Approaches to zoo animal nutrition

Marcus Clauss
Clinic for Zoo Animals, Exotic Pets and Wildlife, Vetsuisse Faculty, University of Zurich, Switzerland
BIO354 Zoo Biology 2019
Zoo animal nutrition
Historical approach

Variations in Eastern Bongo (Tragelaphus eurycerus isaaci) Feeding Practices in UK Zoological Collections
D. J. Wright,† H. M. Omed,‡ C. M. Bishop,‡ and A. L. Fidgett§
Zoo Biology 30:149–164 (2011)

Research Article
Feeding practices for captive greater kudus (Tragelaphus strepsiceros) in UK collections
Lucy A. Taylor†, Christoph Schweitzer‡, Norman Owen-Smith§, Michael Kreuzer§ and Marcus Clauss‡

- Gefangene Tiere richtig füttern
- Säugetiere
- Hdbk Nutrition & Food Section G Food Habits Diets Invertebrates & Vertebrates (Handbook of Nutrition & Food)
Approach to zoo animal nutrition

+ “do as we always did”
  based on experiences what has been working

- sometimes ‘experiences’ are mistakes one has been making for long time

“imitate the natural diet”
  best approach
Approach to zoo animal nutrition

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“imitate the natural diet”
  best approach
  depends on what you know about the natural diet, and what feeds are available
Example: Giant anteater (Myrmecophaga tridactyla)

Gull et al. (subm.)
Example: Maned wolf (Chrysocyon brachyurus)

various studies, e.g. Bueno et al. (2004)
Example: Coati (Nasua spp.)

- Insects: 24%
- Millipedes: 17%
- Spiders: 11%
- Vertebrae: 3%
- Gastropods: 1%
- Plant parts: 26%
- Fruits: 15%

Alves-Costa et al. (2004)
Natural diets

Research Article

Feeding practices for captive greater kudus (*Tragelaphus strepsiceros*) in UK collections as compared to diets of free-ranging specimens

Lucy A. Taylor¹, ², Christoph Schweitzer³, Norman Owen-Smith³, Michael Kreuzer⁴ and Marcus Claus³
Natural diets

EAZA Husbandry and Management Guidelines

2.2 Feeding

A. Knowledge of giraffe nutrition in the wild

It is important to know what giraffes are feeding on in the wild, when determining the proper diet in captivity.

2.2.1 Selection of feeding plants

Hofmann (1973) classifies the giraffe as a browser. Tree or shrub browse are the dominant food plants (for a compilation of literature references see section 4, part D), leaves and shoots making up the most important items of the diet (Table 2.1). Selectivity of feeding behaviour is characterised by Van Soest (1994) to be of an intermediate degree. Due to its large body size, a giraffe just cannot afford to feed as selectively as smaller ruminant species.

<table>
<thead>
<tr>
<th>Plant parts ingested</th>
<th>Importance to the diet</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaves, small twigs</td>
<td>++</td>
<td>Leuthold and Leuthold (1973)</td>
</tr>
<tr>
<td>Some bark, flowers and fruits</td>
<td>+</td>
<td>(1973, 1978)</td>
</tr>
<tr>
<td>Leaves and shoots of trees and shrubs</td>
<td>++</td>
<td>Leuthold and Leuthold (1973)</td>
</tr>
<tr>
<td>Herbaceous material (climbers, vines, tall forbs)</td>
<td>Up to 7%</td>
<td>Owen-Smith (1988)</td>
</tr>
</tbody>
</table>

- Shoot tips: 78%
- Leaf whors: 14%
- Flowers: 5%
- Pods: 3%
- Others: 1%

If new growing shoots are available (including young leaves, twigs and thorns), they represent the favoured food resource according to Sauer et al. (1982). Older leaves are ingested when shoots are not available. Owen-Smith (1988) reports considerable amounts of woody material to be included in the diet (5% in the rainy and 15% in the dry season).
Natural diets

There are no secret, species-specific ingredients!

