Acta Agraria Kaposváriensis (1999) Vol 3 No 2, 247-253
Pannon Agrártudományi Egyetem, Állattenyésztési Kar, Kaposvár
Pannon University of Agriculture, Faculty of Animal Science, Kaposvár

Effect of dietary crude protein level on reproductive traits of commercial pigeons in different production terms

I. [1]Meleg, K. [2]Dublecz, L. [2]Vincze, P. [1]Horn
[1]Pannon University of Agriculture, Faculty of Animal Science, Department of Poultry Science
Kaposvár, H-7400 Guba S. u. 40, Hungary
[2]Pannon University of Agriculture, Faculty of Agricultural Science, Department of Nutrition
Keszthely, H-8361 Deák F .u. 16, Hungary

ABSTRACT

The experiment was conducted to measure the effects of feeding diets containing 12,14,16,18 and 20% crude protein to utility pigeons in the first and second production terms. The traits studied were: egg production, egg weight, hatchability of eggs laid, mortality of breeding pairs, growth of squabs up to weaning and feed intake. 30 breeding pairs per treatment were kept in pairs in a specially designated three tier cage system, in a windowless environmentally controlled house at a constant 12-hour light period throughout the year. The test period was 12 months in each production terms. Different protein levels failed to affect the length of egg cycle, annual egg production, egg weight, hatchability of eggs laid and mortality of squabs. Increasing dietary crude protein content and the weaning weight of squabs increased significantly (P<0.05). Annual squab production and feed intake of parents increased when higher protein diets were fed. The feed conversion ratio of squabs decreased with increase in the protein content of the diet.
(Keywords: pigeon, diet, protein, reproduction, meat)

ZUSAMMENFASSUNG

Einfluss des Rohproteingehaltes im Futter auf die Reproduktionsleistung von Masttauben in verschiedenen Produktionsperioden

I. [1]Meleg, K. [2]Dublecz, L. [2]Vincze, P. [1]Horn
[1]Pannon Agrarwissenschaftliche Universität, Fakultät für Tierproduktion
Lehrstuhl für Geflügelzucht, Kaposvár, H-7400 Guba S. u. 40. Ungarn
Pannon Agrarwissenschaftliche Universität, Georgikon Fakultät für Landwirtschaft
[2]Lehrstuhl für Futtermittelkunde, Keszthely, H-8361 Deák F. u.16. Ungarn

In einem Versuch wurde das Futter für Masttauben mit unterschiedlichem Rohproteingehalt in den ersten beiden Produktionsjahren angereichert, und zwar mit 12, 14, 16, 18 und 20% Rohprotein. In jeder Versuchsgruppe standen 30 Zuchtpaare zur Verfügung. Die einzelnen Paare wurden in Käfigen gehalten, der Stall war fensterlos, die Belichtungsdauer betrug 12 Stunden pro Tag. Die Testperiode betrug 12 Monate in jeder Produktionsperiode. Legezyklus, Eierzahl und Eimasse, individuelles Eigewicht, Schlupfrate und Verlustrate wurden vom Rohproteingehalt des Futters nicht signifikant beeinflusst. Erhöhung des Rohproteingehaltes im Futter erhöhte die Anzahl der geschlüpften Jungtauben und der pro Zuchtpaar aufgezogenen Jungtauben signifikant

(P<0.05). Mit steigendem Rohproteingehalt im Futter erhöhte sich auch das Lebendgewicht der Masttauben im Alter von 4 Wochen signifikant (P<0.05). Futteraufnahme stieg parallel mit dem höheren Rohproteingehalt im Futter, wobei die Futterverwertung - bezogen auf das Lebendgewicht der aufgezogenen Jungtauben - mit steigendem Rohproteingehalt signifikant (P<0.05) verbessert werden konnte.
(Schlüsselwörter: Tauben, Futter, Mast, Protein, Reproduktion)

INTRODUCTION

Pigeons are monogamous and squabs are raised by their parents, both male and female, which feed the young pigeons with 'crop milk' in the first 5-7 days of their life. Because of this special characteristic the feeding system of pigeons differs markedly from that of other poultry species.

Few studies have been published on the protein requirements of pigeons. *Goodman* and *Griminger* (1969) found that a pigeon diet containing 16.5% crude protein increased weaning weights of squabs compared to a 14.7% crude protein diet. *McNabb et al*. (1972) reported higher weaning weight in pigeons fed wheat compared to soybean meal. *Little* and *Angell* (1977) found that a 10% crude protein diet containing 10% corn oil did not cover the requirements of pigeons. On the other hand, 20% and 40% crude protein failed to result in significant change in the weaning weight of young pigeons. *Böttcher et al.* (1985) established that 14% dietary crude protein content is enough for good squab production of breeding pairs.

