EFFECT OF DIFFERENT FEEDING PROGRAMS ON GROWTH AND CARCASS QUALITY OF THREE GENOTYPES OF PEKIN DUCKS

MARIACA E., BLÁHA J.

Abstract

The effect of different feeding programs on growth, feed conversion and carcass quality of Pekin ducks has been studied. Three genotypes of Czech Pekin ducks were used for this purpose: TTH, RITO 14 and RITO M. In this experiment there were compared two-diet program in control group and three-diet program in experimental groups of ducks. The experimental diets were formulated from maize, wheat, soybean meal, fish meal, soybean oil and feed additives. Crude protein content of diets was 22.5 % for starter, 18 % for grower, 16 % and 15 % for finisher diets. 15 % of crude protein in finisher diet showed better results in live weight and weight gains in all genotypes than 16 % one in males. The highest live weight was achieved in genotype TTH (3434 g) in males.
To the contrary in females better results showed 16 % of crude protein in the finisher diet in all genotypes than 15 % one. The highest live weight was achieved in genotype RITO M (3213 g) in females. The differences were statistically significant in genotypes TTH, RITO 14 and RITO M in males, and in RITO M in females. The same results were reached in weight gains in the period 1 – 49 days. In all genotypes and sexes during the period 36 – 49 days, 15 % of crude protein in finisher diet showed higher weight gains than 16 % one except males RITO 14 and RITO M. The differences were statistically significant in genotypes TTH, RITO 14 and RITO M in males, and in RITO M in females. Feed conversion was the best in three-diet program with 15 % of crude protein in finisher diet in both sexes and all genotypes. Carcass yield was the best in two-diet program in both sexes and all genotypes despite of the highest live weight was achieved in three-diet program.

Key words: Pekin ducks, different diet program, growth, feed conversion, slaughter quality.

INTRODUCTION

The study was intended to investigate the influence of two or three-diet program on performance of meat-type Pekin ducks.
Besides of temperate zone, Czech Pekin ducks were proved in tropical zone. Czech genotypes of Pekin ducks were imported to Vietnam (1986), where was realized experiment with Czech Pekin ducks and Cherry Valley ducks. The experimental ducks were placed in the same environmental and food conditions.
The Czech ducks weighed 2720 ± 50 g in comparison with 2080 ± 28 g for Cherry Valley ducks
in 8th week of fattening. Food conversion was for Czech ducks 2.78 kg, and for Cherry Valley ducks 3.04 kg (Nguyen, Tran, Pham, 1986).
In formulating diets for meat ducks, care must be taken in adjusting the balance of protein : energy
to try and minimize carcass fat deposition (Leeson, S. and Summers, J. D., 1991). Carcass quality continues to be a major limitation, since the duck especially has a propensity to deposit considerable quantities of subcutaneous fat (Leeson, S. and Summers, J. D., 1991). Leeson, S. and Summers, J. D. (1991) reported about diets for meat ducks with protein level 22 – 23 % for starter and 16 – 20 % for grower-finisher.
According to Dean (1972) in two-diet program the diet contains 22 % of protein for the period from 0 to 2 weeks and 16 % for the period from 2 to 7 weeks. The level of crude protein should be in between 16 – 22 % in starter diet, and in between 12 – 18 % in growing-finishing diet (Scott and Dean, 1991). According to Wilson (1975) and Siregar (1982) the need for 22 % of protein during the starting period is questionable. They reported that protein levels of 18 and 19 % in diet providing 12.6 to 12.7 MJ ME_n/kg were adequate from 0 – 2, 2 – 4 and 4 – 7 weeks, respectively (Wilson, 1975; Leclercq, 1986).
According to Leeson, S. and Summers, J. D., (1991) the duck seems to be able to digest fiber slightly better than does the chicken, and as such, metabolizable energy value for ducks may be 5 – 6 % greater than corresponding values for chicken – such differences should be considered in setting energy specifications
of diets. Both authors reported 2756 kcal/kg i.e. 11.531 kJ/kg ME and 2900 kcal/kg i.e. 12.134 kJ/kg ME for starter diets and 2695 – 2976 kcal/kg i.e. 11.276 kJ/kg – 12.452 kJ/kg ME for grower-finisher diets. High energy diets are often blamed for the high levels of fat seen in the carcass. However, the duck seems to eat to its energy requirement over quite a wide range of diet energy levels, and so it is not so obvious that high diet energy levels will lead to increase energy intake. In most instances, such high energy diets are not adjusted for crude protein content, and it is the balance of protein to energy that is most often the culprit that leads to increases in carcass fat observed with high energy diets (Leeson, S. and Summers, J. D., 1991). Leeson, S. and

Summers, J. D., (1991) suppose that this is reason to believe that the net energy of fat is increased when considerable portions of fat are being deposited in the carcass, and this situation does detract from the use of high energy diets. Due to the duck's apparent superior utilization of crude fiber, and the duck's ability to adjust feed intake response to diet energy concentration, there seem to be advantages to using diets of medium-low energy concentration.

