How to choose a pelleted product: Manufacturer portfolios, feeding instructions, product promotion and nutritional knowledge

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EAZA Acadmey Liberec 2017

University of Zurich[UZH]

Clinic of Zoo Animals, Exotic Pets and Wildlife

EAZA ACADEMY

Choosing a specific diet I

- Following your own specifications (basically, having a nutritionist on your payroll):
    - knowledge of requirements
    - concept of feeding regime

=> look for a diet that meets your specifications

or

=> have a diet produced according to your specifications

Commercial manufacturers are suppliers of a choice or service, but not consultants. Catalogues are only a selection of your choice of options (which you might want to expand by ordering the production of a specific diet).

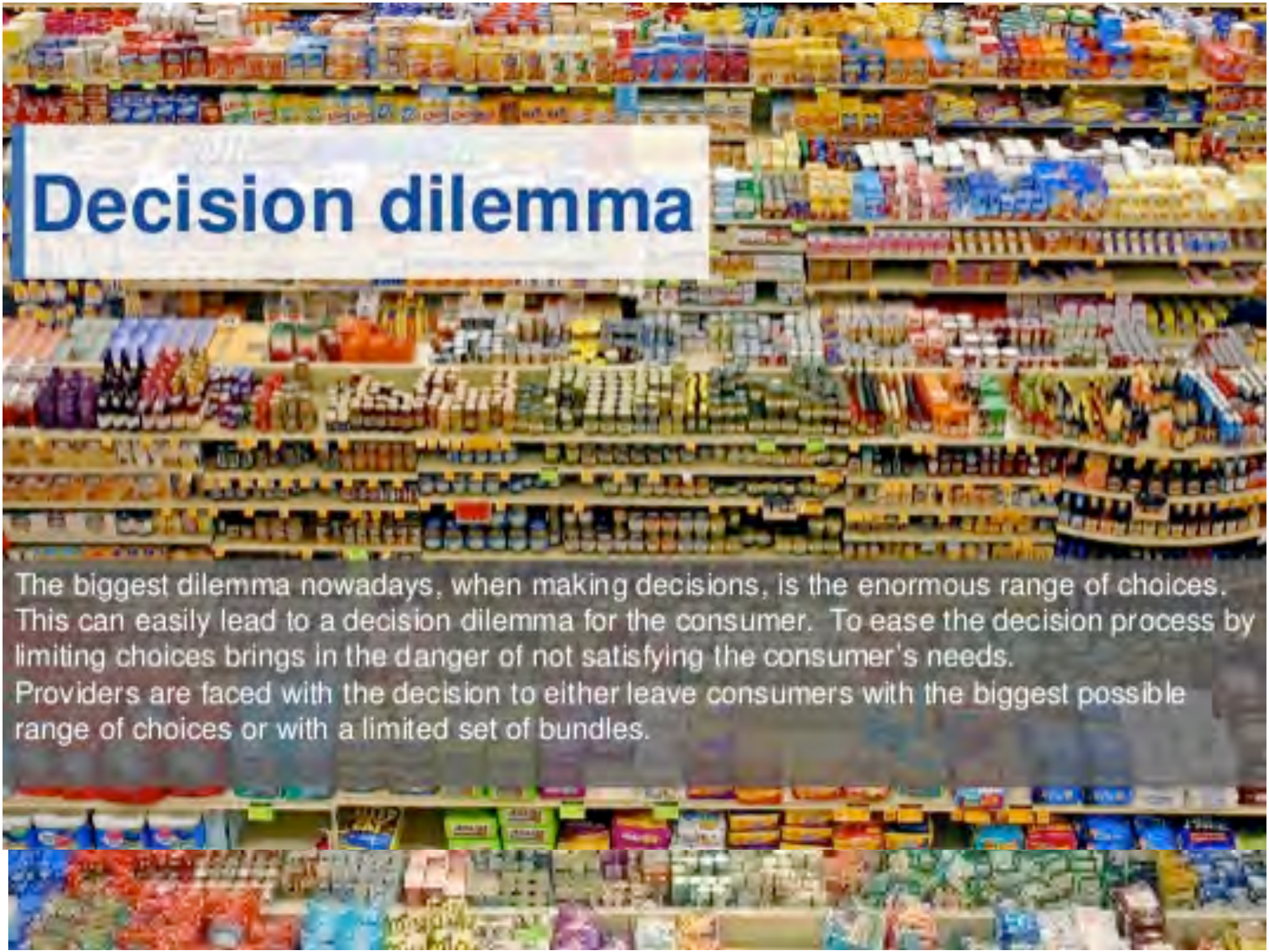
Choosing a specific diet II

- You do not really know

⇒ *check (amongst other sources) manufacturer catalogues for potential solutions*

=> ask manufacturer or retailer for suggestions

Commercial manufacturers are suppliers and also consultants. The dilemma typically is that consultation is considered a free service and manufacturers can only earn money if selling their products.


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.

The overriding question

- How do you judge whether a manufacturer is not only a trustworthy supplier but also a trustworthy consultant?

=> look of web page/catalogue
=> correctness completeness of information
=> the nutritional approach / philosophy
communicated by the portfolio, the advertisement, the recommendations

Or, as commercial manufacturers, how do you convince potential clients that you are a trustworthy consultant?

Correct information

- Are there evident mistakes in the given information?

Correct information

HIGH FIBER PRIMATE DIET

9021

This diet is designed to be fed as the sole source of nutrition for ALL primates with the exception of tamarins and marmosets. This diet incorporates all of the latest innovations and technical developments.

* No wheat gluten product
* All vegetable–no animal fat or protein
* Patented source of vitamin C with a shelf life of near infinity
* Extended shelf life–if properly stored, up to six months
* Higher fiber content–typically testing 18 to 20 percent ADF (acid detergent fiber)
* All natural source of vitamin E (d-alpha-tocopherol)
* Low iron content
* Probiotics (*Lacctobacillus acidophilus, L. casie, Bifido, and Enterococcus faecium)*
* Metal Amino Acid Complex added for chelate mineral benefits
* Form and texture which promotes good gum health and reduction in dental plaque

FEEDING DIRECTIONS

Feed as sole source of nutrition but if produce or browse is fed, the HIGH FIBER PRIMATE DIET should comprise no less than 50% of dry matter intake. Eliminate or severely limit the feeding of high sugar and high carbohydrate produce such as bananas, grapes, and oranges. Use leafy fiborus items such as kale, celery and lettuce.

Adult consummation rate is approximately 1 pound for each 30 pounds of body weight. This will vary from animal to animal and should be used as a rough guide only.

