

**2nd International
Symposium
on
Pet Bird Nutrition**

4th – 5th Oktober 2007
Hannover, Germany

Institute of Animal Nutrition,
University of Veterinary Medicine
Hannover, Foundation

Abstracts

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I. Basic Knowledge

Anatomy, Body Composition, Digestion

Oral Presentations

1. Metabolic and Digestive Plasticity of Psittacines

Klasing, K.C., Koutsos, E.A. and Kohler, L.M.

Objectives± Many psittacine species are generalist and eat dozens of different food type during any given seasons. Smaller psittacines tend to prefer seeds and nectars, whereas larger species tend to consume a greater proportion of nuts and animal matter. Some species are specialists, including nectarivores (lorikeet), granivores (cockatiel), and herbivores (kakapo). Often, we do not know the natural diets of species commonly kept in captivity with sufficient detail to reconstruct their natural nutrient intake. In captivity, diets based on common foods and feed ingredients are use in place of natural diets. It is not clear how well psittacines adapt to captive diets that may have levels of nutrients that are considerably different than found in their natural diets. Our objective was to determine the ability of cocktails to adapt to a wide range of protein, energy, and vitamin levels.

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2. Development of enzyme activities (in small intestine content and pancreatic tissue) of pet birds during nestling period

Wolf, P. and Kamphues, J.

Institute of Animal Nutrition, University of Veterinary Medicine, Foundation, Hannover

Introduction: Precocial birds (i.e. Galliformes) start self-employed feed intake immediately after hatch, whereas nidicolus birds are fed by their parents (feed is ingested by adults before given to nestlings). In contrast to precocial birds, in which development of enzyme activities is in-depth investigated (1), data for pet bird nestlings are seldom. **Aim** of this study with nestlings was the investigation of enzyme activities in the young organism as well as enzyme development during growth to optimize the composition of diets used for hand rearing of nestlings.

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3. Microbiological examinations on the gastrointestinal flora of healthy lovebirds (*Agapornis* spp.) under the influence of a starch-, fat- or fibre-rich diet

U. Kümme¹, J. Verspohl², P. Wolf¹ and J. Kamphues¹

¹Institute of Animal Nutrition, ²Institute of Microbiology and Infectious Diseases
University of Veterinary Medicine Hannover, Foundation

Introduction: With regard to the gastrointestinal flora of pet birds the following aspects are with particular interest: on the one hand, the microorganisms in the alimentary tract are involved in several digestion processes (esp. degradation of crude fibre). On the other hand several problems in digestion result from an imbalance (dysbiosis) of the gastrointestinal flora or from infections with exogenic bacteria. Against this background the investigations made should enable deeper knowledge on the composition (qualitatively and quantitatively) of the gastrointestinal flora of lovebirds. This species has – in comparison to other pet birds – a higher developed large intestine. Additionally, according to investigations of FRÖMBLING (2000), lovebirds show higher digestibility rates compared to other birds offering identical feed.

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4. Comparison of Physical Examination Characteristics and Freshly Voided Fecal Gram's Stain Parameters Between Budgerigars Raised on Seeds and Those Fed an Organic Formulated Diet

Harrison, G.J.

In a controlled study of African grey parrots fed a traditional seed and supplement diet versus a balanced formulated organic diet the fecal Gram's stain increased in numbers and percentages of gram positive bacteria, while the gram negative bacteria became almost completely gone.¹

A study on budgerigars with insufficient numbers and poor project design concluded that there were no significant differences between the fecal samples from the two groups, except that the fungus *Macrorhabdus ornithogaster* was identified in 48.3 % of the samples from the group fed the commercially formulated diet but from only 3.4 % of the samples from the group fed the seed mixture.² Freshly voided feces from individual caged birds were not used for the study but instead cloacal swabs were used. Cloacal swabs are not appropriate to ascertain normal gut flora in Gram's stain studies.

A ongoing study using 10 pairs of budgerigars fed a balanced formulated organic diet and 10 pairs fed seed for one year shows the seed group with 80% gram-positive (50% gram positive rods and 50% cocci) 20% gram negative; the formulated group 90 % gram positive and 10 % gram negative. No yeasts in either group.³

None of these articles report the changes seen by the author who performed a physical examination on an eight week old budgerigar raised on seeds and converted to an organic formulated diet over the next fourteen months. The bird went from having feathers that were bent, broken, discolored; cere, beak and legs were peeling; baldness on plantar surface of feet all returned to normal except the pattern of baldness on the feet which were still not completely normal.

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5. Feed intake, ingestion behaviour as well as amounts and composition of cast into three species of birds of prey fed day-old chicks or mices

Lüdtke, M., Wolf, P. and Kamphues, J.

Institute of Animal Nutrition, University of Veterinary Medicine, Foundation, Hannover

Birds of prey have been kept in human custody for centuries (hawking/zoos). Also, more recently so-called "hospices" have been established whose purpose is to take temporarily care for injured animals until health is restored and to return subsequently them to their natural habitat. During hospitalization the birds are ususally fed day-old chicks and mices (sometimes enriched with supplements).

Aim of this study was to gain qualitative and quantitative ideas on feed consumption, size and composition of the cast, feed digestibility and nutrient supply.

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6. Studies on ceca function in owls with special regard to calcium absorption

Hellmann, A.N., Kummerfeld, N., Wolf, P., Meyer, W.

Avian ceca are blind ending sacs that extend from the proximal end of the colon. They range in size from large and paired to small and single, or may be completely absent. Functional variety is suggested, including digestion of small food particles, absorption of nutrients, production of antibodies, microbial action, or utilization and absorption of water. To date, there are only very few publications on the ceca of carnivorous bird species. Therefore, this study aimed to examine the ceca of owls to gain new insight into their function.

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7. Influences of feeds and diets on excreta quality in pet bird

Janssens, G. P.J.

Introduction: For many pet bird fanciers, excreta quality is a very important, though subjective measure of bird health. If a diet fails to sustain or enhance the perceived excreta quality of an owner's birds, he will mostly tend to shift to another diet, so excreta quality is a key feature in pet bird nutrition, both from a commercial and a veterinary point of view.

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Poster Section

8. Osteological examinations on the budgerigar (*Melopsittacus undulatus*) with special reference to skeletal alterations conditioned by breeding

Bartels, T., Cramer, K., Wolf, P., Boos, A.

Introduction

The budgerigar (*Melopsittacus undulatus*) is one of the best known psittacine birds kept in aviculture. In the beginning breeding efforts were focused on the establishment of colour variants, while later fancy breeders selected the birds with emphasis on their body size and feather structure. The aims of this study were to examine the skeletons of domesticated budgerigars of phenotypically different breeding types, to describe the expression of skeletal changes and to discuss the results with special reference to the causes and effects of breed-conditioned alterations.