There were compared two-diet program in control group and three-diet program in experimental groups of ducks in this experiment. There were used three genotypes of Czech Pekin ducks: TTH, RITO 14 and RITO M.

MATERIAL AND METHODS

The experiment started on 1200 one-day-old Pekin ducks – 600 males and 600 females. Three checks genotypes – 400 ducks TTH, 400 ducks RITO 14, and 400 ducks RITO M were studied in this experiment. The ducklings were sexed. One-day-old ducklings were individually weighted, and allotted to 18 groups.

N°	genotype	group	sex	number of ducks
1	TTH	control group TTH	males	67
2	TTH	experimental group 1	males	67
3	TTH	experimental group 2	males	67
4	RITO 14	control group RITO 14	males	67
5	RITO 14	experimental group 3	males	67
6	RITO 14	experimental group 4	males	67
7	RITO M	control group RITO M	males	66
8	RITO M	experimental group 5	males	66
9	RITO M	experimental group 6	males	66
10	TTH	control group TTH	females	67
11	TTH	experimental group 7	females	67
12	TTH	experimental group 8	females	67
13	RITO 14	control group RITO 14	females	67
14	RITO 14	experimental group 9	females	67
15	RITO 14	experimental group 10	females	67
16	RITO M	control group RITO M	females	66
17	RITO M	experimental group 11	females	66
18	RITO M	experimental group 12	females	66

The control and experimental groups of ducks were kept in the following temperatures:

until 5 days of age	32-30 °C
6-10 days	29-25 °C
11-21 days	24-18 °C
21-49 days	25-15 °C

The density was following:

1 – 21 day of age 20.40 ducks/m^{-2}
22 – 49 day of age 3.36 ducks/m^{-2}

The control and experimental groups were exposed to the light for 24 hours per day until 21st day of age, and for 16 hours per day from 22nd to 49th day. Intensity of the light was 10 lx per 1 m^2 of floor space. The ducks were kept in deep litter from the wood shaving. The ducks were given drinking water and fed ad libitum.

The diets VKCH 1 were fed to both control and experimental groups until 21st day of age. Diet VKCH 2 was fed to control groups until 49th day of age and to experimental groups until 35th day of age. Diets VKCH 3A and VKCH 3B were fed to experimental groups from 36th to 49th day of age.

The composition of the diets is given in Table 1.

Besides the monitoring of growth rate, feed consumption, feed efficiency and carcass composition were evaluated.

The ducklings were weighted individually, and ten birds were taken for meat analysis from each group at the 49th day. Slaughter dissection was made 50th day.
The ducks were slaughtered, bled, plucked and eviscerated. Head was cut off between the occipital bone and the first neck vertebra. Skin of the neck remained as a part of the carcass. During evisceration, intestines, cloaca, oesophagus, trachea, pancreas, lungs and feet were removed, and giblets and intestinal fat were taken out. The weight of giblets was recorded as the sum of weights of heart, gizzard, liver and neck without skin. Also intestinal fat was weighted. Feet were cut off in a heel joint. Gizzards were cleaned and gall bladders were removed. The day after, when the carcasses were cooled down, the abdominal fat was taken off and weighted, also every carcass was weighted. The weight of abdominal fat was recorded as the sum of intestinal fat and abdominal fat. Legs were cut off in coaxal joint and muscles of thighs were segregated from bones. Then the breast muscles were segregated from the breast bone. Breast and thigh muscles with skin and without skin were weighted separately.

$$\text{Dressing percentage was calculated} = \frac{\text{carcass weight + giblets}}{\text{live weight}} \times 100$$

$$\text{Slaughter value was calculated} = \frac{\text{carcass weight}}{\text{live weight}} \times 100$$

The results were subjected to a one-way analysis of variance and the significance of differences between groups means was determined using Duncan's multiple range test.