INGREDIENTS

GROUND CORN, DEHYDRATED ALFALFA, CORN GLUTEN, SOYBEAN MEAL,SOYBEAN OIL, GROUND SOYBEAN HULLS, LIMESTONE, ZINC OXIDE, SALT, MANGANOUS OXIDE, COPPER SULFATE, DICALCIUM PHOSPHATE, CHORINE CL, DRIED LACTOBACILLUS ACIDOPHILUS FERMENTATION PRODUCT, L-LYSINE, BIOTIN, SOURCE OF VIT. C, METAL AMINO ACID COMPLEX , YEAST CULTURE, VIT. E SUPPLEMENT, NIACIN SUPPLEMENT, CALCIUM PHOSPHATE, MANGANESE OXIDE, CALCIUM IODINATE, COPPER SULFATE, ZINC OXIDE, SODIUM SELENITE.

CALCULATED NUTRIENTS

CRUDE PRO.....23.80% MIN
CRUDE FAT.....4.60%
CRUDE FIBER.....9.00%

ASH.....6.20%
ME.....2598.70CAL/kg
CALCIUM.....0.90%
PHOSPHORUS.....0.62%
POTASSIUM.....0.84%
SODIUM.....0.21%
COPPER.....11.80PPM
IODINE.....0.60PPM
IRON.....300.00PPM
MAGNESIUM.2305.00PPM
MANGANESE.....45.00PPM
POTASSIUM.....0.80PPM
SELENIUM.....0.02PPM
ZINC.....111.11PPM
VITAMIN D3.....1.5IU/g
VITAMIN A.....25.60IU/g
VITAMIN E 132.0IU/kg
BIOTIN.....0.09mg/kg
CHOLINE.....1145.00mg/kg
NIACIN.....46.00mg/kg
PANTOTHENIC.22.00mg/kg
RIBOFLAVIN.....9.00mg/kg
THIAMINE.....4.00mg/kg
VITAMIN B12.....0.02mg/kg
VITAMIN C.....100.00mg/kg

Correct information

Browser Rhino Plus Diet

Description

Browser Rhino Plus Diet is a nutritionally balanced starch-, phosphorus- and iron- controlled blended diet designed for captively managed herbivores with increased energy demands.

Features and Benefits

- **Nutritionally balanced.**
- **High in fermentation fibers** - Provides energy and supports healthy rumen.
- **Starch controlled (<4.0%).**
- **Reduced phosphorus and iron formulation.**
- **Highly palatable** - Enhanced by beet pulp and molasses addition.
- **Contains flaxseed** - Source of Omega-3 fatty acids.
- **Naturally preserved with mixed tocopherols.**

Product Form

Wet pelleted feed: ¼" diameter x ½" to ¾" length, with molasses.

- 40 lb. net weight paper sack

Guaranteed Analysis

Crude protein not less than	13.0%
Crude fat not less than	7.5%
Crude fiber not more than	30.0%
Ash not more than	9.0%

Calcium not less than	0.55%
Calcium not more than	1.05%
Phosphorus not less than	0.40%
Salt not less than	0.15%
Salt not more than	0.65%
Sodium not more than	0.85%

Correct information

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Product Form

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- 40 lb. net weight paper sack

Guaranteed Analysis

Crude protein not less than	13.0%	Calcium not less than	0.55%
Crude fat not less than	7.5%	Calcium not more than	1.05%
Crude fiber not more than	30.0%	Phosphorus not less than	0.40%
Ash not more than	9.0%	Salt not less than	0.15%
		Salt not more than	0.65%
		Sodium not more than	0.85%

Correct information

Designed in conjunction with Mr Richard Knock of the Zoological Society of London at Whipsnade Park, and from the publications of Professor Hoffman at Giessen in Germany.

Journal of Zoo and Wildlife Medicine 23(2): 230–234, 1992

HEMOSIDEROSIS IN THE BLACK RHINOCEROS (*DICEROS BICORNIS*): A COMPARISON OF FREE-RANGING AND RECENTLY CAPTURED WITH TRANSLOCATED AND CAPTIVE ANIMALS

Nancy Kock, D.V.M., M.S., Chris Foggin, B.V.Sc., Ph.D., Michael D. Kock, B.Vet.Med., M.P.V.M., and Richard Kock, M.A., Vet.M.B.

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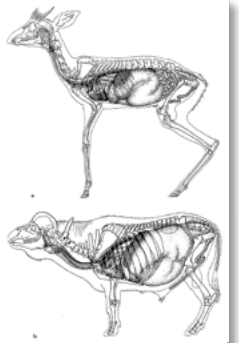
Evolutionary steps of ecophysiological adaptation and diversification of ruminants: a comparative view of their digestive system*,**



R.R. Hofmann

Information policy

- Is the labelling proactively informative (in particular, are all ingredients listed in meaningful terms), or does the labelling only conform to legal requirements?

Information policy

Ingredients

Soya Bean Meal, Soya Oil, Molasses, Oat Byproduct, Grass Meal, Cellulose Powder, Vitamin and Mineral Premix.

Soya Bean Hulls, Lucerne, Oat Hulls and Bran, Dehulled Extracted Toasted Soya, Molasses, Soya Bean Oil, Minerals and Vitamins.

Ingredients

Ground aspen, dried beet pulp, dehydrated alfalfa meal, dehulled soybean meal, soybean oil, cane molasses, sucrose, salt, magnesium oxide, dicalcium phosphate, calcium carbonate, monosodium phosphate, potassium phosphate dibasic, l-lysine, l-ascorbyl-2-polyphosphate (stabilized vitamin C), inositol, dl-methionine, choline chloride, d-alpha tocopheryl acetate (form of vitamin E), pyridoxine hydrochloride, copper sulfate, menadione sodium bisulfite complex (source of vitamin K), calcium iodate, thiamine mononitrate, zinc oxide, cholecalciferol (form of vitamin D_3), folic acid, biotin, calcium pantothenate, vitamin A acetate, vitamin B_{12} supplement, riboflavin supplement, nicotinic acid, cobalt carbonate, sodium selenite.

Information policy

Storage Conditions

For best results, store contents of open paper sack in container with sealing lid. Store in a cool (75°F or colder), dry (approximately 50% RH) location. Freezing will not harm the diet and may extend freshness. Use within 1 year of bag manufacturing.

Diet design

- How up to date and how logical is the formulation of an individual diet?