Waldie et al. (1991) reported that a 22% CP diet with or without corn and a 16% diet without corn gave similar responses for production of breeding pairs and 4-week body weight of squabs.

In this experiment the effects of diets with different protein levels (12, 14, 16, 18 and 20%) on the production of auto-sexing utility type pigeons in the first and second production term were measured.

MATERIALS AND METHODS

The pigeon population

The utility-type pigeons used originated from auto-sexing Texan and King populations imported in the mid 1970s from the USA and later from France. All stocks were homozygous or hemizygous for the St^F (faded) gene described by *Hollander* (1942), which causes great differences in feather colour between the sexes, and in down feathering at the juvenile stage. During the last decade the whole population was bred as a single auto-sexing utility pigeon stock. More details regarding this population were published by *Meleg* and *Horn* (1998).

Management

The birds were housed in an environmentally controlled, windowless pigeon house. All pairs were randomly allocated to individual pigeon breeding cages (*Ballay*, 1976) designed to keep pigeon pairs separately. In each breeding cage the parents were able to feed their squabs up to the age of 28 days, the weaning stage. At this age squabs are ready and in prime condition for slaughter or are transferred to colony cages to be reared further. In this way the performance data for each pair and their offspring could be recorded separately.

The duration of the test period in the experiment was 12 months. The lighting programme was 12 light hours, with a light intensity of 2.5 w/m^2, provided by incandescent tubes throughout the year. The heating system ensured that the indoor temperature was at least 15°C in winter. Ventilation provided a maximum of 5 m^3 air per kg live weight per hour.

Feeding

Five pelleted low and high protein diets (from 12 to 20%) with ad libitum feeding were compared. Each experimental diet was fed to 30 breeding pairs. Pelleted diets were fed ad libitum during the whole test period. Water and mineral grit were also provided ad libitum. The composition of the experimental diets is shown in *Table 1*.

Table 1

Composition and nutrient content of experimental diets

	Protein levels (%) (1)				
Ingredient (%)(2)	12	14	16	18	20
Maize (3)	73	67.5	62	56.5	51
Wheat (4)	10	10	10	10	10
Bran (5)	5	5	5	5	5
Soybean meal (46% CP) (6)	3	8	13	18	23
Sunflower (40% CP) (7)	4	4.5	5	5.5	6
Vitamin mix (8)	5	5	5	5	5
Total (9)	100	100	100	100	100
Calculated nutrient content (10):					
ME (MJ/kg) (11)	12.92	12.64	12.37	12.10	11.83
Crude protein (%) (12)	12.14	14.05	16.03	18.01	20.00
Crude fat (%)(13)	3.19	3.10	2.99	2.89	2.80
Crude fibre (%) (14)	3.37	3.63	3.83	4.02	4.22
Met+Cys(%) (15)	0.49	0.53	0.59	0.64	0.67
Lysine (%) (16)	0.42	0.55	0.78	0.85	0.99
Met (%) (17)	0.24	0.26	0.28	0.32	0.34
Na (%) (18)	0.12	0.12	0.12	0.12	0.12
Ca (%) (19)	1.02	1.04	1.06	1.07	1.08
P (%) (20)	0.64	0.66	0.70	0.71	0.74
Vit. A (NE/kg) (21)	13200	13200	13200	13200	13200
Vit. D_3 (NE/kg) (22)	2640	2640	2640	2640	2640
Vit. E (mg/kg) (23)	22	22	22	22	22

1. Tabelle: Zusammensetzung und Nährstoffgehalt der Futtermischungen

Anteil von Rohprotein(1), Zusammensetzung(2), Mais(3), Weizen(4), Kleie(5), Sojagriess (46% RP)(6), Sonnenblumen (40% RP)(7), Vitaminergänzung(8), Gesamt(9), Kalkulierte Futterkomponente(10), ME(11), Rohprotein(12), Rohfett(13), Rohfaser(14), Methionin +Zystin(15), Lysin(16), Methionin(17), Na(18), Ca(19), P(20), A Vitamin(21), D_3 Vitamin(22), E Vitamin(23)

Measurement of traits

During the experiment length of egg cycle, egg production, egg weight, hatchability, number of squabs hatched, number of squabs weaned, squab mortality up to 28 days of age, squab weaning weight, annual squab production per pair, annual feed consumption per pair and squab feed conversion ratio were measured.