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9. Ontogeny of L-carnitine, thyroid hormones and cortisol in pigeons (*Columba livia domestica*)

Janssens G.P.J.¹, Darras V.M.²

¹Laboratory of Animal Nutrition, Ghent University, Heidestraat 19, B-9820 Merelbeke, Belgium; ²Laboratory of Comparative Endocrinology, Catholic University of Leuven, Belgium

Objectives. In the pigeon (*Columba livia domestica*), the nutrition of young squabs mainly exists of crop milk, a fat-rich secretion of desquamated epidermal cells of the parent pigeons' crops. Together with the resorption of the yolk-sac, this must induce a high rate of fatty acid metabolism, which is reflected in the very high growth rate of pigeon squabs. Yet, in all studied animals, it has been described that neonatal levels of L-carnitine, an important mediator of fatty acid combustion, are low in comparison to adult levels. Therefore the present study investigated the plasma levels of L-carnitine, its precursor γ -butyrobetaine and separate short-chain acyl-L-carnitines during development in relation to cortisol, triiodothyronin (T₃) and thyroxin (T₄), hormones that are crucial in neonatal development.

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II. Feed Science

Composition, Nutritive Value, Contaminants

Oral Presentations

10. Protein content and amino acid composition in feedstuffs offered to pet birds in comparison to avian synthesized proteins

Kamphues, J., Bayer, G., Wolf, P.

Objective: Good feeding practices aim to provide an adequate protein supply to animals, ensuring high performance (e.g., growth, egg production) and proper body condition. An excessive supply of nutrients and deficiencies must be avoided. With regard to this, crude protein (CP) content (g CP/kg diet) and protein composition (g amino acid/100 g CP) of feedstuffs must be taken into consideration. In special stages of life (reproduction, growth), the amino acid composition of protein offered should be similar to the protein synthesized by the bird itself (as egg, accreted body mass, feathers).

Aim: Recent studies focused on the determination of CP content and amino acid composition of feedstuffs used in pet bird nutrition and of the avian body's own protein in different tissues (egg, weight gain, feathers) in growing and adult animals.

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11. Composition of common feedstuffs offered to nectarivorous birds with special emphasis on Loriidae

Häbich, A.-C., Wolf, P. und J. Kamphues

Institute of Animal Nutrition, Univ. of Veterinary Medicine Foundation Hannover, Germany

In the wild, nectarivorous species, such as lorries, hummingbirds and honeyeaters, mainly gather pollen, nectar and wild fruits. Occasionally, these species also ingest insects. Not all original feedstuffs mentioned above are available for birds in the custody of humans. Therefore substitutes must be used. Nectar, for example, is provided by sugar/water solutions, whereas wild berries are replaced by domestic fruits, and fresh pollen is substituted with commercially available pollen (wet or freeze dried). In addition, pet feed manufacturers offer products on the market that are supposed to be suitable to meet energy and nutritional requirements of nectarivorous species.

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12. Carnivorous birds: what do they actually eat?

Nijboer J., Wolf P. and Bauer J.

Introduction: Birds can be divided into granivorous, omnivorous and carnivorous birds. Granivorous birds are normally fed grains and fruits while omnivorous birds (can) will also ingest animal (material) products. The diet of carnivorous birds however consists mainly of animal products. This presentation gives an overview of what is known in literature on analyses of animals/aquatic products eaten by these birds and also shows some analyses performed in the laboratory.

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13. Trypsin Inhibitors in Parrot diets

CLARKE, E and WOLF, P.

Contact author: Dr Emily Clarke, WALTHAM Centre for Pet Nutrition

Introduction

Many animals, including a large number of parrot species, rely heavily on their ability to extract nutrients from plant material. As a defensive mechanism against this predation, plants contain a wide array of secondary metabolites, known as anti-nutritional factors (ANFs), which are often toxic. Common ANFs include lectins, antigenic proteins, tannins, alkaloids, phytates, α -galactosides and trypsin inhibitors (TIs). TIs greatly reduce amino acid digestibility by forming an irreversible complex with trypsin. Oilseeds and legume plants are known for their high ANF content but their high protein content makes them attractive candidates for addition to parrot diets. The objective of this work was to measure the trypsin inhibitor activity (TIA) of ingredients commonly used in parrot diets.

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14. Risk assessment of food species fed to birds of prey, from bacteria, viruses, parasites and toxins

Forbes, NA.

Abstract: Diseases of raptors related to the food they have consumed are many and varied, and form a large percentage of the cases presented to Veterinary Surgeons. This paper highlights the risks associated with ingestion of foods derived from different species.

Feeding Birds of Prey in Captivity

Foods available for feeding to captive raptors include day-old chick (doc) (i.e. hatchery waste males), “grown-ons” (chickens or turkeys of several weeks old), quail, rabbit, various rodents, beef, lamb and horsemeat, fallen wildlife and farm stock.

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15. Development of the hygienic quality in husbandry of fruits and cooked foods for parrots during offering

Siesnop, U., Kirpal, G., Kamphues, J.

Objectives: In the last years offering “cooked foods” became more and more popular. It means that a mixture of beans, peas and lenses together with dried vegetables is cooked for about 20 minutes, and then - after removing the lot water – offered as mush to parrots for several hours, mostly during the whole day. Such a mush has a high palatability, a marked protein content, a high digestibility, but also a susceptibility regarding microbial deterioration. Also fruits are offered in cages and aviaries during a longer period so that microbial growth could occur on those products. The nutrition of parrots is diversified due to the feeding of different fruits. **Aim** of this study was to test the development of the hygienic status of cooked feed during 24 hours.

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16. Investigations on drinking water quality in husbandry of pet birds – influences and importance –

U. Kümmel¹, U. Siesenop² and J. Kamphues¹

¹Institute of Animal Nutrition, ²Institute of Microbiology and Infectious Diseases
University of Veterinary Medicine Hannover, Foundation

Introduction: In contrast to livestock (KAMPHUES et al. 2007) where the offered water comes from an in-house fountain, pet birds often get drinking water in high quality from the public network. However it is not guaranteed, that the consumed water is from high quality. Between offering and ingestion the quality of water can be influenced by several factors also, which will be presented here.

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Poster Section

17. Birdseed from wild segetal species? Working list of potential grain plants in Germany

Aboling, S.

Objectives: Pet bird species of the genera *Serinus* (Canary), *Melopsittacus* (Budgerigar), *Nymphicus* (Cookatiel) und *Agapornis* („Love-birds“) were fed with seeds of cereals, cabbage, flax and other in Middle Europe cultivated plants as well as imported seeds of tropical cultivations such as millet (*Panicum spec.*) and *Dari* (*Sorghum spec.*). In contrast, segetal species, *i.e.* wild plants of the fields are scarcely known as possible source of birdseed. Segetal species comprise both native (indigenous) and adventive grain plants. The latter are species that have been carried off via uncleaned seeds or through trade and traffic after the year of 1492. The aim of this study is to present a working list of all wild potential grain plants in Germany.

Materials and methods: Grain plants from the complete Flora of Germany (4145 species, sub-species, hybrids) were selected after the following criterias: (1) life form: annual; (2) seed length either more than 2 mm or, if less, seeds in dense panicles; (3) habitat: field.

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17. Evaluation of Acai in Psittacines

Ryan, T.

Objective: To evaluate the role of ACAI extract to control hypercholesterolemia and its role as an antioxidant in pet bird nutrition.

Characterization of the Acai palm: Family: Arecaceae; Genus: *Euterpe*; Species: *oleracea* ;
Synonyms: *Euterpe badiocarpa*

Common Names: Acai, açai, acaí, acaizeiro, acaí-do-Pará, asai, ashái, assaí, cabbage palm, cansin, chonta, guasai, hasabis, hausai, huai, jicara, juçara, manac, manaka, manicole, morroke, naidí, palisade pine, palmito, palmitero, panan, pina, pinau, pinot, piriá, prasara, saké, uassi, ungurahua, wasei, wapoe, yisara, yuyu chonta

Parts Used: fruit, root

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18. Nutritional Aspects of Feeder Insects

Ryan, T.