Formic acid in anteater formulas?
Natural diets

There is no single source of quantitative natural diet information on mammals.
Approach to zoo animal nutrition

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Two traditions in imitating natural diets

Ratcliffe and Wackernagel

- a complete feed for each animal (group) (pelleted)
- atypical physical structure
- some nutrients difficult to limit
- behavioural deficits

Hediger

- ‘natural’ feeds (forages, fruits/vegetables), that resemble the natural diet
- selective feeding possible
- available feeds differ from in nutrient content from the natural diet
Frugivores don’t eat supermarket fruit

<table>
<thead>
<tr>
<th>Fruits</th>
<th>Vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banana</td>
<td>Musa acuminata</td>
</tr>
<tr>
<td>Apple</td>
<td>Malus domestica</td>
</tr>
<tr>
<td>Orange</td>
<td>Citrus x sinensis</td>
</tr>
<tr>
<td>Kiwi</td>
<td>Actinidia deliciosa</td>
</tr>
<tr>
<td>Papaya</td>
<td>Carica papaya</td>
</tr>
</tbody>
</table>

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

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Photos and design, Tjalling Huisman, 2012.
Information used from Danish Food Composition Table and Schmidt et al., (2005).

Contact: Tjalling Huisman
Email: tjalling.huisman@wur.nl
Phone: +31 (0)58 2846311

courtesy Tjalling Huisman
Traditions in imitating natural diets

**Diet and Oral Health in Captive Amur Tigers (Panthera tigris altaica)**

L. I. Haberstroh, D.V.M. *
D. E. Ullrey, Ph.D. **
J. G. Sikarski, D.V.M., M.S. *
N. A. Richter, D.V.M. ***
B. H. Colmery, D.V.M. *
T. D. Myers, D.D.S. ****

**A SOFT VERSUS HARD DIET AND ORAL HEALTH IN CAPTIVE TIMBER WOLVES (Canis lupus)**

K.M. Vosburgh, B.S. *
R.B. Barbiers, B.S. *
J.G. Sikarskie, D.V.M., M.S. *
D.E. Ullrey, Ph.D. **
Traditions in imitating natural diets
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“use a suitable domestic species as model”
  ‘scientific compromise’
  huge amount of knowledge
  species-specific peculiarities are easily overlooked
Idiosyncratic nutrient requirements of cats appear to be diet-induced evolutionary adaptations*

James G. Morris
Idiosyncratic nutrient requirements of cats appear to be diet-induced evolutionary adaptations*

James G. Morris

* indicates a special note or condition associated with the content.
Idiosyncratic nutrient requirements of cats appear to be diet-induced evolutionary adaptations*

James G. Morris

essential nutrients:
- high protein requirement
- amino acids taurine and arginine
- arachidonic acid
- vitamin A (β-carotene useless)
- vitamin D
- niacine

not essential for dogs
Idiosyncratic nutrient requirements of cats appear to be diet-induced evolutionary adaptations*

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  “based on studies in zoo animals”
  ‘scientific approach’ financially and logistically challenging, difficulty in summarizing knowledge
Studies in zoo animals

- Case reports / case series
- Inventories of diets, pathological states, husbandry success
- Differences between free-range and zoo
- Epidemiological / controlled studies
Examples: case studies

DIETARY TAURINE SUPPLEMENTATION AND CARDIAC FUNCTION IN THE GIANT ANTEATER (Myrmecophaga tridactyla): PRELIMINARY FINDINGS

J. Andrew Teare, DVM, MS,¹* Alan D. Weldon, DVM, Dipl AVCIM,² and Nikolay Kapustin, DVM¹
2009 PROCEEDINGS AAZV AAWV JOINT CONFERENCE

TAURINE DEFICIENCY IN MANED WOLVES (Chrysocyon brachyurus) MAINTAINED ON TWO DIETS MANUFACTURED FOR PREVENTION OF CYSTINE UROLITHIASIS

Sara E. Childs-Sanford, DVM¹* and C. Roselina Angel, PhD²
2004 PROCEEDINGS AAZV, AAWV, WDA JOINT CONFERENCE

no control group
Examples: inventories

Grisham and Savage (1990)

Marholdt (1991)

Müller et al. (2011)

no direct association
Examples: differences wild - zoo

obesity
Social Factors Influence Ovarian Acyclicity in Captive African Elephants (Loxodonta africana)

Elizabeth W. Freeman, Greg Guagnano, Deborah Olson, Mike Keele, Janine L. Brown

Females more likely to be acyclic had a larger body mass index and had resided longer at a facility with the same herdmates. Results suggest that controlling the weight of an elephant might be a first step to helping mitigate estrous cycle problems.
Examples: epidemiological/controlled studies

Hepatic Hemosic Common Marmosets, Co Effect of Diet on Incident

Georgina F. Miller,1 Dennis E. Barnard,1 Ruth A. Woodward

=> Fe ≥ 350 ppm DM leads to massive liver damage
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Where is the information?
Thank you for your attention