Laboratory Animal Science

Vol 47, No 2
April 1997

Hepatic Hemosiderosis in [redacted] Common Marmosets, *Callithrix jacchus*: Effect of Diet on Incidence and Severity

Georgina F. Miller,[1] Dennis E. Barnard,[1] Ruth A. Woodward,[1] B. Michael Flynn,[1] and Jeff W. M. Bulte[2]

Abstract | We examined the effect of dietary iron concentration on the incidence of hepatic hemosiderosis in common marmosets (*Callithrix jacchus*) and assessed the impact of hemosiderosis on animal health. Thirteen young adult common marmosets were fed nutritionally balanced natural-ingredient diets formulated to contain either 100 or 500 ppm of iron. Six were fed the low-iron and seven received the high-iron diet. Baseline blood values and liver iron content were determined for each animal. Animals were weighed monthly, blood work (hematologic analysis, serum iron concentration, total iron-binding capacity, percent of transferrin saturation) was performed semi-annually, and liver biopsies for iron analysis were obtained after marmosets had consumed the test diets for 13 months or at necropsy. Midway in the study, the high-iron diet was reformulated to contain 350 ppm of iron because of the death of a male which had consumed that diet for 7 months. Four of seven marmosets fed the high-iron diet died during the first year of the study, compared with one death in the low-iron cohort. The mean increase in liver iron content of the marmosets fed the high-iron diet was 6,371 µg/g, dry weight analysis. In contrast the low-iron cohort had a mean decrease of 621.5 µg/g. These results indicate that liver iron content can be affected by dietary iron intake. The increased mortality in the marmosets fed the high-iron diet also suggests that hepatic hemosiderosis can be detrimental to marmoset health.

Diets containing high concentrations of iron fed to marmosets in captivity are the cause of hepatic hemosiderosis. Commercial marmoset diets vary greatly in their iron content. New World Primate Diet 5040 (PMI Feeds, Inc.,) contains 381 ppm of iron; NIH-48 marmoset diet (Zeigler Bros., Inc., Gardners, Pa.) contains 380 ppm of iron; and Zu/preem canned marmoset diet (Hill's Pet Nutrition, Inc.) contains 20 ppm of iron. In this study the relative contribution of the 500 and 350 ppm diets to the iron accumulation is unclear. Results from a single marmoset indicate that a diet containing as little as 350 ppm of iron can cause substantial iron accumulation. Marmoset F2 was obtained at 7 months into the study and received the 500-ppm iron diet for only 2 weeks. It died after 4.5 months of consuming the 500-ppm iron diet; in that time its liver iron content had increased from a baseline value of 1,215 µg/g to 10,337 µg/g, greater than an eightfold increase.

Marmoset

2002

Suitable Species

Marmosets and other small New World Primates.

Nutritional Benefits

- Fortified with stable form of Vitamins C.
- Small pellets for easy handling by small animals.
- Provide all essential nutrients which may not be found in fresh raw foods.

Ingredients

Wheat, Maize, Wheatfeed, Soya Bean Meal, Dried Yeast, Poultry Meat Meal, Whey Powder, Soya Oil, Vitamins and Minerals Mix.

Feeding Recommendations

Normally fed with supplementation of fresh foods for enrichment but can be fed as a complete diet.
Food should be introduced gradually to avoid digestive upsets.
Should form about 20-25% of the total daily food intake and this will provide about 50% of the micro-nutrient requirement with a valuable protein boost.

Marmoset

Crude Oil	%	7.50
Crude Protein	%	25.40
Crude Fibre	%	3.70
Ash	%	10.50
N.F.E.	%	42.90
Starches	%	27.80
Sugars	%	7.80
Gross Energy	MJ/Kg	15.80
Dig. Energy	MJ/Kg	13.30
Met. Energy	MJ/Kg	12.00
Linoleic Acid	%	2.12
Linolenic Acid	%	0.27
Calcium	%	2.16
Phosphorus	%	1.46
Phytate Phosphorus	%	0.18
Sodium	%	0.33
Chlorine	%	0.45
Potassium	%	0.81
Magnesium	%	0.29
Iron	mg/Kg	358.00
Copper	mg/Kg	18.00
Manganese	mg/Kg	85.00
Zinc	mg/Kg	71.00
Cobalt	µg/Kg	2018.00
Iodine	µg/Kg	3379.00
Selenium	µg/Kg	232.00
Fluorine	mg/Kg	54.00
Vitamin A	IU/Kg	30142.00
Vitamin D_3	IU/Kg	11640.00
Vitamin E	mg/Kg	105.60
Vitamin B_1	mg/Kg	27.70
Vitamin B_2	mg/Kg	18.20
Vitamin B_6	mg/Kg	14.10
Vitamin B_{12}	µg/Kg	39.40
Vitamin C	mg/Kg	2966.00
Vitamin K_3	mg/Kg	5.30
Folic Acid	mg/Kg	10.20
Nicotinic Acid	mg/Kg	92.70
Pantothenic Acid	mg/Kg	37.30
Choline	mg/Kg	1951.00
Inositol	mg/Kg	1649.00
Biotin	µg/Kg	398.00

Ingredients

Wheat, Barley, Wheatfeed, Soya Bean Meal, Exp. Linseed Cake, Soya Oil, Molasses, Oat Byproduct, Grass Meal, Vitamin and Mineral Premix.

Ingredients

Wheat, Wheatfeed, Soya Bean Meal, Soya Hulls, Soya Oil, Glucose, Molasses, Grass Meal, Cellulose Powder, Vitamin and Mineral Premix.

Grazer

Suitable Species
All Grazing Ruminants.

Nutritional Benefits
- No non-nutrient feed additives, such as antibiotics and growth promoters.
- Contains high levels of starch and low levels of sugars suitable for these specialised feeders.

Ingredients
Wheat, Barley, Wheatfeed, Soya Bean Meal, Exp. Linseed Cake, Soya Oil, Molasses, Oat Byproduct, Grass Meal, Vitamin and Mineral Premix.

Feeding Recommendations
Designed as concentrate feeds to supplement normal grazing and bulk feeds.

Browser Maintenance

Suitable Species
All Browsing Ruminants.

Nutritional Benefits
- Contains high levels of sugar and low levels of starch suitable for these specialised feeders.
- No non-nutrient feed additives, such as antibiotics and growth promoters.
- Contains high levels of Essential Fatty Acids.
- Adequate levels of Vitamin E and Selenium.

Ingredients
Wheat, Wheatfeed, Soya Bean Meal, Soya Hulls, Soya Oil, Glucose, Molasses, Grass Meal, Cellulose Powder, Vitamin and Mineral Premix.

Feeding Recommendations
Normal daily allowance would be about 1Kg per 100Kg bodyweight per day, plus adequate good quality browse.

Additional Information
Can be used with Browser Breeder Diet to provide a complete nutritionally balanced diet throughout the animals life.
Browser rations are specialised and cannot be obtained from normal feed manufacturers.

Ingredients

Wheat, Barley, Wheatfeed, Soya Bean Meal, Exp. Linseed Cake, Soya Oil, Molasses, Oat Byproduct, Grass Meal, Vitamin and Mineral Premix.

Ingredients

Wheat, Wheatfeed, Soya Bean Meal, Soya Hulls, Soya Oil, Glucose, Molasses, Grass Meal, Cellulose Powder, Vitamin and Mineral Premix.

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Ingredients

Soya Bean Meal, Soya Oil, Molasses, Oat Byproduct, Grass Meal, Cellulose Powder, Vitamin and Mineral Premix.