The number of squabs hatched was recorded daily. All squabs were weighed at 28 days of age. Weighing of squabs was always carried out before 10 a.m. to reduce possible variations due to difference in feed intake. Squab mortality was recorded daily for each pair up to the age of 28 days, when the squabs were weaned. The feed consumption of the pairs was measured every day.

Statistical analysis

Hatchability and viability were analysed by Chi^2 test, taking into consideration the methodical recommendations outlined by *Laughlin* and *Lundy* (1976). Traits characterised by normal or close to normal distribution were compared by *ANOVA* (Statgraphic 5.0, 1991).

RESULTS AND DISCUSSION

The effects of the treatments on the production performance of the breeding pairs are presented in *Table 2*.

The length of the egg cycle was not affected by the treatments, either in the first or in the second production cycle. The slight increase in egg number with increase in dietary crude protein content supports the results of *Levi* (1963) and *Böttcher et al.* (1985), who found a similar tendency with utility-type pigeon populations.

The hatchability of laid and fertile eggs was also higher when pigeons were fed high protein diets, but these differences were not significant in either production period. The hatchability traits were 3-5% higher in the first than in the second cycle. The hatchability values recorded in this experiment were lower than those in the literature (*Waldie et al.*, 1991). The reason for this may have been the difference between natural matings in groups and cage matings. In pigeon populations it has often been observed that the reproductive performance of breeding pairs was reduced if sexually mature males and females were hindered in the process of choosing partners (*Levi,* 1963).

Significant differences were observed between the treatments in the number of squabs hatched and weaned. Significantly ($P<0.05$) higher values were obtained for these parameters when pigeons were fed the 20% CP diet in parallel with production cycles.

Squab mortality was also significantly ($P<0.05$) affected by the protein content of the diet. Feeding the 14% CP diet in the first and 12% CP in the second period resulted in the highest values, while the 20% CP diet led to the lowest values in both respective terms.

Parallel to increase in dietary crude protein content the 4-week body weight of squabs also increased significantly ($P<0.05$), although this difference did not exceed 6% between the diets of lowest and highest protein content in parallel with the first and second cycles. Diets containing less than 16% CP fed to pigeons kept in cages resulted in smaller weaned and marketable squabs. Similar tendencies have been observed for pigeons kept in groups in voliers (*Goodman* and *Griminger,* 1969; *Little* and *Angell*, 1977; *Bötcher et al*, 1985). The difference in squab body weight between the 12% and 20% CP feed groups was about 25-30g in the two respective cycles. Annual squab production per pair was significantly ($P<0.05$) higher at 18% CP level compared to all the other treatments in the first and second production terms.

Table 2

Means of quantitative traits of utility-type breeding pairs fed diets containing different protein levels (30 pairs per treatment)

