacines* • *seed composition* • *nutrient requirements* • *formulated diet* • *gout*

Aviculturists often classify caged birds on the basis of their apparent food preferences in captivity (1). The Psittacidae comprise a family of birds with stout, hooked bills commonly called seed eaters despite field studies (2–5) establishing great diversity in food habits in the wild. Psittacines are widespread in tropical and south temperate areas of the world, with major populations in the neotropics and Australia. These regions vary widely in rainfall and temperature and in the food plants that the environment will support (6). Since indigenous psittacines coevolved with their food supply, their food choices in an undegraded habitat represent a nutritional wisdom built on generations of experience. However, studies of caged psittacines suggest that the nutritional wisdom of wild birds does not transfer to captive birds offered cultivated seeds as their principal food. In fact, specific instances of failed dietary husbandry based on seed mixtures have led to this review of natural dietary habits of certain psittacines, the nutritional limitations of seeds and the development of diets formulated to be nutritionally complete.

FOOD SELECTION BY CERTAIN WILD PSITTACINES

Biologists with significant field experience will testify how difficult it is to gather quantitative food intake data on free-living birds. Even qualitative information is difficult to gather. Nevertheless, the follow-

[1] Presented as part of the Waltham International Symposium on Nutrition of Small Companion Animals, at University of California, Davis, CA 95616, on September 4–8, 1990. Guest editors for the symposium were James G. Morris, D'Ann C. Finley and Quinton R. Rogers.

[2] Journal paper from the Michigan Agricultural Experimental Station, East Lansing, MI 48824.

[3] To whom correspondence should be addressed: Department of Animal Science, Michigan State University, 205 Anthony Hall, East Lansing, MI 48824.

[4] Present address: Allen and Baer Associates, 5320 Olney-Laytonsville Road, Olney, MD 20832.

[5] Present address: Energy and Protein Laboratory, Beltsville Human Nutrition Research Center, United States Department of Agriculture, Beltsville, MD 20705.

Food selected by Timneh Gray Parrots from a mix of seeds, fruits, vegetables and an extrusion[1]

Food item
Corn
Sunflower seeds
Peanuts
Safflower seeds
Extrusion
Oranges
Sweet potatoes
Celery
Green beans
Carrots
Spinach
Total

Ziervogel-Futter: Samen-Extrudat-Mischungen

Nutrition of Caged Birds

Formulated Diets Versus Seed Mixtures for Psittacines[1,2]

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FOOD SELECTION BY CERTAIN WILD PSITTACINES

Biologists with significant field experience will testify how difficult it is to gather quantitative food intake data on free-living birds. Even qualitative information is difficult to gather. Nevertheless, the follow-

[1] Presented as part of the Waltham International Symposium on Nutrition of Small Companion Animals, at University of California, Davis, CA 95616, on September 4–8, 1990. Guest editors for the symposium were James G. Morris, D'Ann C. Finley and Quinton R. Rogers.

[2] Journal paper from the Michigan Agricultural Experimental Station, East Lansing, MI 48824.

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Food selected by Timneh Gray Parrots from a mix of seeds, fruits, vegetables and an extrusion[1]

Food item	Percent of diet consumed	
	Fresh basis	Dry basis
	%	
Corn	33.8	42.4
Sunflower seeds	24.3	32.6
Peanuts	4.8	6.4
Safflower seeds	0.7	1.0
Extrusion	8.6	11.3
Oranges	6.0	1.2
Sweet potatoes	8.0	3.4
Celery	4.1	0.4
Green beans	5.4	0.8
Carrots	2.0	0.4
Spinach	2.8	0.4
Total	100.5	100.3

Ziervogel-Futter: Komplettfutter

Ziervogel-Futter: Komplettfutter

Ziervogel-Futter: Pellets/Extrudate

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ORIGINAL ARTICLE

Comparison of the nutrient analysis and caloric density of 30 commercial seed mixtures (in toto and dehulled) with 27 commercial diets for parrots