Moose

Suitable Species

Moose and other similar species which are unable to efficiently utilise Cellulose and Starch.

Nutritional Benefits

- Starch reduced to approximate natural foods and to parallel the seasonal changes in nutrient density of these natural foods.
- Adequate amounts of minerals and vitamins.
- Contains 2.5% Sodium Bicarbonate which helps prevent acidosis and supplies bicarbonate ions which are essential for cellulytic bacteria.

Ingredients

Soya Bean Meal, Soya Oil, Molasses, Oat Byproduct, Grass Meal, Cellulose Powder, Vitamin and Mineral Premix.

Feeding Recommendations

Provide complete nutritional requirement throughout the year.
Diets should be fed together with good quality browse.

Diet design

Brand name	Crude fibre (% DM)
Herbivore 16-ADF[1]	16.7
Herbivore 25-ADF[1]	25.6
Browser breeder[1]	27.8
Browser maintenance[1]	31.1
Moose maintenance[1]	35.6
Grazer[2]	11.2
Browser breeder[2]	18.6
Browser maintenance[2]	21.4
Moose[2]	24.0

[1] Mazuri∃ (PMI, St. Louis, USA)
[2] Mazuri™ (SDS, Essex, UK)

from Clauss & Dierenfeld (2008)

Recommendation rationale

- Do recommendations follow an evident logic?

Recommendation rationale

As a guide for Giant Anteaters feed:

For Maintenance 15g of powder/kg BW/d
(BW= Body Weight)

As a guide for Aardvarks feed:

For Maintenance feed 13g of powder/kg BW/d

An analysis of the factors that influence the level and scaling of mammalian BMR

Brian Keith McNab *

Comparative Biochemistry and Physiology, Part A 151 (2008) 5–28

Species	Mass (g)	BMR (kJ/h)
Myrmecophaga tridactyla	30600	52.23

Species	Mass (g)	BMR (kJ/h)
Orycteropus afer	48000	123.37

=> 96 kJ / $kg^{0.75}$ / d
(or 41 kJ / kg / d)

=> 162 kJ / $kg^{0.75}$ / d
(or 62 kJ / kg / d)

Correct, comprehensive information

Soft-Bill Diet

Description

Soft-Bill Diet is designed for soft-bill birds of all ages, including parent birds caring for their young.

Features and Benefits

- **Nutritionally complete for adult fruit-eating birds** - No supplementation necessary.
- **Extruded Nugget** - Highly palatable and has a nine month shelf life.
- **Each batch is analyzed for iron content** - Allows for proper feeding of iron sensitive species.
- **Contains only natural vitamin E** - Vitamin E comes from only natural sources.
- **Contains mixed tocopherols** - All natural antioxidant.
- **Contains enhanced carotenoid levels** - Serve as natural antioxidants and pigments.

Product Form

- Extruded Pellet: 3/16" diameter x 1/2" length. 15 lb. net weight paper sack.

Guaranteed Analysis

Crude protein not less than 20.0%
Crude fat not less than 8.0%
Crude fiber not more than 5.0%
Ash not more than 7.0%

Ingredients

Wheat flour, wheat germ, soy protein concentrate, corn gluten meal, soybean oil, dicalcium phosphate, brewers grains, brewers dried yeast, sucrose, calcium carbonate, tagetes extract, L-lysine, salt, calcium propionate, powdered cellulose, DL-methionine, choline chloride, menadione dimethylpyrimidinol bisulfite (vitamin K), pyridoxine hydrochloride, biotin, d-alpha tocopheryl acetate (natural source vitamin E), L-threonine, tocopherols (a preservative), cholecalciferol (vitamin D_3), folic acid, manganese sulfate, canthaxanthin, zinc sulfate, vitamin A acetate, riboflavin, cyanocobalamin (vitamin B_{12}), nicotinic acid, thiamin mononitrate, calcium pantothenate, copper sulfate, calcium iodate, sodium selenite.

Feeding Directions

This diet is appropriate for many bird species and is useful when desiring to control dietary iron. Each batch of Soft-Bill Diet is analyzed for iron and the analyzed iron concentration is made available to all customers via the website at www. To switch birds from fruit mixes (or any diet they are currently being fed) to Soft-Bill Diet, do a gradual change over. Start with 10% Soft-Bill Diet and 90% of their customary diet. Each day increase the amount of Soft-Bill Diet by 10% and decrease the amount of the customary diet correspondingly. This diet should be fed at a rate of at least 70% of their daily intake, with the remainder being fruits, vegetables and enrichment items. During the switchover period, as well as for the first week after the switchover, it is critical that birds be observed carefully. Monitor the birds weight and behavior. If the bird loses weight, or if the bird is not consuming the product, offer a 50:50 mix of product and the customary diet. After the bird has stabilized and started to consume the product, continue the conversion process.

For critically iron sensitive species (i.e. Toucans and Mynahs), avoid the addition of high iron food items (e.g. meat, dog food) and stick with items which are consistently low in iron (e.g. Papaya, apple, and other high moisture fruits). For other omnivorous species of birds, food items with higher iron concentration may be appropriate, with the minimum 70% of intake as Soft-Bill Diet serving to reduce the overall dietary iron concentration. Consult your avian veterinarian to determine how iron sensitive your species, or individual bird, may be.

This diet is designed for birds after their first molt. Female birds which are heavy layers (more than 20 eggs per season) should have calcium supplementation in the form of pure, pharmaceutical grade, calcium carbonate at a rate of 2% of their daily intake. Calcium carbonate should be added during the laying season only. The powdered calcium carbonate may be mixed in with the birds fruit mixture.

Always provide a source of fresh, clean water.

Caution

This product is designed to have a low concentration of dietary iron. No readily available iron source is added as an ingredient to this diet. This product is not intended to be a sole diet for growing birds or birds which are not iron sensitive. Prolonged use of this product could result in an iron deficiency.