	Protein levels (%) (1)				
Trait (2)	12	14	16	18	20
Egg cycle (days) (3)	I.-27.84±0.97^{a}	28.50±1.17^{a}	29.84±1.38^{a}	30.56±1.93^{a}	27.53±1.67^{a}
	II.-28.65±1.11^{a}	29.10±1.26^{a}	28.84±1.45^{a}	28.35±1.78^{a}	30.27±1.92^{a}
Annual egg production (no.) (4)	20.18±2.17	21.18±2.72	21.08±2.43^{a}	22.10±3.67^{a}	22.53±3.25^{a}
	20.50±1.58	20.96±2.94	21.49±2.69^{a}	21.24±4.33^{a}	22.85±3.85^{a}
Egg weight (g) (5)	21.16±1.63^{a}	21.75±1.38^{a}	21.51±±1.57^{a}	21.55±1.52^{a}	22.09±1.23^{a}
	21.12±1.09^{a}	21.30±1.65	21.99±1.78^{a}	22.01±1.42^{a}	22.24±0.97^{a}
Hatchability of laid eggs (%) (6)	59.56±18.31^{a}	61.23±17.14^{a}	59.45±19.31^{a}	61.22±21.47	62.35±16.97^{a}
	62.58±12.09^{a}	63.45±17.43^{a}	63.10±20.62^{a}	64.94±19.25	64.56±18.27^{a}
Hatchability of fertile eggs (%) (7)	62.12±1257^{a}	63.20±19.39^{a}	61.55±15.47^{a}	65.43±13.32^{a}	63.95±18.13^{a}
	66.03±10.20^{a}	67.36±13.22^{a}	66.97±14.18^{a}	68.95±12.11^{a}	69.12±14.28^{a}
Hatched squabs per pair per year (no.) (8)	12.02±2.38^{a}	12.97±2.83^{a}	12.53±3.43^{a}	13.53±3.63^{a}	14.04±3.67^{a}
	12.83±2.95^{a}	13.08±3.31^{a}	13.26±3.88^{a}	14.01±3.42^{a}	14.75±3.05^{a}
Weaned squabs per year (no.) (9)	8.17±3.41^{a}	8.61±4.05^{b}	8.58±3.89^{a}	9.37±3.63^{c}	10.20±3.13^{c}
	8.48±3.15^{a}	8.98±3.55^{b}	9.35±3.92^{a}	9.92±3.60^{b}	11.12±2.97^{c}
Mortality of squabs up to weaning (%) (10)	32.02±15.27^{a}	33.61±17.23^{a}	31.52±18.33^{a}	30.74±20.12^{a}	27.35±19.67^{a}
	33.90±16.66^{c}	31.53±18.44^{b}	29.72±19.91^{b}	29.19±19.47^{b}	24.61±18.11^{a}
4-week body weight of squabs (g) (11)	502.58±39.43^{a}	513.90±33.59^{b}	529.93±30.68^{c}	523.91±35.23^{b}	532.30±29.38^{c}
	510.90±35.00^{a}	518.10±38.10^{b}	525.60±31.90^{b}	531.90±29.20^{c}	535.30±26.41^{c}
Annual squab production per pair (kg/pair) (12)	4.10±1.03^{a}	4.42±1.83^{a}	4.54±2.19^{b}	4.91±2.35^{b}	5.42±2.17^{c}
	4.33±0.78^{a}	4.65±1.99^{b}	4.91±2.05^{b}	5.27±1.93^{b}	5.95±1.85^{c}

(a-c P<0.05)
I - First production term (*Erstes Produktionjahr*)
II - Second production term (*Zweites Produktionjahr*)

2. Tabelle: Reproduktionsleistung von Masttauben bei unterschiedlichem Proteingehalt im Futter (30 Paare pro Behandlung)

Anteil Rohprotein(1), Merkmal(2), Zwischenlegezeit (Tage)(3), Eizahl(4), Eigewicht(5), Schlupfrate/gelegte Eier(6), Schlupfrate/befruchtete Eier(7), Geschlüpfte Küken jährlich pro Paar(8), Aufgezogenen Küken jährlich pro Paar(9), Mortalität der Jungtauben bis zur Entwöhnung(10), 4-Wochengewicht der Jungtauben(11), Jährliche Produktion an Jungtaubengewicht, kg/Paar(12)

The feed intake of the birds was also significantly (P<0.05) affected by the composition of the experimental diets (*Table 3*). Pigeons consumed higher quantities of the high-protein diets than of the others. Crude protein intake from the 20% CP diet was thus almost twice as high as that observed at 12% CP. These tendencies were the same in both production periods. The reason for the differences in feed consumption could be that the ME values of the experimental diets decreased with increase in CP (*Table 1*).

Since birds tend to eat in order to satisfy their energy requirement, the differences in feed intake were probably due to the lower ME rather to the CP values of the diets.

Table 3

Means of feed efficiency of meat-type breeding pairs fed diets containing different protein levels (30 pairs per treatment)

	Protein level (%) (1)				
Trait (2)	12	14	16	18	20
Daily feed intake of pairs (g/day) (3)	104.65±10.12^{a}	108.76±11.32^{b}	113.42±11.87^{b}	117.17±12.83^{c}	118.05±12.07^{c}
	108.63±8.27^{a}	114.52±10.90^{c}	114.34±9.93^{b}	119.23±12.38^{c}	123.56±11.31^{c}
Daily protein intake of pairs (g/day) (4)	12.70±2.20^{a}	15.08±2.48^{b}	18.18±2.53^{b}	21.10±2.87^{c}	23.61±3.63^{c}
	13.18±1.98^{a}	16.09±2.61^{b}	18.81±2.61^{b}	21.47±3.28^{c}	24.71±3.39^{c}
Daily ME intake of pairs (kJ/day) (5)	13.52±0.96^{b}	13.74±1.26^{b}	14.03±1.38^{c}	14.17±1.23^{b}	13.96±1.52^{a}
	14.03±0.78^{a}	14.46±1.45^{a}	14.51±1.29^{a}	14.42±1.67^{a}	14.61±1.66^{a}
Annual feed consumption of pair (kg) (6)	38.20±1.98^{a}	39.70±2.56^{b}	41.40±3.19^{b}	42.77±2.85^{b}	43.09±3.49^{c}
	39.65±2.62^{a}	41.80±2.26^{b}	42.83±2.94^{b}	43.52±3.19^{b}	45.10±3.78^{c}
Annual feed conversion of squabs (kg/kg) (7)	9.31±3.12^{c}	8.98±2.98^{b}	9.11±2.13^{c}	8.71±2.85^{b}	7.95±2.03^{a}
	9.15±2.91^{c}	8.98±3.81^{b}	8.72±2.38^{b}	8.25±2.67^{b}	7.57±2.17^{c}