Objectives: Most passerines are primarily seed eaters¹. Seeds are deficient in vitamins A, D, E, K, lysine and methionine and have a poor calcium-phosphorus ratio¹. It is reported that most estrildid passerines are difficult to convert to a pelleted diet². In the wild insects constitute a portion of estrildid finch diets^{3,4}. Many experts consider insects to be the principal protein source in nectarivores^{5,6,7}. Adult passerine and psittacine species require 10-14% dietary protein to maintain body weight⁸. Growing chicks need more protein and it has been postulated that a protein level of 15-20% (assuming correct amino acid ratios) should support normal growth and development in passerine and small psittacines⁸. It has been reported^{9,10} that insects compared to published nutritional requirements for growth and reproduction in birds (as well as mammals) that insects are excellent sources of nitrogen, potassium, magnesium and rarely of calcium.

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19. Hygienic status of feedstuffs for pet birds sent in for quality control

Wolf, P., Siesnop, U. and Kamphues, J.

Objectives: Besides the chemical composition of standard feedstuffs for pet birds, the evaluation of risks due to potential increased levels of microbes is of interest. This may occur in cases when the pet owner has noticed macroscopic deviations of the feed (sometimes combined with the batch fed previously) or when birds have shown clinical signs of illness or have died. **Aim** of the present study was to get an overview of the hygienic status of feedstuffs that had been sent in to our institute for quality control or those related reports of clinical disorders in pet birds.

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20. Hygienic quality of imported fresh oil palm fruits (*Elaeis guinensis*) for nutrition of parrots

Wolf, P.¹, Siesenop, U.², Goebel, A.³ and Kamphues, J.¹

¹*Institute of Animal Nutrition*, ²*Institute of Microbiology and Infectious Diseases, University of Veterinary Medicine Hannover, Foundation*, ³*Bio line, Lissendorf*

Introduction: In the natural habitat African greys stay in many cases in the near of oil palms (*Elaeis guinensis*) whose fruits belong to one of the most preferred feeds. Due to this feed ingestion behaviour fresh oil palm fruits (containing both: flesh and seeds) are recommended frequently for feeding parrots kept as pets in Europe (to simulate the natural resource). The fruits are imported mainly from Africa, where they are harvested and treated. Due to climatic as well as hygienic conditions and different harvesting procedures some problems occur concerning the hygienic quality of those feedstuffs. High contaminations by yeasts and moulds were found in the flesh that could involve probably different clinical signs (i.e. aspergillosis, digestive disorders). Therefore microbiological investigations of samples along the production steps (harvesting, washing, freezing a.s.o.) were carried out to find out weak spots and to redress them.

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21. Mycotoxins in pet birds' nutrition – What is known up to now?

Diste, S., Häbich, A.-C., Wolf, P. and J. Kamphues
Inst. f. animal nutrition

Introduction: Mycotoxins, products of the secondary metabolism of different moulds, have been in focus during the last decades in veterinarian medicine.

Only when there are certain growth conditions for mycotoxin forming moulds, a contamination of the feedstuffs with the following toxins as aflatoxins, fusariotoxins, ochratoxin A or ergot alkaloids can be observed. Thus, feedstuffs from areas with warm and damp climate are infested by aflatoxins more frequently than feedstuffs from areas with temperate climate, where contaminations with ergot alkaloids and fusariotoxins are more prominent. According to long term observation, drain of the two last named toxins is influenced tremendously by the actual climate, so that significant differences can be seen in the course of special years ("Ergot years"). Apart from those factors, the chemical composition of the (food-)plant influences the load by mycotoxins: aflatoxins are mainly found in substrates which are rich in fat, whereas fusariotoxins are mainly found in substrates rich in carbohydrates.

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22. Investigations on chemical composition of different seed and fruits from bushes and trees for pet birds

Youssef, I., Wolf, P. and J. Kamphues

Institute of Animal Nutrition, Veterinary Medicine University-Hannover, Germany

Introduction: A high variety in feeds offered to pet birds to enable a typical feeding behaviour (as it can be observed in the wild), may result in a specific supplementation of the ration with some nutrients (for example: high vitamin C content in rose hips) and gives finally a good feeling to bird fanciers to do the best for their animals. On the market, there are products (fruits/seeds) from foreign countries but also of bushes and trees of the indigenous vegetation. As known from other ingredients (like seeds) birds ingest either the whole fruit or only certain parts (fruit shell, kernel). Therefore, it is necessary to know which part is really ingested.

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23. Investigations on the vitamin content in kernels of different seeds fed frequently to pet birds

Heisler, K., H.-P. Sallmann, P. Wolf und J. Kamphues

Institute of Animal Nutrition, University of Veterinary Medicine Hannover, Foundation

Introduction: Nutrition of pet birds is based on different seed mixtures. Most of these seeds are of no relevance in human nutrition and are not fed to food producing animals. That is the main reason for lacks in knowledge about the vitamin contents of different ingredients that are widespread used. The data concerning vitamin contents could complete informations about nutrient content (Bayer 1996) and mineral content (Wendler 1995) in the kernels of the most frequent used ingredients.

Object of the investigations made was an evaluation of the supply with vitamins in pet birds by the kernels of different seeds.

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III. Feeding Behaviour

FEED Intake, Dietary Approches, Welfare

Oral Presentations

24. Food choices of companion birds: Native diets and taste preference.

Klasing, Kirk, C¹., Kevin Matson

¹*University of California, Davis* and ²*University of Groningen*

Objectives: The sense of taste gives animals the ability to evaluate what they eat and drink and likely aids in the ingestion of nutritionally beneficial foods while preventing the consumption of potentially harmful substances. Little formal work has been done on the food and taste preferences that birds develop during their life and the consequences for appropriate nutrition. There were three objectives of this study: 1) review the literature on the food consumption of free-living birds in their native environments; 2) determine the sensitivity of cockatiels for specific taste categories; 3) examine the taste receptors of cockatiels.

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25. Investigations on ingestion behaviour in macaws kept under different conditions

Britsch, G., Wolf P. and j. Kamphues

Objectives: Aim of this study on three species of macaws (Blue-throated macaw/ *Ara glaucogularis*, Blue and Yellow macaw/ *Ara ararauna*, Hyacinth macaw/ *Anodorhynchus hyacinthinus*) was to asses basic data of feed and water consumption. In addition, dry matter intake per time was determined.

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26. Foraging enrichment as treatment for pterotillomania in grey parrots

Lumeij, J.T. and Hommers, C. J.

Objectives:

This study was performed to determine whether foraging enrichment reduces self-directed psychogenic feather picking (pterotillomania) in parrots. A positive correlation between increased foraging time and improvement of feather score was hypothesized

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27. Feed intake behaviour in *Triclaria malachitacea*

Cornejo, J., Wolf, P. and Gerlach, H.

