

EFFECTS OF A CHANGE IN DIET ON THE NUTRITIONAL STATUS OF HAND-REARED GREY PARTRIDGE (*Perdix perdix*)

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ABSTRACT

LIUKKONEN-ANTTILA, T., PUTAALA, A. and HISSA, R.: EFFECTS OF A CHANGE IN DIET ON THE NUTRITIONAL STATUS OF HAND-REARED GREY PARTRIDGE (*Perdix perdix*). The effect of an abrupt change in diet on the grey partridge was studied. The determined parameters were BM, food consumption, GE, produced excreta, EE, ME, MEC, Hb, Hct, glucose, total protein, triglycerides, uric acid, T₃, T₄, and the masses of gizzards and livers and the lengths of small intestines and caeca. The groups differed significantly from each other according to BM, consumed food, GE, excreta production, EE, ME, MEC and masses of gizzards. On the other hand, no differences were seen in analysed blood metabolites or other morphological measurements. However, on the basis of this study we can conclude that this period of six weeks may not be sufficient to precondition the birds to a life in the wild.

1. INTRODUCTION

Previous studies on galliform species show that hand-reared birds fed with commercial diets differ in their physiology and anatomy from the wild birds (MOSS, 1972, 1983; HANSSON, 1979; PUTAALA AND HISSA, 1995). The first few weeks after the release into the wild seems to be most critical for the survival of hand-reared grey partridge (PANEK, 1988; DOWELL, 1990; PUTAALA *ET AL.*, 1998). The limited ability of the digestive system to use fibrous natural food may contribute to the birds' poor survival. It is even possible that birds starve to death before their digestive system is adapted to the natural diet (PUTAALA AND HISSA, 1993). The adaptation from commercial to fibrous natural food is assumed to take several weeks, if not months (MOSS AND TRENHOLM, 1987; MOSS, 1989).

The aim of this study was to determine if the poor performance of hand-reared partridges after their release into the wild could be explained by digestive constraints associated with the changing diet. We supposed that the change in diet may be expressed in

lowered body mass, higher mass of consumed food, lowered metabolised energy coefficient and changes in gut morphology and in some blood metabolites.

2. MATERIAL AND METHODS

We performed two feeding trials from January to April in 1996 and 1997 on hand-reared grey partridges. We simulated the abrupt change in diet, which takes place when hand-reared birds are released into the wild. In 1996 we used 30 grey partridge females and in 1997 12 females and 12 males. For morphological measures we used 5 males from both diet groups. We examined how a change in diet from commercial to natural affected the grey partridges'

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| a) 1996/1997 | body mass (BM) |
| b) 1996 | food consumption (fresh/dry mass),
gross energy (GE) intake
excreta production, excretory energy (EE)
metabolised energy (ME)
metabolised energy coefficient (MEC) |
| c) 1997 | haemoglobin (Hb), haematocrit (Hct)
glucose, total protein, triglycerides, uric acid
triiodothyronine (T_3), thyroxine (T_4) |
| d) 1997 | gizzard and liver mass
length of small intestine and caeca |

Before the feeding trial birds were acclimated to indoor conditions (+ 15 °C, photoperiod 7L:17D) and fed with pelleted commercial poultry food (Täsmä-Herkku, Raisio, Finland). After the acclimation period birds in the control group continued to receive only commercial food and birds in the test group were fed only with natural food (oat grains, barley sprouts and weed seeds; *Galeopsis* sp., *Fallopia convolvulus*, *Polygonum lapathifolium*), commonly encountered in the winter diet of grey partridge in Finland (PULLIAINEN, 1965, 1984). The energy content of every foodstuff was determined with a Gallencamp bomb calorimeter (CAMBRIDGE INSTRUMENT Co Ltd, England).

BM, food consumption, GE, excreta production, EE, ME and MEC

The birds were weighed every third day both during the acclimation period and during the feeding trial. The food consumption of each foodstuff separately was closely examined on a daily basis. Each bird's diet and its energy content was exactly recorded. Excreta were collected once a week and the energy content of three excreta pellets (ca. 1.0 g each) per bird was determined as mentioned before.

Metabolised energy (ME) content per day was calculated as the difference between gross energy (GE) intake and excretory energy (EE). The metabolised energy coefficient (MEC) was calculated as ME/GE (for terminology and formulae: NIKIFOROV, 1992).

Blood metabolites

Blood samples of 1.5 ml were collected three, five, seven and nine weeks after the birds had been taken inside to ensure they were acclimated. During the feeding trial samples were collected one, two, four and six weeks after the change in diet. Blood was collected from the *vena brachialis* with 23 G needles and syringes handled with 20.8 % EDTA as an anticoagulant. Plasma was separated in a centrifuge.