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Summary

In this paper, an overview is given of the composition of 30 commercially available parrot seed mixtures. As parrots dehull the seeds, the analysis of the total seed mixture tends to differ from that of the ingested feed. Statistical evaluation and comparison of the dehulled seeds vs. the whole seeds indicates that most parrot species are fed a diet rich in fat (31.7 ± 13.1% crude fat) and energy (22.4 ± 2.9 MJ ME/kg). As the analysis of the total seed mixtures underestimates fat and energy content of the ingested feed, it is suggested that researchers, bird nutritionists and bird food producers should calculate diets based on the analysis of the dehulled seeds. Finally, the calculated data were compared with the composition of formulated pelleted/extruded diets on the market. These data indicate that the energy density of most diets (15.6 ± 1.4 MJ ME/kg) is far below the energy density of common seed mixtures.

Introduction

Although there are some publications concerning nutritional requirements in parrots (Kamphues and Wolf, 1997; Wolf et al., 1997a), exact scientific data are rather limited until now. Most parrots are fed seed mixtures, supplemented with fruits, egg food, vegetables etc. The composition of most commercial seed mixtures is based on practical experience rather than on scientific information. For bird food composed of whole seeds, in most European countries the producer is not obliged to supply the analysis of the seed mixture. As a consequence most seed mixtures are commercialized without detailed information concerning their nutrient analysis. As parrots dehull most seeds, evaluation of the nutrient intake is complex. A significant proportion of the offered seeds is waste (Bayer, 1996). As the nutrient analysis of the whole seeds differs from that of the dehulled seeds, the analysis of the kernels should be taken into account to calculate the composition of the really ingested food (Kamphues et al., 1997). A few authors published data on the proportion of husk and kernel and the content of nutrients in dehulled seeds (Ullrey et al., 1991; Kamphues et al., 1993, 1997b, 1999; Bayer, 1996; Wolf, 2002). However, for most bird fanciers it remains a difficult task to calculate the nutrient intake of their birds. Not only the calculation is rather difficult, often bird fanciers do not dispose of the ingredient formula of the seed mixtures.

In order to get a better view on the composition of parrot feed, the nutrient levels in 30 commercially available seed mixtures were calculated according to a procedure presented by Kamphues and Wolf (1997a). The nutrient composition of the total seed mixtures was compared with that of the kernels. A statistical evaluation was made in order to establish

Nutrient	Seed mixtures	Commercial pellets
On weight basis (%)		
Crude protein	20.2 ± 2.7***	16.3 ± 2.6
Crude fat	31.7 ± 13.1***	8.6 ± 4.1
Crude fibre	3.7 ± 0.8***	3.7 ± 1.2
Carbohydrates (NFE)	37.5 ± 15.7^{ns}	56.9 ± 5.0
Calcium	0.181 ± 0.288^{ns}	0.720 ± 0.196
Phosphorus	0.628 ± 0.107***	0.500 ± 0.144
Sodium	0.031 ± 0.008***	0.127 ± 0.057
Calcium/phosphorus	0.29 ± 0.50^{ns}	1.51 ± 0.35

Ziervogel-Futter: Eisenarme Futter

Iron content less than 85 ppm. Each batch is analyzed by an external laboratory.

Ziervögel & Reptilien

Futterinsekten

Futterinsekten

FIG 27.1 Practically speaking, almost all insects are calcium deficient (approximately 1 Ca:5 to 10 P for most insects) and must be fed a diet greater than 8% Ca to develop a positive Ca : P ratio. Note that gut loading does not mean mere feeding; it entails providing a diet fortified with high levels of calcium, as well as multivitamins and trace minerals. Common feeder insects include (A) house or gray crickets (*Acheta domesticus*); (B) black field crickets (*Gryllus bimaculatus*); (C) mealworms (*Tenebrio molitor*), larvae, instar, and beetle; (D) superworms (*Zophobas morio* larvae); (E) waxworm larvae (*Galleria mellonella*); (F) tobacco hornworms or goliath worms (*Manduca sexta*); (G) black soldier fly larvae or Phoenix worms (*Hermetia ilucens*); (H) fruitflies (*Drosophila melanogaster* or *D. hydei*) and cockroaches; (I) dubias (*Blaptica dubia*); and (J) hissing cockroaches (*Gromphadorhina portentosa*).