¹ *Africam Safari, Mexico* ² *Institute of Animal Nutrition, University of Veterinary Medicine, Foundation, Hannover,* ³ *Loro Parque Fundacion, Tenerife, Spain*

Introduction: Limited data are available on the composition of feed ingested by Purple-bellied parrots (*Triclaria malachitacea*) in the wild (Brazil), where their population is in decline. Different authors report a basic diet of seeds and a variety of fruits, with some invertebrates and nectar. Due to a lack of data concerning nutrition in the wild and a special feed intake behaviour this species is difficult to maintain in captivity. **Aim** of the following study was to characterize quantitatively intake of feed, nutrient supply and also water intake. Within this study great importance was attached to the feed intake behaviour of these birds.

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28. Feeding a bird is so more than what's on the label

Hooimeijer, J.

In the past nutrition for captive birds has been primarily about surviving and reproducing. We have learned that one must consider the significance of species specific behavior that occurs in social interaction of flock dynamics, foraging, courtship and reproduction. Natural diets are not commercially viable products so captive birds are fed ingredients that are profitable to produce. This means many of those natural dynamics are missing. Food is too abundant and individuals depend too much on label and advertising of such products to get an understanding of its value.

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Poster Section

29. Evaluation of a commercial seed mixture for parrots: Adaptation to diet

Carciofi, A.C., Sanfilippo, L.F., de-Oliveira, L.D., Prada, F.

Objective: This investigation aimed to assess parrot's adaptation to a commercial seed mixture, evaluating for this its consumption and selection.

Thirteen adult Blue-fronted Parrots (*Amazona aestiva*), individually housed in metabolic cages at the Zoological Park of Sao Paulo, Brazil were used. Adaptation to a commercial seed mixture was evaluated in 3 periods of 7 d each, in a free-choice trial. During period 1, the birds were fed their routine diet plus a commercial seed mixture composed by: sunflower (*Helianthus annuus*), yellow corn (*Zea mays var. mays*), white corn (*Zea mays var. rugosa*), oats (*Avena sativa*), hulled rice (*Oriza sativa*), barley (*Hordeum vulgare*), peanut (*Arachis hypogaea*), wheat (*Triticum aestivum*), kale (*Brassica oleracea*) and vitamin/mineral fortified pellet. In period 2, the birds were fed only fruits and vegetables like banana (*Musa sp.*), papaya (*Carica papaya*), and beet (*Beta vulgaris subsp. vulgaris var. conditiva*) and the seed mixture. Throughout period 3 they were fed only the seed mixture. Alimentary items were supplied in separate feeders and in amounts that guaranteed leftovers. Weight loss through evaporation of each of the offered items was computed and used to correct ingestion values. Body weight of birds was recorded weekly.

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30. Refinements in husbandry and care of psittacine birds kept for research purposes

Kalmar, I.D.¹, Moons, C.P.H.², Meers, L.², Janssens, G.P.J.¹

¹Lab. Anim. Nutr., Ghent University, Heidestr. 19, B-9820, ²Lab. of Ethology, UGhent

Objectives

The use of psittacine birds for scientific purposes and its reporting is subject to national legislations which vary greatly between countries and states. Nevertheless, despite lack of official statistics, the number of psittacine birds used for scientific purposes is presumed to be quite limited. Notwithstanding limited use of parrots in research settings, adequate care should be provided for this relatively small group of laboratory animals, both for ethical and scientific reasons. Therefore, this review aims to give an overview of both practical and theoretical aspects regarding the laboratory use and care of parrots.

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31. Effects of availability of fresh fruit on actual nutrient and energy intake on yellow-shouldered amazons (*Amazona barbadensis*) fed a seed mixture ad libitum

Kalmar, I.D.¹, Geeroms, B.¹, Bürkle, M.², Reinschmidt, M.², Waugh, D.²,
Werquin, G.³ and Janssens, G.P.J.¹

¹*Lab. Anim. Nutr., Heidestr. 19, B-9820*, ²*Loro Parque Fundación*, ³*Versele-Laga Ltd.*

Objectives: Parrots are still commonly fed seed mixtures, which are eventually added with fruits or pellets. However, next to nutritional disproportions inherent to seeds, parrots usually have a strong tendency to consume only a limited number of ingredients when provided a multicomponent diet. The latter resulting in considerable amounts of wasted food and moreover, a distinct nutrient profile between ingested and offered food. This study intended to investigate nutritional effects of seed dehusking and selective feeding in parrots fed a seed mixture with or without addition of fresh fruit.

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32. Investigations into the typical ingestion behaviour of pet birds

Wolf, P., Wentker, M. and Kamphues, J.

Institute of Animal Nutrition, University of Veterinary Medicine, Foundation, Hannover

Although a high variety of different pet bird species is kept as companion birds the feeding pattern of these species in the origin habitat is unconvincing studied. Otherwise crop content of perished birds in the wild contains different constituents (seeds, fruits, buds, insects a.s.o.). In spite of efforts by owners nutritional disorders occur which result partially from typical feed ingestion behaviour of birds. This is not only characterized by a pronounced rhythmic of feed intake but also varied amounts of ingested feed. Food selection and dehusking/shelling of seeds before ingestion have to be considered, too. Moreover, the position of the bowls play an important role for consumed feed as well. Aim of this study was the investigation of the feed ingestion behaviour of different pet bird species, that included estimation of the palatability of different constituents (seeds, fruits, vegetables, foods, formulated diets a.s.o) as well as the rhythm of feed intake and the behaviour concerning different feeding techniques.

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IV. Digestibility

Evaluation, Influencing Factors

Oral Presentations

33. Evaluation of internal markers for apparent digestibility in companion birds

Janssens G.P.J., Sales J.

Objectives. Studying digestibility in birds is useful for many purposes, e.g. the development of an energy evaluation system or the evaluation of certain dietary measures. A typical set-up is to house the animals in metabolism cages, but ethical objections and the potential risk of affecting digestibility through restricted housing, are a drawback. This might be overcome by using markers in the diet. Often, these markers are added to the food as external markers, but the type of food does not always allow the homogenous supplementation of an external marker (e.g. pelleted feed, intact grains or seeds). Therefore, the use of internal markers, i.e. indigestible compounds that are inherent to the food, might provide a practical solution for situations in which companion birds cannot be restricted to metabolism cages.

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34. Feed intake and apparent bioavailability of amino acids in different types of foods for feeding adult blue fronted amazon (*Amazona aestiva*) in captivity

Saad, F.M.O.B., Lara, L. B.; Saad, C.E.P.; Sugiura, E; Ferreira, W. M.

Objectives: The presented study had the aim to compare 6 types of foods given to Blue-fronted Amazons on their protein and amino acid intakes as well as the apparent bioavailability coefficients of the amino acids.

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35. Evaluation of a commercial seed mixture for parrots: Part 2 – Digestibility and composition

de-Oliveira, L.D., Carciofi, A.C., Sanfilippo, L.F., Prada, F.

Objective: This study aimed to evaluate the selection, digestion and chemical composition of the diet effectively ingested by parrots fed a commercial seed mixture.

Thirteen adult Blue-fronted Parrots (*Amazona aestiva*), individually housed in metabolic cages at the Zoological Park of Sao Paulo, Brazil were used. A commercial seed mixture composed of seeds and vitamin/mineral fortified pellets (Table 1) was evaluated. Alimentary items were supplied in amounts that guaranteed leftovers. Food consumption and total faeces collection were taken for a 10 d period. Seed hulls were removed to determine consumption and diet chemical composition. Uric acid amounts were determined from the excreta, its mass was deducted to calculate DM digestibility and its N to calculate CP digestibility.