02/15/06

Soft-Bill Diet

Approximate Nutrient Composition

NUTRIENTS	
Protein, %	**20.5**
Arginine, %	1.11
Cystine, %	0.49
Glycine, %	0.70
Histidine, %	0.47
Isoleucine, %	0.95
Leucine, %	1.87
Lysine, %	1.10
Methionine, %	0.63
Phenylalanine, %	1.10
Tyrosine, %	0.70
Threonine, %	0.83
Tryptophan, %	0.24
Valine, %	1.00
Fat, %	**8.7**
Fiber (Crude), %	**1.7**
Neutral Detergent Fiber, %	4.7
Acid Detergent Fiber, %	1.7
Metabolizable Energy, kcal/gm	**3.74**

MINERALS	
Ash, %	**5.3**
Calcium, %	1.45
Phosphorus, %	0.82
Phosphorus (non-phytate), %	0.60
Potassium, %	0.50
Magnesium, %	0.10
Sodium, %	0.17
Chlorine, %	0.43
Sulfur, %	0.30
Iron, ppm	50-125*
Zinc, ppm	70
Manganese, ppm	85
Copper, ppm	17
Iodine, ppm	0.85
Cobalt, ppm	0.23
Chromium, ppm	0.05
Selenium, ppm	0.20

VITAMINS	
Vitamin K (as menadione), ppm	3.0
Thiamin Hydrochloride, ppm	10
Riboflavin, ppm	15
Niacin, ppm	125
Pantothenic Acid, ppm	20
Choline Chloride, ppm	1,900
Folic Acid, ppm	4.8
Pyridoxine, ppm	12
Biotin, ppm	0.90
Vitamin B_{12}, mcg/kg	66
Vitamin A, IU/gm	7.0
Vitamin D_3 (added), IU/gm	2.0
Vitamin E, IU/kg	300

* Each batch of Soft-Bill Diet, is analyzed for iron and the analyzed iron concentration is available to all customers via the website at www.mazuri.com.

02/15/06

Principles of portfolio design

- Bottom-up: a historical collection of diets that are then sorted into groups

  - customers can always buy what they are used to
  - scientific background or fashion of diets will most likely not be consistent

    state-of-the-art products next to out-dated recipes
    contradictory product lines
    lack of biological/nutritional logic across the portfolio

Historical portfolio: Guinea pig diets

A single Swiss brand sells these Guinea pig products

Diet	Crude fibre	NDF	Crude protein
"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

values in % dry matter

Historical portfolio: pet rodents

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    state-of-the-art products next to out-dated recipes
    contradictory product lines
    lack of biological/nutritional logic

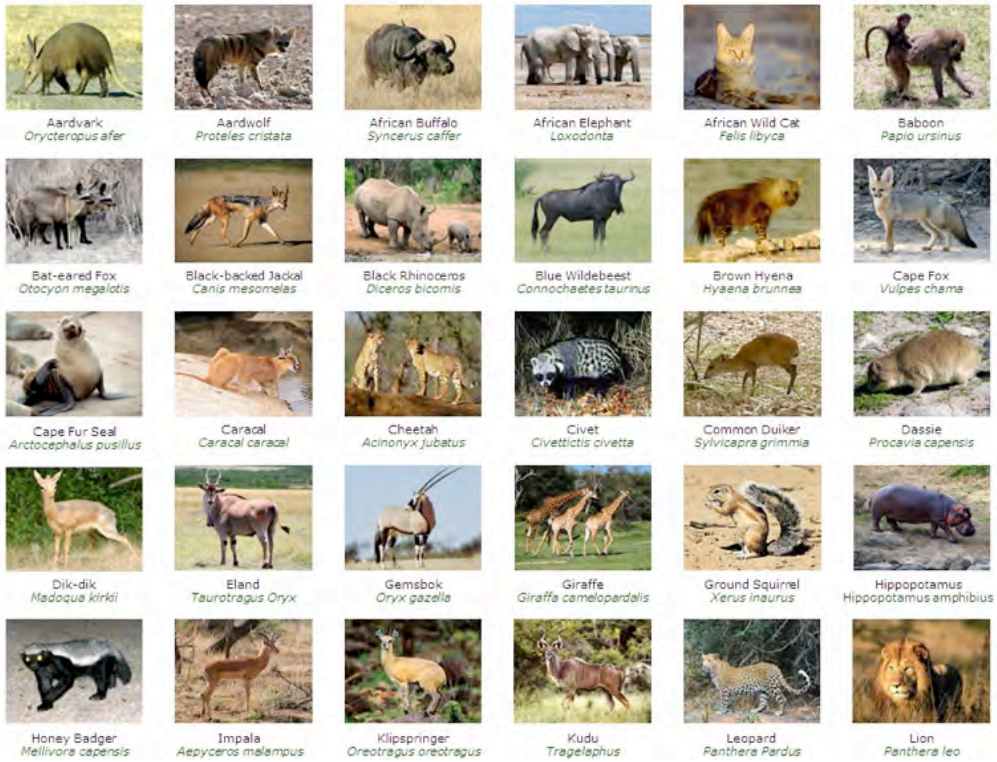
- Top-down: an overruling dietary concept determines the choice of diets offered

  - customers have to adjust to new concepts
  - scientific background or fashion of diets will more likely be consistent

    state-of-the-art products
    consistent product lines
    based on biological/nutritional logic

Portfolio development

- Taxonomic: every species (group) gets a diet of its own



Evidently, this is not really feasible on a species level. The question is, however, on which level you want to do it.
In particular, what about taxonomic groups that share a similar diet?

There are no secret, species-specific ingredients!

A simple way to pretend specialized nutritional knowledge is to produce a pellet, put it in bags of different colours and label (and price) these differently.

Complete feed for rabbits

- maintenance -

Protein	12 %
Fibre	18 %
Calcium	1.2 %

<u>Ingredients:</u> Lucerne meal, soy meal, wheat bran, oats, Calciummonophosphate

Mandrill Special®

Supplement for Mandrills

Years of zoo experience!

Especially nutrient composition for this critical species

Protein.....12 %
Fibre.....18 %
Calcium.....1.2 %

Taxonomic portfolio

Grazer-Pellet
Browser-Pellet
Camelid-Pellet
Rhino-Pellet
Elephant-Pellet
Zebra-Pellet
Kangaroo-Pellet
Moose-Pellet

what about intermediate feeders?

Taxonomic portfolio

Grazer-Pellet
Browser-Pellet
Camelid-Pellet
Rhino-Pellet
Elephant-Pellet
Zebra-Pellet
Kangaroo-Pellet
Moose-Pellet

what is so special about camels?

Taxonomic portfolio

Grazer-Pellet
Browser-Pellet
Camelid-Pellet
Rhino-Pellet
Elephant-Pellet
Zebra-Pellet
Kangaroo-Pellet
Moose-Pellet

what about grazing and browsing rhinos?

Taxonomic portfolio

Grazer-Pellet

Browser-Pellet

Camelid-Pellet

Rhino-Pellet

Elephant-Pellet

Zebra-Pellet

Kangaroo-Pellet

Moose-Pellet

what about grazing and browsing kangaroos?

Taxonomic portfolio

Grazer-Pellet
Browser-Pellet
Camelid-Pellet
Rhino-Pellet
Elephant-Pellet
Zebra-Pellet
Kangaroo-Pellet
Moose-Pellet

why a specific diet for non-moose browsers?

Portfolio development

- Nutrient-based: diets mainly characterised by particular nutrient levels, such as
  - *low iron diets*
  - *low copper diets*
  - *ADF (acid detergent fibre) 16*
  - *ADF 25*
  - *vitamin D_3 diet*

Portfolio development

- Dr. Oetker-approach: rations planned to include different individual diets

  - vitamin supplement pellets (to be given in addition to regular complete pellets)

  - boost supplement (to be given in addition to regular complete pellets)

why not directly incorporated into complete diet?