Boyer & Scott (2019)

Futterinsekten

Insect Composition and Uses in Animal Feeding Applications: A Brief Review

Liz Koutsos,[1,3] Alejandra McComb,[1] and Mark Finke[2]

Annals of the Entomological Society of America, 112(6), 2019, 544–551

Insekt
Mehlwurm-Larve Heimchen Hermetia-Larve Wachswurm-Larve Schabe

Futterinsekten

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Insekt	Wasser % uS
Mehlwurm-Larve	62
Heimchen	69
Hermetia-Larve	61
Wachswurm-Larve	59
Schabe	69

Futterinsekten

Insect Composition and Uses in Animal Feeding Applications: A Brief Review

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Insekt	Wasser % uS	Rohprotein % TS	Rohfett % TS	Chitin % TS
Mehlwurm-Larve	62	49	35	0
Heimchen	69	67	22	7
Hermetia-Larve	61	45	36	6
Wachswurm-Larve	59	34	60	4
Schabe	69	61	32	6

Futterinsekten

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Liz Koutsos,[1,3] Alejandra McComb,[1] and Mark Finke[2]

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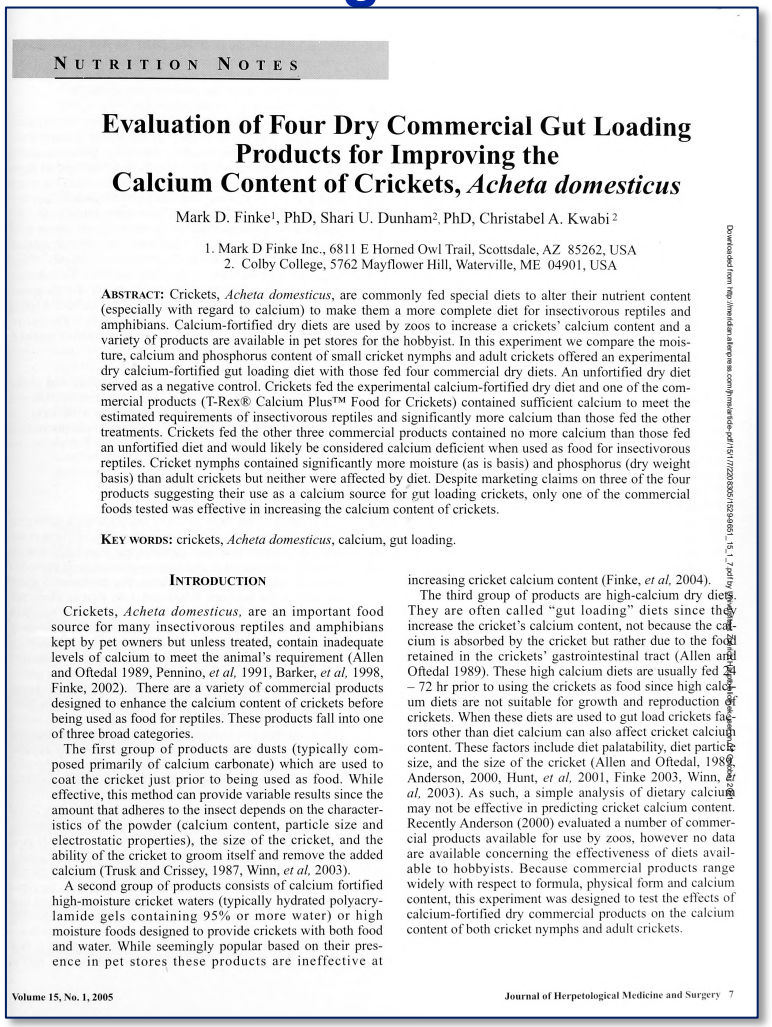
Insekt	Wasser % uS	Rohprotein % TS	Rohfett % TS	Chitin % TS	Calcium % TS	Phosphor % TS
Mehlwurm-Larve	62	49	35	0	0.05	0.76
Heimchen	69	67	22	7	0.13	0.97
Hermetia-Larve	61	45	36	6	2.40	0.93
Wachswurm-Larve	59	34	60	4	0.05	0.48
Schabe	69	61	32	6	0.13	0.58