Hb and Hct were analysed from whole blood from samples drained directly into capillary tubes. Hb analysis was made with an Ames Hb Mini-Pak in an Ames Minilab PC and Hct with a Micro-Haematocrit Reader. Glucose, uric acid, triglycerides and total protein were analysed with Boehringer commercial kits and T₃ and T₄ from plasma with Orion diagnostic radioimmunoassay.

Morphological features

After the feeding trial was completed, five males of both diet groups were killed. Before weighing, the gizzards were emptied and the inner cuticle was removed. Livers were weighed separately. Both caeca and small intestine were straightened but not stretched before measuring, and the mesenteries were removed.

Statistical analysis

All statistical analyses were performed using the statistical software package SPSS 6.3.1. As sexes did not differ from each other in their responses to the change in diet (*Repeated*

Measures Analysis of Variance, $F_{11} = 1.08$, $P = 0.378$), the data from females and males were pooled in 1997.

Mass changes during the acclimation period and feeding trial were tested by Repeated Measures Analysis of Variance. We compared food intake, excreta production, GE, EE, ME and MEC in test and control birds at the end of the acclimation period with by t-test and during the feeding trial by the Repeated Measures Analysis of Variance.

We compared all the blood parameters as mentioned above. The weights of the gizzards and livers and the lengths of the small intestines and caeca in the test and control birds were compared with the *Mann-Whitney U-test*.

3. RESULTS

There was no difference between the groups in 1996 or in 1997 in the BM during the acclimation period. In both years birds in the test group lost BM dramatically after the change in diet, which then stabilised at a lower level than in the control group (1996 $F_{12} = 9.42$, $P < 0.001$; 1997 $F_{12} = 5.54$, $P < 0.001$, **Figure 1.**)

During the acclimation birds in the control and test group did not differ from each other according to food consumption, GE intake, excreta production, EE, ME or MEC. During the feeding trial the test group birds consumed somewhat more food ($F_6 = 18.67$, $P < 0.001$, **Table 1.**) and had lower GE intake ($F_6 = 7.98$, $P < 0.001$, **Table 1.**) than control birds. There was a significant difference between the groups in the amount of produced excreta and excretory energy ($F_6 = 36.25$, $P < 0.001$; $F_6 = 42.44$, $P < 0.001$, **Table 1.**). Test birds metabolised less energy ($F_6 = 10.58$, $P < 0.001$, **Table 1.**) and had a lower metabolised energy coefficient ($F_6 = 15.23$, $P < 0.001$, **Table 1.**) than control birds.

In analysed blood metabolites there was no difference between the groups either before or after the change in the diet. Test group birds had heavier gizzards than birds in the control group (6.0 ± 0.2 g and 4.7 ± 0.3 g respectively, $z = -2.4023$, $P = 0.0163$).

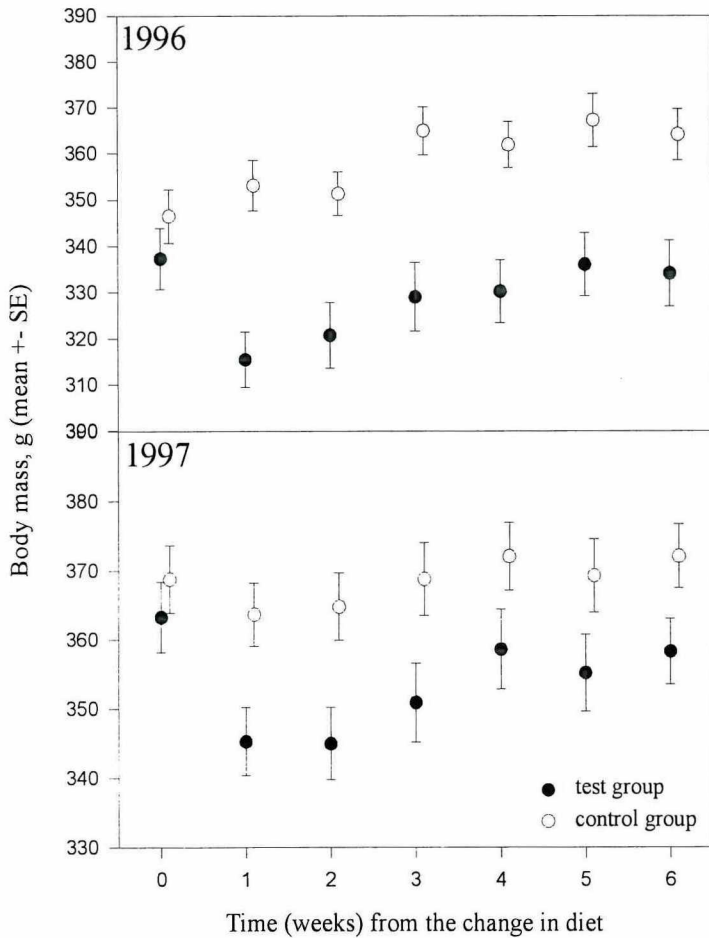


Figure 1: Body masses of the birds in both diet groups. In 1996n=15 and in 1997n=12 in both groups