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36. Effects of grinding level in pellet diets on excreta quality and digestibility in African grey parrots (*Psittacus e. erithacus*)

Kalmar, I.D.¹, Werquin, G.² and Janssens, G.P.J.¹

¹Lab. Anim. Nutr., Ghent University, Heidestr. 19, B-9820, ²Versele-Laga Ltd

Objectives

The current feeding trial was performed to study the influence of particle size in extruded parrot pellets on apparent digestibility, excreta consistency and excreta pH-value in African grey parrots (*Psittacus e. erithacus*).

Two test diets were alternately provided to eight adult, individually housed African grey parrots according to a 2x2 cross-over design with 9 day feeding periods. Both diets were similar in nutrient content and ingredient composition but differed in particle size of the composing particles of individual pellets. Each experimental period started with a 4-day adaptation period, followed by a 4-day collection period in which food and water intake, apparent digestibility of macronutrients, excreta production appearance was assessed. The latter was done by calculation of weight–surface ratio of individual excrements as an objective measurement of consistency. Finally, excreta pH was measured directly on fresh excrements during the last day of each feeding period.

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37. Canary birds – just small hens?

Comparative study on digestibility of organic matter in different pet bird species and hens when fed identical diets

Kamphues, J., Frömbling, M. and P. Wolf

Institute of Animal Nutrition, Univ. of Veterinary Medicine Foundation Hannover, Germany

Objectives: The digestive capacity for feedstuffs differ between species; therefore coefficients of digestibility of organic matter (D_{om}) are considered to be species specific. Variations in D_{om} are minor in species with similar gastro-intestinal systems and can vary to a great extent between species with large or small chambers of fermentation in the gastrointestinal tract. Energy contents depend on digestibility. Some feedstuffs are likewise used in the diets of granivorous species and hens.

Against this background a study on 5 different pet bird species and - for comparison – hens fed identical diets with two different types of fibre (lignified versus non-lignified), was carried out.

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Poster Section

38. Amino acid bioavailability in foods (wheat meal, corn, gelatinized corn, sunflower meal with hulls, and citric pulp) used in extruded diets for adult blue-fronted amazons (*Amazona aestiva*)

Lara, L. B¹ ; Saad, F.M.O.B; Saad, C.E.P.; Suguiura, E; Ferreira, W. M.

The present work aimed to estimate the apparent and true bioavailability coefficients of the amino acids in wheat meal, corn, gelatinized corn, sunflower meal with hulls, and citric pulp for adults blue-fronted parrots (*Amazona aestiva*). We used 12 birds randomly distributed in blocks of three experimental periods, making 6 repetitions per food (36 experimental units). The replacement methodology (Matterson, 1965) was followed replacing 29.76 % (natural matter basis) of a reference food and was added 0.24% of premix in each food. All the foods were extruded. The birds were housed individually receiving water and the tested foods *ad libitum* during 13 days (7 for adaptation and 5 for data collecting) for each one of the 3 periods. At the end of the third experimental period all the birds were submitted to a 3 day fast to determine their metabolic and endogenous losses. High Performance Liquid Chromatography (HPLC) was used for amino acid determination.

39. Amino acid bioavailability in foods (dehulled oat seed, powder albumin, egg yolk powder, wheat germ) used in extruded diets for adult blue-fronted amazons (*Amazona aestiva*)

Lara, L. B¹; Saad, F.M.O.B; Saad, C.E.P.; Sugiura, E; Machado, P.A.R

The present work aimed to find the apparent and true bioavailability coefficient of the amino acids in dehulled oat seed, egg yolk powder, whole egg powder, albumin powder and wheat germ for adults blue-fronted parrots (*Amazona aestiva*). We use 12 birds randomly distributed in blocks of three experimental periods, making 6 repetitions per food (36 experimental units). The replacement methodology (Matterson, 1965) was followed replacing 29.76 % (natural matter base) of a reference food and was added 0,240% of premix in each food. All the foods were extruded. The birds were housed individually receiving water and the tested foods *ad libitum* during 13 days (7 for adaptation and 5 for excreta collection) for each one of the 3 periods. At the end of the third experimental period the birds were submitted to 3 days fast to determine their metabolic and endogenous losses. High Performance Liquid Chromatography (HPLC) was used for amino acid determination.

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40. Amino acid bioavailability in foods (brewer's dried yeast, dried papaya, dried banana, soybean meal and micronized soybean) used in extruded diets for adult blue-fronted amazons (*Amazona aestiva*)

Lara, L. B¹, Saad, F.M.O.B; Saad, C.E.P.; Sugiura, E; Ferreira, W. M.

The present work aimed to find the apparent and true bioavailability coefficient of the amino acids in brewer's dried yeast, dried papaya, dried banana, soybean meal and micronized soybean for adult blue-fronted parrots (*Amazona aestiva*). We used 12 birds randomly distributed in blocks of three experimental periods, making 6 repetitions per food (36 experimental units). The replacement methodology (Matterson, 1965) was followed replacing 29.76 % (natural matter base) of a reference food and was added 0.240% of premix in each food. All the diets were extruded. The birds were housed individually receiving water and food *ad libitum* during 13 days (7 for adaptation and 5 for excreta collection) for each one of the 3 periods. At the end of the third experimental period the birds were submitted to a 3 day fast to determine their metabolic and endogenous losses. High Performance Liquid Chromatography (HPLC) was used for amino acid determination.

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41. Nutrient intake, apparent digestibility, excreta quality and sources of faecal protein in African grey parrots (*Psittacus e. erithacus*) fed either a seed mixture or a pellet diet of moderate or high protein content

Kalmar, I.D.¹, Werquin, G.², Janssens, G.P.J.¹

¹Lab. Anim. Nutr., Ghent University, Heidestr. 19, B-9820, ²Versele-Laga Ltd.

Objectives: The present study was intended to provide data on nutrient intake, apparent digestibility and faecal protein fractions in excreta in African grey parrots when fed a seed diet or two pellet diets differing in protein content.

Eight adult African grey parrots (*Psittacus e. erithacus*) with an average body weight of 490 ± 21 g were individually housed in metabolism cages. Body weights were registered at the beginning and at the end of the trial. The birds were randomly assigned into three groups. The experimental design was a 3x3 cross-over trial with 3 test diets: medium protein pellets (pellets A), high protein pellets (pellets B) or a seed mixture. In each feeding period water and food intake and excreta characteristics were measured during 4 days after an adaptation period of 4 days. Excreta characteristics included pH-value, consistency and daily output. Excreta were pooled per bird, per period and were subjected to proximate analysis and uric acid analysis. Next, samples of all test diets and samples of seed remainders were subjected to proximate analysis in order to calculate nutrient intake and apparent nutrient digestibility. Finally, total protein content of excreta was allocated into vegetal, bacterial and animal (endogenous losses) protein by means of fractional protein analysis.

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V. Energy / Nutrient Requirements

Maintenance and Growth

Oral Presentations

42. How to get fat: nutritional strategies in migratory birds

Bairlein, F.