Futterinsekten

‘Gut loading’



NUTRITION NOTES

Evaluation of Four Dry Commercial Gut Loading Products for Improving the Calcium Content of Crickets, *Acheta domesticus*

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ABSTRACT: Crickets, *Acheta domesticus*, are commonly fed special diets to alter their nutrient content (especially with regard to calcium) to make them a more complete diet for insectivorous reptiles and amphibians. Calcium-fortified dry diets are used by zoos to increase a crickets’ calcium content and a variety of products are available in pet stores for the hobbyist. In this experiment we compare the moisture, calcium and phosphorus content of small cricket nymphs and adult crickets offered an experimental dry calcium-fortified gut loading diet with those fed four commercial dry diets. An unfortified dry diet served as a negative control. Crickets fed the experimental calcium-fortified dry diet and one of the commercial products (T-Rex® Calcium Plus™ Food for Crickets) contained sufficient calcium to meet the estimated requirements of insectivorous reptiles and significantly more calcium than those fed the other treatments. Crickets fed the other three commercial products contained no more calcium than those fed an unfortified diet and would likely be considered calcium deficient when used as food for insectivorous reptiles. Cricket nymphs contained significantly more moisture (as is basis) and phosphorus (dry weight basis) than adult crickets but neither were affected by diet. Despite marketing claims on three of the four products suggesting their use as a calcium source for gut loading crickets, only one of the commercial foods tested was effective in increasing the calcium content of crickets.

KEY WORDS: crickets, *Acheta domesticus*, calcium, gut loading.

INTRODUCTION

Crickets, *Acheta domesticus,* are an important food source for many insectivorous reptiles and amphibians kept by pet owners but unless treated, contain inadequate levels of calcium to meet the animal’s requirement (Allen and Oftedal 1989, Pennino, *et al,* 1991, Barker, *et al,* 1998, Finke, 2002). There are a variety of commercial products designed to enhance the calcium content of crickets before being used as food for reptiles. These products fall into one of three broad categories.

The first group of products are dusts (typically composed primarily of calcium carbonate) which are used to coat the cricket just prior to being used as food. While effective, this method can provide variable results since the amount that adheres to the insect depends on the characteristics of the powder (calcium content, particle size and electrostatic properties), the size of the cricket, and the ability of the cricket to groom itself and remove the added calcium (Trusk and Crissey, 1987, Winn, *et al,* 2003).