SCHEMA OF EXPERIMENT

Groups	Feed				Level of CP in finisher (%)
	1-21 d	22-35 d	22-49 d	36-49 d	
males					
Control group TTH	VKCH 1		VKCH 2		18
Exp. group 1 TTH	VKCH 1	VKCH 2		VKCH 3A	16
Exp. group 2 TTH	VKCH 1	VKCH 2		VKCH 3B	15
Control group RITO 14	VKCH 1		VKCH 2		18
Exp. group 3 RITO 14	VKCH 1	VKCH 2		VKCH 3A	16
Exp. group 4 RITO 14	VKCH 1	VKCH 2		VKCH 3B	15
Control group 5 RITO M	VKCH 1		VKCH 2		18
Exp. group 5 RITO M	VKCH 1	VKCH 2		VKCH 3A	16
Exp. group 6 RITO M	VKCH 1	VKCH 2		VKCH 3B	15
females					
Control group TTH	VKCH 1		VKCH 2		18
Exp. group 7 TTH	VKCH 1	VKCH 2		VKCH 3A	16
Exp. group 8 TTH	VKCH 1	VKCH 2		VKCH 3B	15
Control group RITO 14	VKCH 1		VKCH 2		18
Exp. group 9 RITO 14	VKCH 1	VKCH 2		VKCH 3A	16
Exp. group 10 RITO 14	VKCH 1	VKCH 2		VKCH 3B	15
Control group 5 RITO M	VKCH 1		VKCH 2		18
Exp. group 11 RITO M	VKCH 1	VKCH 2		VKCH 3A	16
Exp. group 12 RITO M	VKCH 1	VKCH 2		VKCH 3B	15

RESULTS

In Table 1 composition of the diets and content of nutrients are shown. Compound feeds were nearly identical in the composition just in VKCH 3 the content of maize was very low to have the same level of ME in all diets.

In Table 2a and 2b body weights at the age of 1, 21, 35, and 49 days are shown. The highest final live weight was in males in genotype TTH in experimental group 2, in RITO 14 in experimental group 4, and in RITO M in experimental group 6 – it means in groups with three-diet program with 15 % of crude protein in finisher diet. There were statistically significant differences between two-diet and three-diet program in all genotypes. The highest final live weight in females was achieved in genotype TTH in experimental group 7, in RITO 14 in experimental group 9, and in RITO M in experimental group 11 – it means in groups with three-diet program with 16 % of crude protein in finisher diet. In females there were also observed statistically significant differences between two-diet and three-diet program in all genotypes. It is evident that three-diet program with lower protein in the finisher diet demonstrates higher live weight.

In Table 3a and 3b live weight gains are shown. Weight gains in period from 1 to 21 days, from 22 to 35 days, from 36 to 49 days, and from 1 to 49 days. The highest live weight gains in period 1 – 49 days were achieved in males in genotype TTH in experimental group 2, in RITO 14 in experimental group 3, and in RITO M in experimental group 6 – it means in groups with three-diet program with 15 % of crude protein in finisher diet. There were statistically significant differences between two-diet and three-diet program in all genotypes. The highest live weight gains in period 1 – 49 days were achieved in females in genotype TTH in experimental group 7, in RITO 14 in experimental group 9, and in RITO M in experimental group 11 – it means in groups with three-diet program with 16 % of crude protein in finisher diet. In females there were statistically significant differences between two-diet and three-diet program in genotypes TTH and RITO M.

In Table 4a and 4b feed conversion is shown, consumption of feed for 1 kg of gain in period from 1 to 21 days, it means conversion of VKCH 1, from 22 to 35 days, conversion of VKCH 2 for experimental groups, from 22 to 49 days, conversion of VKCH 2 for control group, and from 36 to 49 days, conversion of VKCH 3 for experimental groups. Conversion of feed was the best in three-diet program with 15 % of crude protein, and was the worst in two-diet program in both sexes and in all genotypes.

In Table 5a and 5b the mortality is shown. The mortality was very low and didn't exceed 4 %.

In Tables 6a – 6f results of slaughter analysis of each genotype and sex are shown. The best results of slaughter analysis were reached in two-diet program in both sexes and all genotypes.

DISCUSSION

This experiment was conducted on three check genotypes of Pekin ducks. We tested three-diet program with different levels of crude protein. Control group was fed in two-diet program as it is usual. The content of crude protein decreased from 22 % in starter to 18 % in finisher. In the experimental groups 1, 3, 5, 7, 9, and 11 the content of crude protein decreased from 22 % in starter to 16 % in finisher, and in the experimental groups 2, 4, 6, 8, 10 and 12 the content of crude protein decreased from 22 % in starter to 15 % in finisher.