Migration is a period of exceptionally high energy demands. To meet these demands during flight, energy is stored in the bird's body. As fat is the prime fuel for migrating flights many migratory birds therefore accumulate large amount of lipids in adipose tissue prior to and during migration at stopover. Garden warblers, *Sylvia borin*, for example, long-distance European migratory songbirds wintering in tropical Africa, weigh about 16-18 g during the breeding and wintering seasons, but increases its body mass to up to 37 g just before leaving to cross the Sahara, in both autumn and spring. This fat accumulation is under endogenous control reflecting genetically programmed temporal shifts of the body mass set point.

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43. Investigations into protein and energy requirements of macaws for maintenance

Britsch, G., Wolf, P. and Kamphues, J.

Institute of Animal Nutrition, University of Veterinary Medicine, Foundation, Hannover

Only few scientific investigations into protein and energy requirement of macaws in maintenance are published. Due to an impact of excretion mechanisms caused by a protein oversupply or the risks of obesity followed by an energy surplus those data are on interest. **Aim** of the study into adult macaws was a regression derivation of the protein (N-balance = 0) and energy requirement for maintenance offering feedstuffs with different protein or energy contents. As aspected different energy contents led to changes in body mass, but these were not taken into consideration in calculation of protein requirement.

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44. Basic data on nutrition in lorikeets

Häbich, A.-C., Wolf, P. und J. Kamphues

For decades, most scientific studies on psittacine nutrition have focused on granivorous species commonly kept as pets. Therefore, limited data are available on nectarivorous species like Loriidae. Below is an overview of basic data (especially feed intake and energy and protein requirements for maintenance) in different species of lorikeets based on the primary author's own results as well as those of other authors.

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45. Metabolic and endogenous losses of energy, nitrogen, crude protein, uric acid and amino acids in adults Blue-fronted Amazon (*Amazona aestiva*) in captivity

Saad, F.M.O.B;Lara, L. B ; Saad, C.E.P; Sugiura, E; Machado, P.A

The present work has the aim to determine metabolic and endogenous losses of energy, nitrogen, uric acid and the amino acids of fasting blue-fronted amazons. The endogenous losses as well as the nitrogen (N) excretion are normally used as a correcting factor for evaluating the metabolizable energy (ME) and true bioavailability of amino acids in birds. The ingested nitrogen minus the excreted nitrogen results in the nitrogen balance (NB) which is affected by the metabolic and endogenous nitrogen.

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46. Investigations into endogenous losses of nitrogen in adult parrots (*Amazona spp.*) in order to determine the protein requirement at maintenance

Westfahl, C., et al.

Objectives: Measurement of inevitable endogenous N-losses enables estimating the requirement for protein at maintenance, since these losses at least have to be replaced in order to maintain nitrogen equilibrium. *The aim* of this study was to quantify the endogenous losses (net-requirement) via excreta by feeding an almost nitrogen (N)-free diet and calculation of the resulting requirement of protein at maintenance (gross-requirement).

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47. Investigations into endogenous losses of macro minerals in adult parrots (*Amazona spp.*) in order to determine their requirement at maintenance

Westfahl, C., Wolf, P., Kamphues, J.

Objectives: For good health reasons macro minerals should be offered in amounts that are required; oversupply as well as deficiency should be avoided. Animals are known to excrete a certain amount of macro minerals even under the condition of a zero intake (= endogenous or inevitable losses). These losses at least have to be compensated to achieve equilibrium. *The aim* of this study was to estimate macro mineral losses in order to determine the Amazons' requirement for maintenance.

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48. Investigations into energy and protein requirements in growing pet birds

Wolf, P. and J. Kamphues

Institute of Animal Nutrition, University of Veterinary Medicine Hannover, Foundation

Objective: First ideas on factorial derivation of energy as well nutrient requirements of growing pet birds (KAMPHUES and MEYER, 1991; KAMPHUES and WOLF, 1997) were extrapolated from data obtained from poultry, due to the absence of species specific scientific investigations. This transfer was necessary due to a lack of quantitative ideas on the requirement for maintenance as well as utilization of energy and nutrients above maintenance requirement (k-coefficient; resultants of digestibility and intermediate utilization) in pet birds. Due to these absent data in the following study a new approach was proved.

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Poster Section

49. Dietary antioxidants reduce post-exercise oxidative stress in adult budgerigars *Melopsittacus undulatus*

Larcombe, S¹, Tregaskes, C², Coffey, J², Stevenson², A, Alexander², L, Arnold, K¹

¹Division of Environmental and Evolutionary Biology, Institute of Biomedical and Life Sciences, University of Glasgow, Glasgow, United Kingdom.

²WALTHAM Centre for Pet Nutrition, Freaby Lane, Waltham on the Wolds, Leics, LE14 4RT, United Kingdom.

Introduction: Antioxidants are known to play an important role in quenching free radicals produced by metabolism, preventing oxidative stress (Diplock, 2004). Exercise is encouraged in captive animals, owing to its benefits to an animal's health and welfare. However, since increased metabolism associated with exercise will increase oxidative stress, dietary antioxidants may be a limiting factor in determining physical performance, and post-exercise stress (Blount and Matheson, 2005).

Objective: Here we tested this hypothesis by assessing differences in post-flying oxidative stress in captive adult budgerigars, after they received a diet containing either enhanced (EA) or reduced (RA) levels of an antioxidant supplement.

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50. Long term use of the B-Fit guide to monitor body condition of budgerigars

Clarke, E.,

Introduction: Obesity is a commonly reported form of malnutrition in birds and assessment of body condition is a vital part of the physical examination. Whilst body condition scoring (BCS) guides are commonly available for birds, they often require lengthy training to produce meaningful scores. The Bird Fitness Indicator Tree (B-FIT) uses a decision tree of yes-no answers to objectively guide the assessor to a score based on the subcutaneous fat reserves.

The usefulness of a body condition score is dependent on three factors: repeatability, reproducibility and predictability. Previous work showed no significant effect of assessor or occasion and a strong correlation ($R^2 = 0.77$) between body condition score and chemically determined fat content. These results indicated that B-FIT guide is a valid tool but the longer-term accuracy of the B-FIT guide had not been validated. The aim of this work was to evaluate the capacity of B-FIT guide to measure changes in body condition of individual birds over time.

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51. Effect of nectar food dilution and apple on energy and nutrient intake in rainbow lorikeets

Kalmar, I.D.¹, van Loon, M.¹, Bürkle, M.², Reinschmidt, M.²,
Waugh, D.², Werquin, G.³, Janssens, G.P.J.¹

¹*Lab. Anim. Nutr., Heidestr. 19, B-9820*, ²*Loro Parque Fundación*, ³*Versele-Laga Ltd*

Objectives: Commercial nectar foods are available as principal nutrition for most lorikeet species. Because these foods are sold as a powder that has to be diluted before use, the degree of dilution can be determining for overall nutrient and energy intake. Thus, an improper feeding strategy can lead to either weight loss or obesity. Additionally, the diet of captive lorikeets is often supplemented with fruit, and therefore this has to be taken into account as a potential biasing factor for nutrient and energy intake from the “basic” nectar food. The present trial was aimed to reveal the effect of dilution degree of a nectar food and availability of supplemental fruit on nectar food intake, water intake and body weight changes.

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52. Protein requirements for muscovy duck and fulvous whistling duck growth

Carciofi, A.C., Valente, F.A.V., Sanfilippo, L.F., de-Oliveira, L.D., Prada, F.