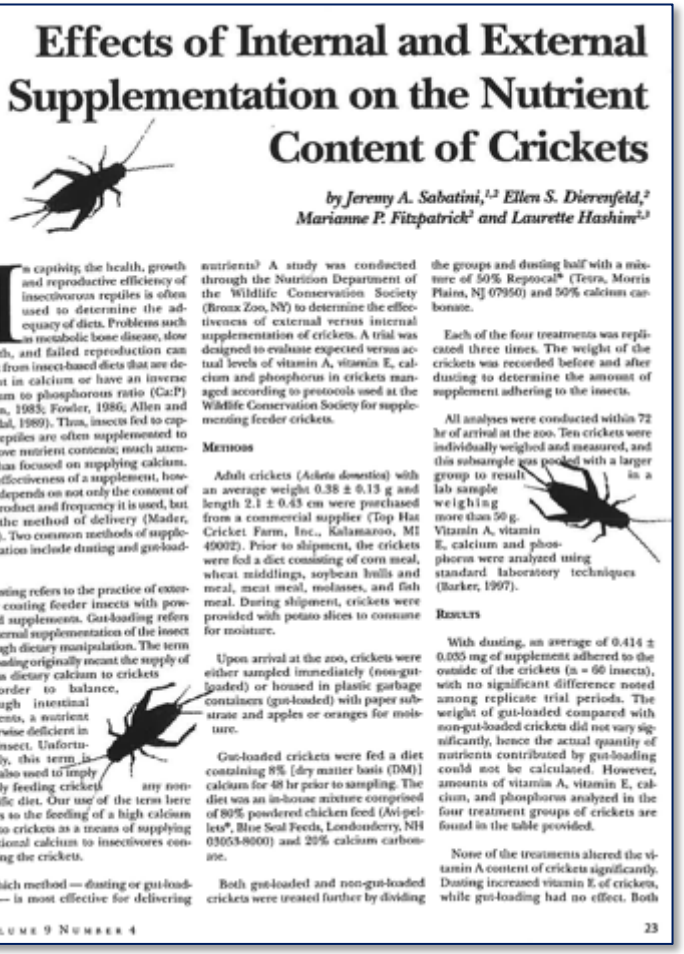
A second group of products consists of calcium fortified high-moisture cricket waters (typically hydrated polyacrylamide gels containing 95% or more water) or high moisture foods designed to provide crickets with both food and water. While seemingly popular based on their presence in pet stores these products are ineffective at increasing cricket calcium content (Finke, *et al,* 2004).

The third group of products are high-calcium dry diets. They are often called “gut loading” diets since they increase the cricket’s calcium content, not because the calcium is absorbed by the cricket but rather due to the food retained in the crickets’ gastrointestinal tract (Allen and Oftedal 1989). These high calcium diets are usually fed 24 – 72 hr prior to using the crickets as food since high calcium diets are not suitable for growth and reproduction of crickets. When these diets are used to gut load crickets factors other than diet calcium can also affect cricket calcium content. These factors include diet palatability, diet particle size, and the size of the cricket (Allen and Oftedal, 1989, Anderson, 2000, Hunt, *et al,* 2001, Finke 2003, Winn, *et al,* 2003). As such, a simple analysis of dietary calcium may not be effective in predicting cricket calcium content. Recently Anderson (2000) evaluated a number of commercial products available for use by zoos, however no data are available concerning the effectiveness of diets available to hobbyists. Because commercial products range widely with respect to formula, physical form and calcium content, this experiment was designed to test the effects of calcium-fortified dry commercial products on the calcium content of both cricket nymphs and adult crickets.

Ca:P in small and large crickets after being on the gut-loading diet for 48 h

	Timberline Cricket Power Food + 15% $CaCO_3$	Timberline Cricket Power Food	Fluker’s ® High-Calcium Cricket Feed	ESU Reptile® Gut Load™ Cricket and Insect Food	Jurassi•Diet™ Gut-load for crickets and other prey	T-Rex® Calcium Plus Food™ for Crickets
Treatment	1	2	3	4	5	6
Ca:P						
- Small	1.21:1.0	0.21:1.0	0.27:1.0	0.39:1.0	0.37:1.0	1.26:1.0
- Large	0.75:1.0	0.20:1.0	0.23:1.0	0.20:1.0	0.34:1.0	0.89:1.0

‘Gut loading’ & ‘Dusting’



Effects of Internal and External Supplementation on the Nutrient Content of Crickets

by Jeremy A. Sabatini,[1,2] Ellen S. Dierenfeld,[2] Marianne P. Fitzpatrick[2] and Laurette Hashim[2,3]

In captivity, the health, growth and reproductive efficiency of insectivorous reptiles is often used to determine the adequacy of diets. Problems such as metabolic bone disease, slow growth, and failed reproduction can result from insect-based diets that are deficient in calcium or have an inverse calcium to phosphorous ratio (Ca:P) (Allen, 1983; Fowler, 1986; Allen and Oftedal, 1989). Thus, insects fed to captive reptiles are often supplemented to improve nutrient contents; much attention has focused on supplying calcium. The effectiveness of a supplement, however, depends on not only the content of the product and frequency it is used, but also the method of delivery (Mader, 1996). Two common methods of supplementation include dusting and gut-loading.