Table 1. Consumed food and its energy content (GE), excreta and excretory energy content (EE), metabolised energy (ME) and metabolised energy coefficient (MEC) (mean \pm SE) before the change in diet (week 0) and during the feeding trial (weeks 1-6). n = 15 in each group.

Weeks after the change in diet	Group	Consumed food, g fresh weight/day	GE, kJ/day	Excreta, g dry weight/day	EE, kJ/day	ME, kJ/day	MEC
0	test	24.4 \pm 1.9	383.7 \pm 13.7	9.1 \pm 0.3	105.5 \pm 3.7	278.2 \pm 11.7	0.72 \pm 0.01
	control	22.9 \pm 1.5	360.3 \pm 16.7	8.8 \pm 0.5	103.6 \pm 6.7	256.7 \pm 13.0	0.71 \pm 0.01
1	test	17.1 \pm 1.1	219.1 \pm 18.9	6.0 \pm 0.4	75.3 \pm 6.1	143.9 \pm 16.9	0.62 \pm 0.04
	control	22.3 \pm 0.4	350.9 \pm 5.5	10.4 \pm 0.3	121.3 \pm 4.2	229.7 \pm 5.9	0.65 \pm 0.01
2	test	32.8 \pm 2.6	371.2 \pm 30.1	13.2 \pm 1.0	157.4 \pm 11.2	213.9 \pm 25.1	0.56 \pm 0.03
	control	24.8 \pm 0.9	389.9 \pm 14.0	4.1 \pm 0.1	45.6 \pm 1.4	344.4 \pm 14.0	0.88 \pm 0.01
3	test	21.2 \pm 1.5	264.9 \pm 16.6	9.1 \pm 0.6	99.8 \pm 7.4	165.1 \pm 14.9	0.61 \pm 0.03
	control	18.6 \pm 0.6	291.9 \pm 9.3	10.7 \pm 0.3	97.3 \pm 4.4	194.6 \pm 9.2	0.66 \pm 0.02
4	test	25.7 \pm 1.7	332.7 \pm 10.9	11.6 \pm 0.7	123.5 \pm 7.9	209.2 \pm 13.1	0.62 \pm 0.03
	control	22.6 \pm 0.6	354.2 \pm 10.1	8.0 \pm 0.3	74.2 \pm 3.0	280.0 \pm 9.3	0.79 \pm 0.01
5	test	26.2 \pm 1.5	306.6 \pm 11.2	11.9 \pm 0.6	154.1 \pm 7.9	152.5 \pm 11.8	0.49 \pm 0.03
	control	23.4 \pm 0.7	367.7 \pm 11.7	7.2 \pm 0.2	86.6 \pm 4.5	281.1 \pm 9.2	0.77 \pm 0.01
6	test	37.2 \pm 1.2	294.7 \pm 15.7	9.0 \pm 0.9	95.3 \pm 5.7	199.4 \pm 16.4	0.67 \pm 0.03
	control	18.7 \pm 0.7	294.1 \pm 11.1	8.2 \pm 0.3	76.4 \pm 3.1	217.7 \pm 8.9	0.74 \pm 0.01

4. CONCLUSIONS

The abrupt change in diet affected the birds' ability to utilise energy from the fibrous natural food. The change decreased the birds' BM and although the birds were able to gain mass after a week from the change in diet, this may indicate a higher water content of the alimentary canal, due to the higher water content of eaten sprouts. For the same reason the amount of consumed natural food is somewhat higher on fresh weight basis than the amount of commercial food. Heavier gizzards may indicate a greater need for effective grinding ability. Results of the plasma analysis did not express significant nutritional stress or analysed parameters were not sufficiently sensitive to nutritional changes in birds.

After an acute change in diet from commercial to natural food, the released birds have to find proper food items and require more time for feeding. Further, they have to increase food intake to compensate for the poor quality of the food compared with the commercial food. A six week period of natural feeding in captivity before release may not be sufficient to make birds preconditioned to feeding in the wild.

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