Objective: This investigation aimed to evaluate the protein requirements for growth of two waterfowl species.

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VI. Nutrition in Avian Medicine
*Disorders, Diagnostics, Dietetics, Hand
Rearing*

Oral Presentation

53. Frequently observed nutritional disorders in veterinarian avian practice – an overview 1992 – 2004

Hochleithner C und [Hochleithner M](#)

Material and Method:

In the time between 1992 and 2004 55 673 birds from pet bird owners have been presented to our clinic and have been examined. Different diseases and symptoms have been correlated to nutritional disorders and will be discussed. Seasonal changes as well as changes over the years in the appearance of diseases will also be discussed.

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54. Nutritional disorders in African greys kept as companion birds in Germany

Bürkle M.

Clinic for pet birds and exotic animals, Karlsruhe

Nutritional disorders are seen frequently in avian and exotic medicine and are described not seldom in literature. From January 2005 to June 2007, 432 African Grey parrots (*Psittacus erithacus spp.*) were presented for clinical examination. This contribution is reviewing the nutritional history of the birds, their clinical examination, haematological and biochemical values. Biochemistries were performed using the VetScan classic and VS2 (ABAXIS, USA). Haematological examinations were performed in the in-house laboratory. This review shows a correlation between blood biochemistry values, clinical symptoms and the nutritional history of the birds.

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55. Nutritional disorders in captive psittacine birds in brazil

Werther, K., Pereira, M.E., Costa, T. P., Nery C. V. C., Candioto, C. G., Carciofi, A.C.

Introduction and objectives: This paper shows the occurrence of nutritional disorders in psittacines in Brazil. Especially amazon parrots are very common as a pet animal in Brazil. Frequently the animal is captured very young in the wild and maintained in captivity with inadequate diet, causing a lot of nutritional disorders and malnutrition, both viewed also at adult animals, because of the intake of home made food.

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56. Thiamine in Northern Goshawks (*Accipiter gentilis*) – typical deficiency syndrome and diagnosis

Carnarius, M., Hafez, H.M., Henning, A., Henning, H.J. and Lierz, M.

Between 2002 and 2006 an increased number of juvenile Northern goshawks (*Accipiter gentilis*) with central nervous symptoms were presented. Typically the birds showed these disorders at an age of 45-55 days and were fed with thawed day-old chicks. As a reason a thiamine deficiency was suspected.

The birds demonstrated opisthotonus, rotations and somersaults above all when the birds were handled or stressed. The birds showed thiamine- whole-blood values of 2.2µg/l -6.0µg/l with no other pathological findings (including blood values) present.

After the treatment of the first case with an initial intramuscular injection of 4mg/kg thiamine hydrochloride (Vitamin B-Komplex; Serumwerke Bernburg AG), continued over a period of five days of 2mg/kg thiamine hydrochloride (Thiamin Kapseln – Vitamin B1; Vaniplan-Pharma GmbH) orally SID, the blood thiamine level of this bird increased to 476 µg/l.

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57. Vitamine E- reference values in captive falcons and their interpretation

Schink, B., Hafez, H.M. and Lierz. M.

The present study was performed to determine reference values for α -Tocopherol (α -TOC) in falcons and to investigate influences of different diets. Twenty-nine falcons were randomly selected from a collection of 500 captive breeding falcons, fed on four-weeks-old chicken, and α -TOC concentrations in plasma were analyzed. Reference values ranged from 16.77 to 46.05 mg/l with a mean circulating α -TOC of 27.54 ± 8.72 mg/l. A group of 5 falcons were fed day-old chickens for several weeks resulting in a mean α -TOC blood-concentrations of 34.9 ± 5.61 mg/l. Changing their diet to turkey-breast meat for 4 weeks reduced plasma values significantly (13.1 ± 2.63 mg/l). The study clearly demonstrates the dependence of Vitamin E values on different diets- The reference values allow an estimation of the nutritional quality of the food in a falcon breeding population and may led to a suspicion of deficiency e.g. in case of a poor breeding performance.

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58. Measurement of bone mineral content and density in avian species

Liesegang A., Messikommer R., Fischer I.

Objectives: The bone parameters commonly used to investigate bone mineral quality are bone ash, bone breaking strength and atomic absorption spectrophotometry for the determination of mineral concentrations. The main disadvantage of these methods is that either the bone itself or a bone biopsy are needed to perform an analysis. Peripheral quantitative computer tomography (pQCT) is a non-invasive technique commonly used to measure bone mineral content (BMC) and bone mineral density (BMD) in vivo. PQCT is used diagnostically in humans to assess osteoporosis and has been adapted to measure bone quality in vivo in poultry and other animal species. In this study, different avian species were measured and compared to get an idea of differences in bone quality in vivo.

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59. Guidelines for the assessment of sequential blood chemistry panels in scientific studies

Scope, A., Schwendenwein, I.

Monitoring of clinical chemistry parameters is common practice in clinical studies. Usually data are tested for significance. Often any statistically significant change is interpreted as a biological change but as data show a more differentiated approach is required.

The critical evaluation of the significance of changes in results obtained by analysis of serial samples can be performed only after consideration of biological variation in combination with analytical variation. The so-called critical difference is the change needed between two serial results to indicate an actual biological change and can be calculated from the variability of the parameter.

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60. Hematologic and Biochemical Reference Ranges for Budgerigars: Are They Really “Normal” and Clinically Useful?

Harrison, G.J.

The authors of two recent articles failed to observe significant health issues in birds that died during their studies and accepted hematology and biochemistry results as normal.^{1,2} These studies reflect similar results seen in articles up to 3 decades earlier.

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61. Investigations of zinc levels in pet birds suspected of chronic zinc intoxication

Kothe, R., Wolf, P. and Kummerfeld, N.

In the literature both acute zinc intoxication (associated with increased mortality, nephropathy and central nervous and gastro-intestinal disorders; Levensgood et al. 2000) and lack of this trace element (associated with parakeratosis, skeletal disorders and an impaired immune response; Spears 2007) have been described. In addition, chronic zinc intoxication (CZI) may result in anaemia, nephropathies, exocrine pancreas insufficiencies and haematological changes. Diagnosis of CZI can be difficult due to an insufficient clinical history and the delayed onset of symptoms. In these patients increases in zinc levels were not found in plasma but could be identified in the pancreas, the kidneys and occasionally in the liver (Lü and Combs 1988). The purpose of this study was to test the diagnostic value of plasma zinc levels in birds suspected of CZI.

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62. The Role of Manganese in Iron Storage Disease

Ryan, T

Objective: Iron storage disease is an excessive accumulation of iron in the liver and other organs resulting in hepatic dysfunction attributed to iron toxicosis. This term must be differentiated from hemosiderosis and hemochromatosis. Iron storage disease has been reported especially in toucans, mynahs, birds of paradise, starlings and to a lesser extent psittacines.

When iron levels increase, damage occurs to the lysozymes resulting in the release of ionic iron and this causes oxidative damage to membranes and proteins. These damaged cells may be replaced by fibrosis. The resultant hepatic fibrosis results in hypoalbuminemia, ascites and respiratory-cardiovascular collapse.

Although the exact cause is not known, various theories have been proposed.