(a-c $P<0.05$)
I - First production term (*Erstes Produktionjahr*)
II - Second production term (*Zweites Produktionsjah*)

3. Tabelle: Futterverwertung von Masttauben bei unterschiedlichem Proteingehalt im Futter (30 Paare pro Behandlung)

Anteil Rohprotein(1), Merkmal(2) Tägliche Futteraufnahme der Paare(3), Tägliche Proteinaufnahme der Paare(4), Tägliche Energieaufnahme der Paare(5), Jährlicher Futterverbrauch eines Paares(6), Jährliche Futterverwertung der Jungtauben(7)

In spite of the higher feed consumption of the 20% CP diet fed to adult birds, the feed conversion ratio of their squabs was the lowest in this case. This means that the higher feeding cost was compensated for by higher numbers of weaned squabs per breeding pair in the two consecutive terms.
From the results of this experiment it can be concluded that the protein content of pigeon diets plays an important role and effects the most important reproduction traits significantly. Feeding utility-type breeding pairs with high-protein diets increases both the number and the weight of weaned squabs. The feed conversion ratio of squabs can also be improved. The effect of difference in dietary ME value and energy: protein ratio requires further investigation.

ACKNOWLEDGEMENTS

The work was supported by a grant from the Hungarian Scientific Research Fund (OTKA), project No. F022788.

REFERENCES

Ballay A. (1976). Keeping pigeons in cages. In: Biszkup F., Gouth J., Horn P. ed.: Commercial squab production. Mezőgazdasági Kiadó, Budapest, 164-170.

Böttcher, J., Wegner, R.M., Petersen, J. Gerken, M. (1985). Untersuchungen zur Reproduktions-, Mast- und Schlachtleistung von Masttauben. Arch. für Geflügelk., 49. 2. 63-72.

Goodman, D.B., Griminger, P. (1969). Effect of dietary energy source on racing performance in the pigeon. Poultry Sci., 48. 2058-2063.

Hollander, W.F. (1942). Auto-sexing in the domestic pigeons. Journal of Heredity, 33. 133-135.

Laughlin, K.F., Lundy, H. (1976). The influence of sample size on the choice of method and interpretation of incubation experiments. British Poultry Sci., 17. 53-57.

Levi, W.M. (1963). The Pigeon. Levi Publ. Co. Inc. Sumter. S.C.

Little, J.M., Angell, E.A. (1977). Dietary protein level and experimental artherosclerosis. Artherosclerosis, 26. 173-179.

McNabb, F.M.A., McNabb, R.A., Ward, J.M. (1972). The effects of dietary protein content on the water requirements and ammonia excretion in pigeons, C. Livia. Comp. Biochem. Physiol. A. Comp. Physiol., 43. 181-185.

Meleg I., Horn P. (1998). Genetic and phenotypic correlations between growth and reproductive traits in meat-type pigeons. Arch. für Geflügelk., 62. 2. 86-88.

STATGRAPHICS. (1991). Version 5.0, copyright STCS Inc.

Waldie, G.A., Olomu, J.M., Cheng, K.H., Sim, J. (1991). Effects of two feeding systems, two protein levels, and different dietary energy sources and levels on performance of squabbing pigeons. Poultry Sci., 70.1206-1212.

Corresponding author (*Adresse*):

István Meleg
Pannon University of Agriculture, Faculty of Animal Science
H-7401 Kaposvár, P.O. Box 16. Hungary
Pannon Agrarwissenschaftliche Iniversität, Fakultät für Tierproduktion
H-7401 Kaposvár, Pf.: 16. Ungarn
Tel.: 36-82-314-155, Fax: 36-82-320-175
e-mail: melegi@atk.kaposvar.pate.hu