Portfolio development

- Season-based
  - *Moose maintenance*
  - *Moose breeder*

why only for moose but not for non-moose seasonal herbivores such as ... muskoxen, reindeer, red deer etc. ?

- Life stage-based
  - *Growth*
  - *Lactation*
  - *'Breeder' diets*

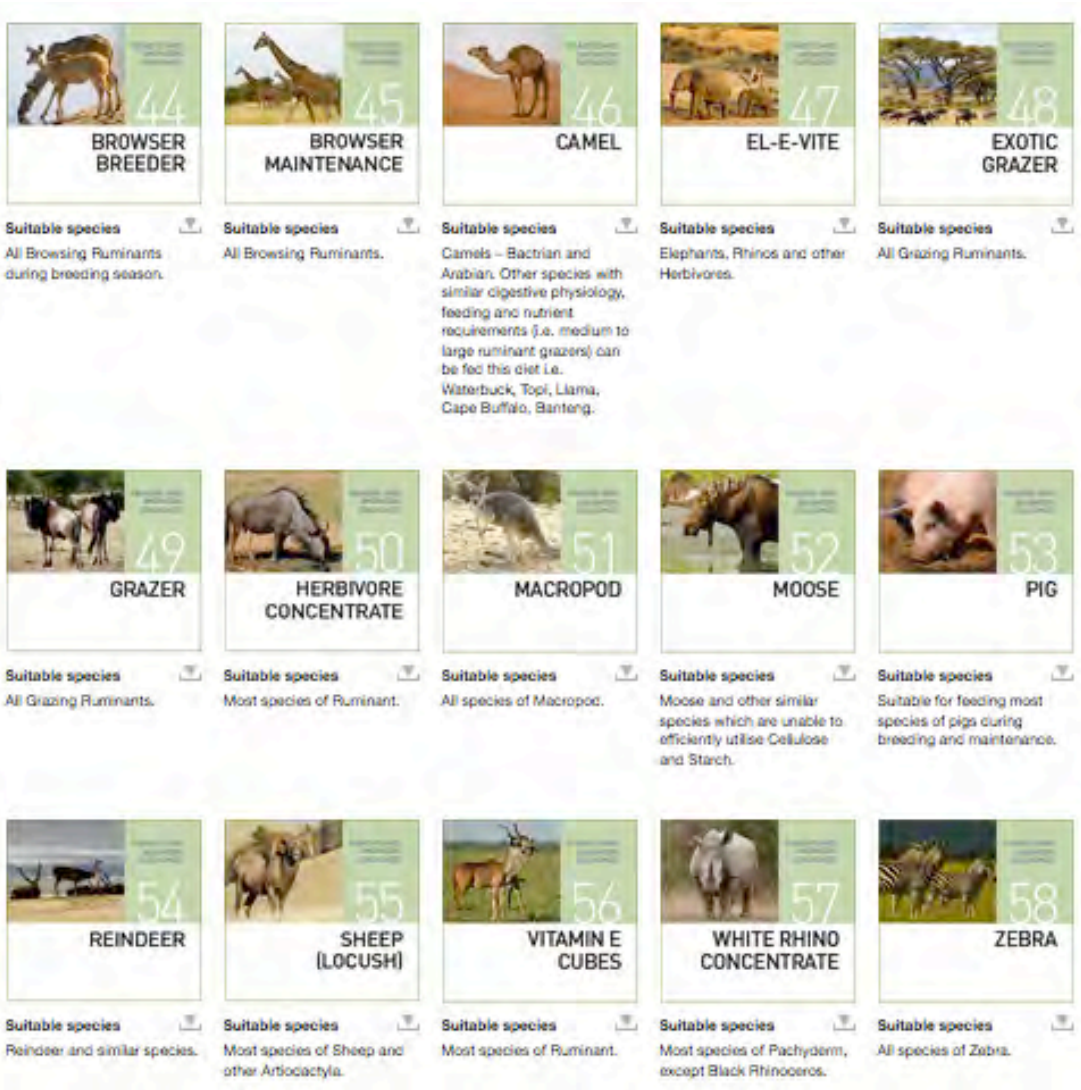
necessary? (e.g. in many birds – yes; in large herbivores – no)

Portfolio development

- Combinations of these principles depending on
  - history,
  - a striving for portfolio complexity,
  - a striving for portfolio simplicity

Hoostock – large historical portfolio I

Hoostock – large historical portfolio II



Hoostock – simple (top-down) portfolio

Herbivore nutrition

Herbivores eat plants. This animal group has specialized digestive physiology to utilize plant materials by different strategies to supply energy for life, growth and reproduction. To be able to digest plant material, herbivores live in symbiosis with microorganisms in their gastrointestinal tract (bacteria, yeasts, other protozoa). These microorganisms ferment plant fibers, especially cellulose, that are otherwise indigestible for vertebrates. Fermentation takes place either in a foregut (e.g., cows) or hindgut system (e.g., horses), so that a distinction is made between foregut fermenters and hindgut fermenters.

Furthermore, herbivores are classified according to their choice of preferred feed in three different groups: grazers, browsers and intermediate feeders. Thus the feed in the zoo must be adjusted to the different requirements of those groups:

GRAZERS

Preferred feed
Grazers feed mainly on grasses. These animals graze large areas in one place and ingest vast amounts of grasses in a relatively unselective way.

Anatomy
Grazers have a wide mouth with a small mouth opening and stiff lips. Ruminating grazers usually have a large, divided foregut system.

Feeding
With regard to feeding solutions in zoos the main focus should be on high fiber and moderate protein and energy contents.

INTERMEDIATE FEEDERS

Some species are so-called intermediate feeders as they combine the characteristics of both groups: for example, sheep, goats or certain types of deer and antelope.

BROWSERS

Preferred feed
Browsers are highly selective in their search for food while primarily eating young shoots, herbs or buds. They gather their feed in different areas.

Anatomy
Compared with grazers, browsers have sensitive lips with a larger mouth and longer tongue to pick their preferred food. Ruminating browsers usually have a smaller foregut system.

Feeding
In zoos the main focus should be on a high content of fermentable fibers and a sufficient protein supply.

Hoostock – simple (top-down) portfolio

Hoostock – simple (top-down) portfolio

Application:

Which product is best suited for your animal?

Among other factors, the choice of a supplementary diet depends largely on the additional fed roughage and its composition as well as the quantities of the single components of the daily ration. The following lists are not to be considered as complete. Talk to our experts for further information.