1. Genetic-Certain species may have developed very efficient mechanisms to extract dietary iron. Fruits and insects are usually poor sources of dietary minerals.
2. Excessive dietary levels of iron. One study found that the iron concentration of food items ingested in the wild by keel billed toucans averaged less than 50mcg/g in 7 of 15 items consumed. In contrast, commercial avian diets had 210 mcg/g.
3. Cofactors that inhibit or increase absorption.

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63. The influence of fructo-oligosaccharides and lactose supplementation on apparent digestibility and *Salmonella* excretion during salmonellosis in pigeons (*Columba livia domestica*)

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Objectives. Several experiments in broiler chickens have demonstrated that prebiotic oligosaccharides like lactose and fructo-oligosaccharides can decrease the incidence of *Salmonella* infections. The differences in gut morphology between chicken and pigeon made it worthwhile studying the effect of these prebiotics on disease resistance and the recovery of digestion in pigeons infected with *Salmonella* Typhimurium var. *Copenhagen*, a prominent intestinal pathogen in the pigeon.

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64. Hand rearing of pet birds – diverse aspects

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Hand rearing of pet birds became more and more important within the last years, because it serves the conservation of endangered species.

Feeding of the youngs is done with so-called home made diets (based on baby food, rusk meal, cooked egg yolk or egg powder) as well as with commercial hand rearing diets. These diets have to be diluted in different proportions with warm/hot water and directly applicated by a tube into the crop or beak (later by a syringe or a teaspoon). Per meal on average 10% of the actual body mass are applied. The feeding frequency depends on the passage time of the chyme. A new application of mush should not be done until the crop is nearly emptied (in budgerigars and lovebirds in general after 1,5 up to 2 hours). The evaluation of the mixed feed should be done firstly by a critical sensory proofment (colour: similar or differing to the previous butch? odour: rancid? Smell: salty?). The assessment of the homogeneity of the mixture as well as the capacity of expansion led to a first impression. For example, some of these diets showed a strong swelling (firm consistency after 10 minutes) resulting in risks of passage disorders (crop stasis).

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65. Suspected hypervitaminosis in artificially reared psittacine nestlings

Krautwald-Junghanns M.-E., Schmidt V., Stelzer G., Wolf P., Cramer K., Bartels T.

For the main part only generalised recommendations concerning vitamin requirements of pet birds were available at the time of this investigation. Administration of the recommended vitamin supply generally seems to work well in practice, but the decision for a specific dosage is largely empirically based and not supported by scientific investigation. Species differences in vitamin requirements are rather likely, not the least because of varying food spectra (granivorous, frugivorous, nectarivorous etc.) and geographical origins (neotropical, afrotropical, oriental or australasian region). Recommendations for vitamin allowances are mostly aimed at adult birds, and it has to be considered that the vitamin demand is generally higher during growth.

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Poster Section

66. Investigations into potential adverse effects of high doses of vitamin K₃ in the diet fed to lovebirds (Agapornis spp.)

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Objectives: For many years, diets of several species were usually supplemented with vitamin K₃ (menadione). However, in the late 90's, some articles on toxic effects of vitamin K₃ in pet birds were published in magazines for pet bird fanciers, on the internet and in veterinary journals. Against this background the following study was carried out with lovebirds in order to test if various dosages of orally administered vitamin K₃ could result in negative effects on pet birds' health. Diets with 3 levels of supplemental vitamin K₃ were offered: none, moderate and excessively high.

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67. Efficacy of pro- and prebiotics on E. coli- and Campylobacter-infections of canaries (Serinus canaria)

Auerbach, M. I. and Glünder, G.

Probiotics as microorganisms and prebiotics beneficially affect the host animal by improving microbial balance of the intestinal tract. ToyoCerin®, Cylactin®, BioPlus 2B® and Bene-Bac® as probiotics and Bio-Mos® and MacroGard® as prebiotics were tested for the ability to stabilize the intestinal flora and prevent bacterial infections of pet birds.

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68. Effect of nectar food dilution degree and pollen on body condition, body weight and breeding performance in the nectarivorous parrot population at Loro Parque Fundacion

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Objectives. A previous study demonstrated that the dilution degree of nectar food in combination with the provision of fruit could alter energy intake in two species of rainbow lorikeets. The present study aimed to evaluate this strategy on body condition score (BCS), body weight and breeding performance in a large group of diverse nectarivore parrot species.

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69. Influences of different feed additives on feather growth and moulting into pet birds (Agapornis spp.)

Jürgens, N., Wolf, P. and Kamphues, J.

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Pet food industry offers a high variety of supplementary feeds/products whose data on the label promote an undisturbed moult and an improved feather quality. These products are mainly supplemented with different minerals, vitamins or amino acids and the dosages correspond to recommendations for poultry. Up to now there are only few scientific investigations regarding the potential effects of these additives mentioned above on feather growth and quality, respectively. **Aim** of this study was an investigation of influences of such additives like selenium, zinc, copper, vitamins, sulphur containing amino acids or silicea on feather growth and moulting in pet birds.

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70. Iron storage disease (haemosiderosis) in blue-masked leafbirds (*Chloropsis venusta*)

Legler, M., Kummerfeld N., Wolf P.

The Blue-masked leafbird (*Chloropsis venusta*), the smallest member of the family of leafbirds (*Chloropseidae*; genus *Chloropsis*) is endemic to Sumatra. The leafbirds are a small group of passerines found throughout tropical and subtropical forests in indomalayan asia. In general, birds of this familiy are fruit eaters and nectar feeders, they also eat insects and spiders.

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71. Case study of idiopathic hyperlipideamia in a macaw

Ryan, T.

Introduction: Hyperlipidemia and hypercholesteremia is well documented in psittacines. This case report traces a five year history of a twenty five year old male Blue & Gold Macaw for persistently elevated cholesterol and hyperlipidemia. This macaw was treated with a variety of medications and dietary adjustments over this time period.

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72. Evaluation of Policosanol to control hyperlipidemia

Ryan, T.

Objective: Policosanol is a mixture of long chain alcohols being advocated as a non-prescription safe way of lowering blood cholesterol levels. It is found in sugar cane, beeswax, yams, rice bran, and wheat germ. Policosanol has been advocated a cholesterol lowering agent in people¹⁻¹⁰, rabbits¹¹⁻¹³, and birds¹⁴⁻¹⁵. The purpose of this study was to investigate the use of policosanol in the treatment of hypercholesteremia in pet psittacines. A variety of psittacines and dosing were used. These birds were on a variety of diets. It was decided not to do dietary change would play in any cholesterol level changes and second there was no way to verify the information that owners provide. The ages of the birds were not included in the study since we could not verify the accuracy of the information provided.

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73. Zinc intoxication in budgerigars (*Melopsittacus undulatus*)

Wolf, P.¹, Haupt, C.² and Kamphues, J.¹

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²*Clinic for companion animal, Frankfurt*

Introduction: Whereas zinc intoxication is a well documented incident in food producing animals, scientific studies on zinc tolerance or limits as well as case reports on zinc intoxication in pet birds are seldom (there is a case report in monk parakeets published by DORRESTEIN et al. 2002). However, it has to be assumed, that incidence of zinc intoxications is higher as reported, particularly when birds are kept in new aviaries („new wire disease“). Typical clinical symptoms are not obviously withal and sometimes birds have perished before a clinical checkup has carried out.

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