

AVIAN REARING NUTRITION

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Introduction

A number of major changes in body composition take place during development which effect the nutritional requirements of birds as they mature. These changes can be grouped into 3 categories.

- Body composition changes
- Digestive capability develops
- Maintenance:growth ratio alters

Examples of the compositional changes are seen in the following table for meat chickens.

Table 1: Chicken Body Composition

Liveweight	Water	Ash	Protein	Lipid
g	%	%	%	%
115	64	12	15	7
160	61	12	16	9
540	59	12	18	10
900	57	12	18	11
1650	55	12	19	13

These compositional changes, along with the increasing size and maturity lead to different nutritional requirements at different stages of development.

Table 2: Nutritional Requirements of Pullets

	Starter	Grower
Crude Protein	19-20	16-18
Methionine	0.50	0.35-0.45
Lysine	1.12	0.75-0.95
Calcium	1.0-1.1	0.35-0.45
Phosphorus	0.45-0.50	0.35-0.45

These differences vary from species to species, and are even more pronounced in turkeys.

Table 3: Turkey Rearing Diets

	Protein	Energy
Starter	28%	2900 kcal/kg
Finisher	16%	3300 kcal/kg

Grey Faced Petrel Nutritional Study

A joint study was undertaken with the Department of Conservation to determine the nutritional requirements of adult and juvenile Grey-Faced Petrels. We investigated the nutrient composition of the crop contents of grey-faced petrel (*Pterodroma macroptera*) adults and chicks. Crop content samples were obtained from birds breeding at Bethells Beach, Auckland, New Zealand over a four month period (Sep–Dec 1999) and bulked according to age: 3-5, 6-10, 60-90 d old, and adults. Crop content samples were analysed for crude protein, amino acids, gross energy, lipids, fatty acids, ash and minerals. All four age groups contained high levels of crude protein (26-60%) and lipid (20-44%), while the ash level was highly variable between age groups (4-41%). In general, the amino acid pattern of the crude protein fraction was similar between the four age groups except for taurine and several other amino acids in the 3-5 d old group. The pattern of fatty acids was similar between the four age groups although myristic and palmitoleic acid were higher in the free fatty acid and triglyceride fraction of the 3-5 d age group. The calcium to phosphorus ratio in the fat extracted crop content samples of the 60-90 d old and adult birds was 2.5 and 2.9, respectively. The present study provides preliminary information on the nutrient composition of the crop content of growing and adult grey-faced petrels that can be used to formulate balanced artificial diets for the different life stages of growth and adulthood, for the taiko or magentae petrel, a related, endangered species.

Table 4: Gross nutrient composition of crop content samples for the four age groups of grey-faced petrels (*Pterodroma macroptera*)

Nutrient	Age group			
	3–5d	6–10d	60–90d	adult
Dry matter (g/100g as is)	44	44	26	28
Crude protein (g/100g DM [*])	60	26	48	45
Lipids (g/100g DM)	44	40	43	20
Ash (g/100g DM)	4	41	14	35
Gross energy (MJ/100g DM)	32 [†]	26 [†]	27	17

^{*}DM, dry matter

[†]Calculated values based on values for the 60-90 day old and adult group.

Table 5: Crude protein amino acid composition^{*} (g/100 g crude protein) of the crop content of four age groups of grey-faced petrels (*Pterodroma macroptera*)

Amino acid	Age group			
	3–5d	6–10d	60–90d	adult
Taurine	0.1	0.3	0.7	1.3
Aspartic acid	12.2	10.1	10.3	9.5
Threonine	3.9	4.7	4.5	4.5
Serine	4.1	4.2	4.4	4.2
Glutamic acid	11.7	14.5	13.6	13.4
Proline	11.3	3.5	4.0	4.1
Glycine	4.5	4.4	5.7	5.4
Alanine	3.9	5.4	5.5	5.1
Cysteine	1.9	1.1	1.2	0.9
Valine	3.0	5.0	4.6	4.4
Methionine	8.5	3.8	3.7	3.1
Isoleucine	4.2	4.7	4.7	4.3
Leucine	7.6	7.8	7.8	7.3
Tyrosine	9.4	3.7	4.4	4.0
Phenylalanine	8.6	4.2	4.9	4.4
Histidine	2.7	2.1	2.6	2.1
Lysine	6.9	8.0	7.2	7.1
Arginine	10.2	6.4	6.8	6.4