GRAZERS			INTERMEDIATE FEEDERS	BROWSERS	
Elephant	**Grazer**	**Grazer Cu-controlled**	**Browser**		**Rhino and tapir**
Product no. 969.60 3715 PD S25	Product no. 957.60 3697 PD S25	Product no. 958.60 3698 PD S25	Product no. 959.60 3699 PD S25		Product no. 969.60 3695 PD S25
Asian Elephant	Buffalo	Wild Sheep	Muskox	Giraffe	Black Rhinoceros
African Elephant	Banteng	Llama	Eland Antelope	Okapi	Sumatran Rhinoceros
	Wild Cattle	Alpaca	Impala	Bushbuck	Indian Rhinoceros
	Wildebeest	Vicuña	Thomson's Gazelle	Nyala	Javan Rhinoceros
	Waterbuck	Guanaco	Springbok	Sitatunga	Tapirs
	Oryx		Pronghorn	Gerenuk	
	Oribi		Saiga Antelope	Duiker	
	Topi		Dama Gazelle	Suni	
	Blackbuck		Ibex	Dikdik	
	Bactrian Camel		Goats	Klipspringer	
	Dromedary		Chamois	Kudu	
	Père David's Deer		Wapiti	Muntjac	
	Zebra		Sika Deer	Roe Deer	
	Hippopotamus		Red Deer	Moose	
	White Rhinoceros		Mule Deer	Tree-kangaroos	
	Eastern Grey Kangaroo		Rock-wallabies	Small Wallabies	
	Red Kangaroo			Reindeer*	
				Bongo*	
				Pigmy Hippopotamus*	
				Water Deer*	

NUTRITIONAL ... FOR YOUR

Primates – historical or functional portfolio?

LEAF EATER PRIMATE

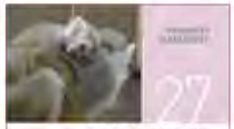
Suitable species

All leaf eating Primate species.

MARMOSET GUM

Suitable species

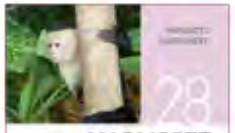
Marmosets and Tamarins, also suitable for other primate species.



MARMOSET JELLY

Suitable species

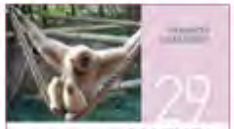
Nursing and adolescent Marmosets and similar species of New World Primates. All non-human primates that are ill or under similar stress may find it palatable and beneficial.



MARMOSET (MINI MAREX)

Suitable species

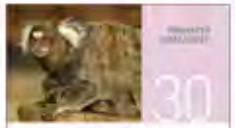
All small New World Primates.



MAZURI PRIMATE

Suitable species

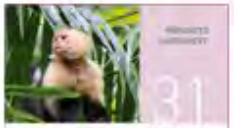
New and Old World Primate species, including Great Apes.



NEW WORLD PRIMATE
GLUTEN FREE – 20% VFI

Suitable species

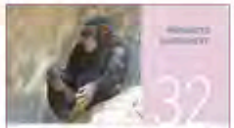
For all New World Primates.This diet has been formulated to provide 20% of their daily dry matter intake or voluntary feed intake (VFI).



NEW WORLD PRIMATE
GLUTEN FREE – 75% VFI

Suitable species

For all New World Primates This diet has been formulated to provide 75% of their daily dry matter intake or voluntary feed intake (VFI).



OLD WORLD MONKEY

Suitable species

Great Apes and Old World Primates.

TAMARIN CAKE

Suitable species

All species of Tamarin.

TRIO MUNCH

Suitable species

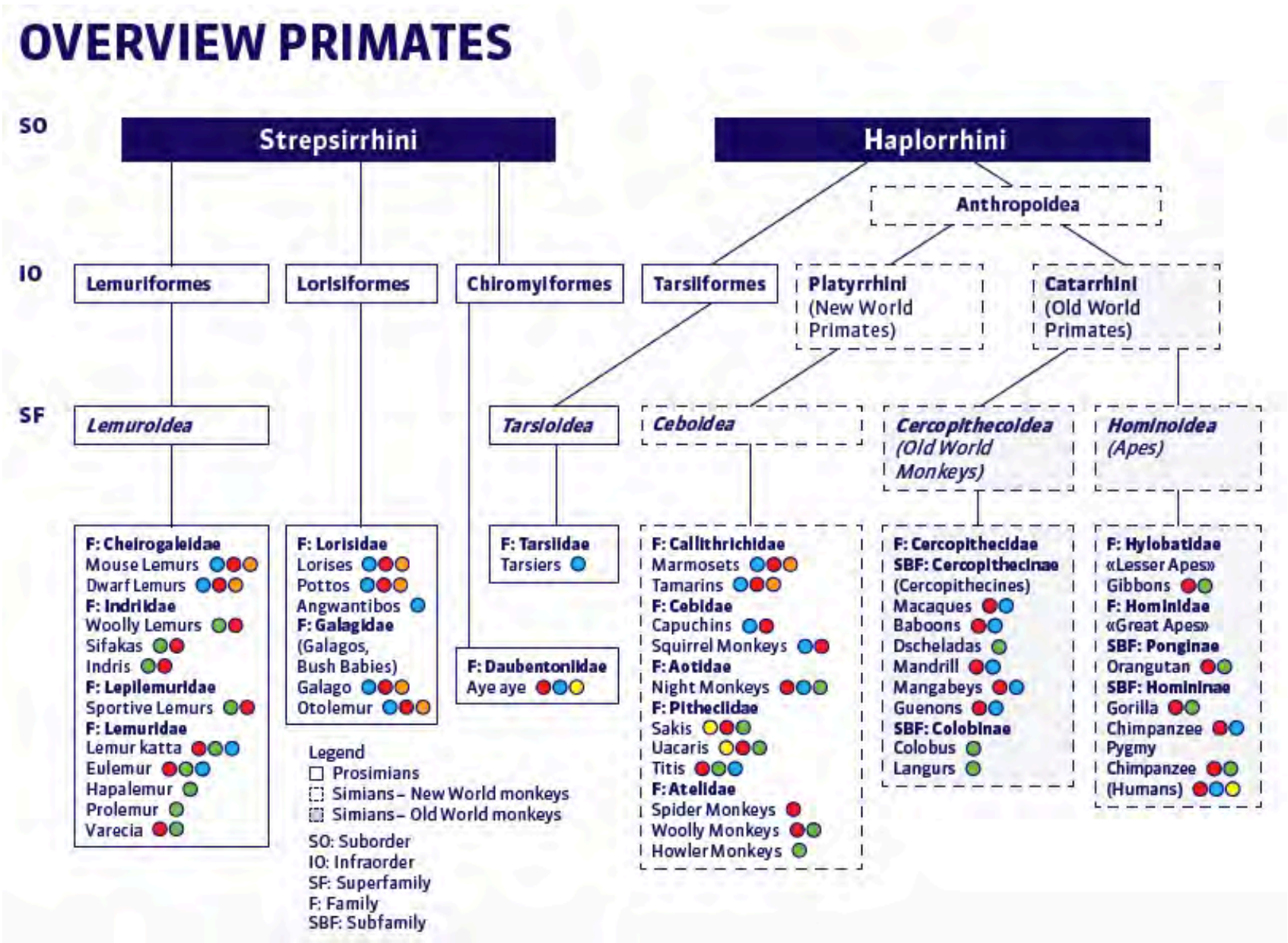
Old and New World Primates.