Dusting refers to the practice of externally coating feeder insects with powdered supplements. Gut-loading refers to internal supplementation of the insect through dietary manipulation. The term gut-loading originally meant the supply of excess dietary calcium to crickets in order to balance, through intestinal contents, a nutrient otherwise deficient in the insect. Unfortunately, this term is now also used to imply simply feeding crickets any non-specific diet. Our use of the term here refers to the feeding of a high calcium diet to crickets as a means of supplying additional calcium to insectivores consuming the crickets.

Which method — dusting or gut-loading — is most effective for delivering nutrients? A study was conducted through the Nutrition Department of the Wildlife Conservation Society (Bronx Zoo, NY) to determine the effectiveness of external versus internal supplementation of crickets. A trial was designed to evaluate expected versus actual levels of vitamin A, vitamin E, calcium and phosphorus in crickets managed according to protocols used at the Wildlife Conservation Society for supplementing feeder crickets.

Methods

Adult crickets (*Acheta domestica*) with an average weight 0.38 ± 0.13 g and length 2.1 ± 0.43 cm were purchased from a commercial supplier (Top Hat Cricket Farm, Inc., Kalamazoo, MI 49002). Prior to shipment, the crickets were fed a diet consisting of corn meal, wheat middlings, soybean hulls and meal, meat meal, molasses, and fish meal. During shipment, crickets were provided with potato slices to consume for moisture.

Upon arrival at the zoo, crickets were either sampled immediately (non-gut-loaded) or housed in plastic garbage containers (gut-loaded) with paper substrate and apples or oranges for moisture.

Gut-loaded crickets were fed a diet containing 8% [dry matter basis (DM)] calcium for 48 hr prior to sampling. The diet was an in-house mixture comprised of 80% powdered chicken feed (Avi-pellets®, Blue Seal Feeds, Londonderry, NH 03053-8000) and 20% calcium carbonate.

Both gut-loaded and non-gut-loaded crickets were treated further by dividing the groups and dusting half with a mixture of 50% Repcal® (Tetra, Morris Plains, NJ 07950) and 50% calcium carbonate.

Each of the four treatments was replicated three times. The weight of the crickets was recorded before and after dusting to determine the amount of supplement adhering to the insects.

All analyses were conducted within 72 hr of arrival at the zoo. Ten crickets were individually weighed and measured, and this subsample was pooled with a larger group to result in a lab sample weighing more than 50 g. Vitamin A, vitamin E, calcium and phosphorus were analyzed using standard laboratory techniques (Barker, 1997).

Results

With dusting, an average of 0.414 ± 0.035 mg of supplement adhered to the outside of the crickets (n = 60 insects), with no significant difference noted among replicate trial periods. The weight of gut-loaded compared with non-gut-loaded crickets did not vary significantly, hence the actual quantity of nutrients contributed by gut-loading could not be calculated. However, amounts of vitamin A, vitamin E, calcium, and phosphorus analyzed in the four treatment groups of crickets are found in the table provided.

None of the treatments altered the vitamin A content of crickets significantly. Dusting increased vitamin E of crickets, while gut-loading had no effect. Both

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Heimchen	Vitamin A IE/Heimchen	Vitamin E IE/Heimchen	Calcium mg/Heimchen	Phosphor mg/Heimchen
unbehandelt	0.22	0.005	0.31	0.56
‘dusted’	6.73	0.04	15.04	3.29
‘gut-loaded’	0.16	0.02	0.70	0.64
‘dusted’ & ‘gut-loaded’	7.33	0.03	9.42	2.40

Vitamin A-Versorgung

Insekten – enthalten wenig Vitamin A

Vielen Dank für Ihre Aufmerksamkeit!