*Free amino acid molecular weights were used to calculate each weight

Table 6: Fatty acid profile (mol/100 mol fatty acid) of the crop contents for the four age groups of grey-faced petrels (*Pterodroma macroptera*)

Fatty acid	Age group			
	3–5d	6–10d	60–90d	adult
Myristic acid (C14:0)	12	5	5	5
Palmitic acid (C16:0)	20	25	21	20
Palmitoleic acid (C16:1)	20	12	11	10
Margaric acid (C17:0)	trace	trace	3	7
Stearic acid (C18:0)	trace	trace	trace	trace
Oleic acid (C18:1)	39	44	47	44
Linoleic acid (C18:2)	trace	trace	trace	trace
Linolenic acid (C18:3)	trace	trace	trace	trace
Arachidonic acid (C20:4)	9	16	10	12
Docosahexaenoic acid (C22:6)	2	0	5	4

Table 7: Mineral composition of fat extracted crop contents of 60-90 d old and adult grey-faced petrels (*Pterodroma macroptera*).

Element	Age group	
	60-90 d	adult
	(g/kg fat-free matter)	
Calcium	9.0	14.8
Phosphorus	3.6	5.1
Potassium	2.7	6.4
Sodium	3.6	7.0
Sulphur	4.2	7.0
Magnesium	1.7	1.8
Iron	23.9	14.6
	(mg/kg fat-free matter)	
Manganese	704	435
Zinc	78.1	76.1
Copper	8.9	15.6
Selenium	8.4	3.6

Captive Rearing Diet of the New Zealand Shore Plover

A collaborative project between Massey University and Mt Bruce National Wildlife Centre was carried out to describe the composition in term of nutrient content and digestibility of nutrients of the diet fed to captive NZ Shore Plover held a Mt. Bruce National Wildlife Centre (Masterton).

Six NZ Shore Plover (two brooders of three birds each) were used in the study. For a period of 7-days they were fed once a day (intake recorded) and faecal output was collected twice-daily (amount recorded). The composition of the diet fed to the birds is presented in Table 8.

Table 8: Diet of captive NZ Shore Plover at Mt Bruce National Wildlife Centre.

Ingredient	Amount
Friskies Go-Cat (chicken,beef, calcium and vegetable)	20%
Oxheart mince	17%
Wambaroo Insectivore mix	7%
Water	39%
Mealworms	17%

Samples of diet and faeces were analysed for dry matter/ash, protein/amino acids, minerals, lipid (fat) and fatty acids. The apparent digestibility was calculated for all results using the formula:

$$\frac{\text{IN (diet) - OUT (faeces)}}{\text{IN (diet)}} \times 100$$

An example of this is the dry matter (DM). DM of the diet was 33%, and of this 61% was digested by the birds. Apparent digestibilities of other components of the diet are presented in Table 9.

Table 9: Apparent faecal gross nutrient digestibility of the diet consumed by captive NZ Shore Plover.		
	In Diet	Digested
Dry matter	33%	61%
Organic matter	93%	64%
Lipid	18%	81%
Amino Acid nitrogen	40%	76%
Fatty acids saturated	79%	60-92%

The protein, lipid and fatty acid components of the diet fed to NZ Shore Plover at Mt. Bruce National Wildlife Centre (Masterton) is highly digestible and provides a good balance of nutrient to the birds.

Only the carbohydrate fraction appears to be poorly digested. The pattern of nutrient digestion of the shore plover is consistent with that expected of an insectivore. The diet has a good balance of most nutrients. Although the calcium to phosphorus ratio is adequate for adult non-breeding birds (1.1:1), during the breeding season this ratio should be increased (to 5:1) by the addition of calcium.

It is recommended that this diet developed at Mt. Bruce National Wildlife Centre (Masterton) for the insectivorous NZ Shore Plover should be evaluated as a general diet for other endangered insectivores such as the kiwi.

Proposed Plover Research

The information arrived at through the above project will now be tested. Initially three objectives have been defined.

- Continue using mineral supplement developed
- Develop NZ insectivore mix
- Trial diet containing NZ insectivore mix supplement

A rearing trial (Grey-Faced Petrels) will also be undertaken with two objectives.

- Compare New and Old rearing diets for:
 - –Survival
 - –Performance
- Compare chicks on rearing diets with those naturally reared in the wild

Conclusions

Little is known of the nutritional requirements of most NZ birds and assumptions may be incorrect. Good reproductive and rearing performance requires adequate nutrition.