Primates – historical portfolio

	DIET	Form	Starch	Other Features	RECOMMENDED SPECIES	LIFESTAGE
BISCUITS*	L/S Cinnamon Biscuit (5M1S)	Medium biscuit	Lowest	Added probiotics & vitamin supplementation	All New World and Old World primates	All
	L/S Banana Stick (5M1G)	Small biscuit	Lowest	Added probiotics & vitamin supplementation	All New World and Old World primates	All
	Growth & Repro (5MA1)	Medium biscuit	Higher	Contains Dentaguard	All reproducing primates	Growing & Breeding
	Maintenance Diet (5MA2)	Large biscuit	Higher	Contains Dentaguard	Apes & other Old World Primates, all folivores & prosimians	Maintenance
	High Fiber Sticks (5MA3)	Small biscuit	Moderate	No sugar added	All New World and Old World primates	All
	Browse Biscuit (5MA4)	Large biscuit	Moderate	Contains Dentaguard	Apes & other Old World Primates, all folivores & prosimians	All
	New World Primate (5MA5)	Small biscuit	Higher	Contains Dentaguard	Callitrichids & other New World Primates	All
	Leafeater Biscuit (5M02/5672)	Small or Large Biscuit	Higher	No sugar added	Apes & other Old World Primates, all folivores & prosimians	All
	Basix Biscuit (5NAA)	Medium biscuit	Higher	Economical maintenance diet	Apes & other Old World Primates	Maintenance
GELS**	L/S Gel (5B25)	Powder	Lowest	Added probiotics & vitamin supplementation	All New World and Old World primates	All
	Callitrichid Gel Heat Stable (57R0)	Powder	Moderate	Stable in a variety of environments	Callitrichids & other New World Primates	All
	Callitrichid Gel Gluten Sensitive (5B32)	Powder	Moderate	No detectable gliaden	Callitrichids & other New World Primates	All
	Callitrichid Gel Plus (5B33)	Powder	Moderate	With higher protein, fat and fiber	Callitrichids & other New World Primates	All
SUPPLEMENTS & ENRICHMENT***	Monkey Crunch (5M29)	Medium biscuit	Higher	Soaks well, suitable for enrichment & training	All New World and Old World primates	All
	Enrich Bits (5ZG7)	Very small biscuit	Higher	High fiber foraging particle with balanced nutrition	All New World and Old World primates	All
	Enrichment Gel Berry (5MF1)	Powder	Lowest	Very palatable high moisture enrichment gel	All New World and Old World primates	All
	Gum Arabic (5B35)	Powder	N/A	suitable for enrichment of gum-eating primates	Gum-eating primates	All
	VitaZu Primate Tab (5072)	Tablet	N/A	Supplement for diets with low biscuit inclusion	All New World and Old World primates	All

Primates – simple (top-down) portfolio

Primates – simple (top-down) portfolio



Primates – simple (top-down) portfolio

OUR FEED AND ITS BENEFITS

Our products have been developed for use as supplementary feed in order to meet the nutritional requirements of various primate groups as part of an overall ration that includes vegetables, fruit, leaves and other feedstuffs.

Callitrichids

Product number: 805.20 3450.PS.S15

For callitrichids and other New World monkeys

- With vitamin D supplements which are specially formulated to meet the needs of callitrichids, thereby preventing vitamin D deficiency and toxicity
- Without gluten- containing grains
- With vitamin C
- Moderate iron content
- With taurine
- 4-mm pellets

Leaf-eating Primates

Product no.: 804.20 3491.PS.S25

For primates that primarily eat leaves

- Use of various high-fibre plant materials to ensure appropriate amounts of ADF and NDF
- With moderate amounts of iron and vitamin C, suitable for sensitive species
- With taurine
- 4-mm pellets

Primates

Product number: 802.90 3446.EM.S12

For various types of primate without special requirements

- Contains poultry meal as a high-quality source of animal protein
- Without gluten-containing grains
- With vitamin C
- With taurine
- 12-mm extrudate

Primates High Fiber

Product no.: 807.90 3497.EM.S12

Vegetarian feed for Old World monkeys including apes

- High in fibre and low in starch to meet the primates' nutritional needs and prevent obesity
- Without gluten-containing grains
- With vitamin C
- With taurine
- 10-mm extrudate

Acacia gum

Product number: 806.90 2990.OM.BU1

Complementary feed for all primates that consume a significant amount of plant sap as part of their natural diet

- Helps to maintain a more natural diet
- Can also be used in combination with enrichment
- Powder

Primates vitamin and mineral concentrate

Product number: 2988-0 2988.MA.PB1

Vitamin and mineral concentrate designed especially for use as a dietary supplement at certain stages of life, e.g. to support recovery or convalescence

- Powder

WHICH PRODUCT IS BEST SUITED FOR YOUR PRIMATE SPECIES?

Feed should be selected according to the type of primate and its feeding habits. Different feeds may be suitable for some species, depending on the animal's current nutritional status, age and other criteria. The following list is not conclusive. Decisions should be made on an individual basis.

CALLITRICHIDS	LEAF-EATING PRIMATES	PRIMATES HIGH FIBER	PRIMATES	ACACIA GUM
Product number 805.20 3450.PS.S15	**Product number 804.20 3491.PS.S25**	**Product number 807.90 3497.EM.S12**	**Product number 802.90 3446.EM.S12**	**Product number 806.90 2990.OM.BU1**
Capuchins	Geladas	Macaques	Macaques	Marmosets
Saimiris	Colobus	Mandrills	Mandrills	Tamarins
Marmosets	Langurs	Mangabeys	Mangabeys	Lorises
Tamarins	Howler monkeys	Guenons	Guenons	Galagos
	Sakis	Baboons	Baboons	Cheirogaleids
	Lemurs	Chimpanzees	Chimpanzees	
	Ruffed lemurs	Bonobos	Capuchins	
		Gorillas	Saimiris	
		Orangutans		
		Gibbons		

Principles of portfolio design ... and choice

- A complicated portfolio with no directly apparent logic

  ... is difficult to communicate within the zoo or within an interest group such as a keeper forum

  ... supports the impression that nutrition is

  difficult to understand & very complicated

  mythical

  ... and indirectly leads to feeding mistakes because people do not think along

- A simple portfolio with a clear biological logic

  ... can be communicated easily within the zoo or within an interest group

  ... is a didactic experience for users

  ... and indirectly helps to avoid feeding mistakes because people understand what they do and think along

thank you for your attention