Content of energy was nearly the same in every feed. In starter 12.32 MJ/kg, in grower 12.33 MJ/kg and in finisher 12.22 MJ/kg.

The highest live body weights of male ducks at the age of 49 days were achieved in all genotypes in experimental groups 2, 4, and 6, it means in groups with 15 % of crude protein. In females, in genotypes RITO 14 and RITO M, the highest live weight in 49 days was in experimental groups 9 and 11, it means in groups with 16 % of crude protein. In genotype TTH the highest live weight was in control group. The best live body weights achieved ducks in three-diet program. Males weighted from 3294 to 3434 g (depending on genotype), females weighted from 3141 to 3166 g (depending on genotype). According to Knížetová et al. (1991) the ducks fed on a starter diet containing 17.6 % of crude protein (11.41 MJ ME/kg) from hatching to 3 weeks of age weighted from 826 to 1033 g. In the diet up to 10 weeks of age the feed with 14.8 % of crude protein was used. At the age of 7 weeks the ducks weighted from 2559 to 3141 g.

Farhat and Chavez (2000) reached in experiment with two sexed lines of Pekin ducks 3266 g of live weight in females and 3458 g in males at 7 weeks of age.

MTD Ústrašice (2002) shows in report of test 27 live weight of ducks at 7 weeks of age in two feed-diet program. In males of genotype RITO 14 they reached 3310 g, and 3047 g in females. In genotype RITO M they reached 3498 g in males, and 3321 g in females. Genotype TTH (MTD Ústrašice, 2003, report of test 62) weighted at 7 weeks of age 3106 g in males and 2718 g in females.

It's evident that in three-feed diet program the ducks demonstrate better results in live weight that in two-feed diet program.

Feed conversion was the best in experimental groups with the lowest amount of crude protein (15 %).

In males TTH feed conversion was 2.18, 2.11, and 2.10 kg in control group, experimental group 1 and experimental group 2, respectively. In males RITO 14 feed conversion was 2.20, 2.15 and 2.11 kg in control group, experimental group 3 and experimental group 4, respectively. In males RITO M feed conversion was 2.22, 2.16 and 2.13 kg in control group, experimental group 5 and experimental group 6, respectively. In females TTH feed conversion was 2.29, 2.19 and 2.22 kg in control group, experimental group 7 and experimental group 8, respectively. In females RITO 14 feed conversion was 2.26, 2.20 and 2.24 kg in control group, experimental group 9 and experimental group 10, respectively. In females RITO M feed conversion was 2.19, 2.17 and 2.14 kg in control group, experimental group 11 and experimental group 12, respectively.

According to Farhat and Chavez (2000) feed conversion was 2.48 kg in males, and 2.62 kg in females. In comparison with MTD Ústrašice (2003, report of test 28) feed conversion is comparable. In males of genotype RITO feed conversion was 2.65 kg, in females 2.72 kg, in genotype TTH (2003, report of test 62) 2.97 kg in males and 2.74 kg in females. In comparison with Leeson, Summers and Proulx (1982) feed conversion is comparable - 2.62 kg in males and 2.83 kg in females.

In slaughter analysis, percentage share of thighs muscles in males TTH was 13.35, 13.09 and 11.52 % in control group, experimental group 1 and experimental group 2, respectively. In males RITO 14 13.51, 13.33 and 12.33 % in control group, experimental group 3 and experimental group 4, respectively. In males RITO M 13.85, 14.23 and 13.85 % in control group, experimental group 5 and experimental group 6, respectively.

In females TTH 12.75, 13.50 and 13.39 % in control group, experimental group 7 and experimental group 8, respectively. In females RITO 14 14.36, 14.74 and 14.73 % in control group, experimental group 9 and experimental group 10, respectively. In females RITO M 14.41, 13.28 and 13.97 % in control group, experimental group 11 and experimental group 12, respectively. MTD Ústrašice (2003, report of test 28) reached percentage share of thighs muscles in genotype TTH 13 % in males and 12.7 % in females. In genotype RITO 14 12.6 % in males and 12.7 % in females. In genotype RITO M 11.4 % in males and 12.5 % in females (2002, report of test 27).

Percentage share of breast muscles in males TTH was 16.36, 15.36 and 15.65 % in control group, experimental group 1 and experimental group 2, respectively. In males RITO 14 16.67, 17.53 and 14.54 % in control group, experimental group 3 and experimental group 4, respectively. In males RITO M 15.14, 15.31 and 15.50 % in control group, experimental group 5 and experimental group 6, respectively. In females TTH 17.99, 17.15 and 17.55 % in control group, experimental group 7 and experimental group 8, respectively.

In females RITO 14 18.73, 17.47 and 18.04 % in control group, experimental group 9 and experimental group 10, respectively. In females RITO M 17.58, 17.17 and 18.21 % in control group, experimental group 11 and experimental group 12, respectively. MTD Ústrašice (2003, report of test 28) reached percentage share of breast muscles in TTH 13.8 % in males and 15.7 % in females. In RITO 14 15.4 % in males and 16.4 % in females. In genotype RITO M 15.3 % in males and 15.1 % in females (2002, report of test 27).

Percentage share of abdominal fat in males TTH was 1.77, 1.75 and 1.76 % in control group, experimental group 1 and experimental group 2, respectively. In males RITO 14 1.94, 2.15 and 2.27 % in control group, experimental group 3 and experimental group 4, respectively. In males RITO M 1.66, 1.82 and 1.68 % in control group, experimental group 5 and experimental group 6, respectively. In females TTH 2.02, 2.54 and 2.03 % in control group, experimental group 7 and experimental group 8, respectively. In females RITO 14 2.98, 2.32 and 2.05 % in control group, experimental group 9 and experimental group 10, respectively.

In females RITO M 1.91, 2.09 and 2.20 % in control group, experimental group 11 and experimental group 12, respectively. Leeson, Summers and Proulx (1982) noticed 1.8 % of abdominal fat in males and 2.0 % in females. 2.26 % of abdominal fat noticed Farhat and Chavez (2001). MTD Ústrašice (2002, report of test 27) noticed 1.8 % of abdominal fat in males and 1.7 % in females of genotype RITO 14. 1.5 % in males and 1.6 % in females of genotype RITO M, and in genotype TTH (2003, report of test 28) 1.2 % in males and 1.4 % in females.

Dressing percentage in males TTH was 72.89, 71.38 and 71.50 % in control group, experimental group 1 and experimental group 2, respectively. In males RITO 14 73.09, 72.72 and 69.94 % in control group, experimental group 3 and experimental group 4, respectively. In males RITO M 70.36, 72.07 and 71.19 % in control group, experimental group 5 and experimental group 6, respectively. In females TTH 72.41, 71.37 and 73.29 % in control group, experimental group 7 and experimental group ,8 respectively. In females RITO 14 76.59, 75.15 and 72.16 % in control group, experimental group 9 and experimental group 10, respectively.

In females RITO M 76.27, 70.78 and 75.22 % in control group, experimental group 11 and experimental group 12, respectively. MTD Ústrašice (2003, report of test 28) achieved in RITO 14 dressing percentage 72.1 % in males and 72.5 % in females. In TTH 71.7 % in males and 72.0 % in females. In RITO M 71.3 % in males and 71.3 % in females (2002, report of test 27). Farhat and Chavez (2000) reached dressing percentage 73.1 % in control group and 75.65 % in muscle thickness group.

CONCLUSION

Despite of males of TTH reached the highest live weight and weight gains in three-diet program with 15 % of crude protein in finisher, the results of slaughter analysis (% share of thighs muscles, % share of breast muscles and dressing percentage) were better in two-diet program. Content of abdominal fat was the highest in three-diet program but without statistically significant difference. The same was achieved in genotype RITO 14. Live weight and weight gains were also the highest in three-diet program with 15 % of crude protein in finisher, but slaughter analysis (% share of thighs muscles, % share of abdominal fat and dressing percentage) was better in two-diet program. Only % share of breast muscles was better in three-diet program with 16 % of crude protein in finisher. In RITO M the live weight and weight gains were also the highest in three-diet program with 15 % of crude protein in

finisher. But slaughter analysis didn't show any relations as in previous genotypes.

In females, in genotype TTH the highest live weight and weight gains were in three-diet program with 16 % of crude protein in finisher, but this group showed the worst results of slaughter analysis. The highest % share of breast muscles and the lowest % share of abdominal fat was in two-diet program, the highest % share of thighs muscles in three-diet program with 16 % of crude protein and the best dressing percentage in three-diet program with 15 % of crude protein. In genotype RITO 14 the live weight and weight gains were also the highest in three-diet program with 16 % of crude protein in finisher. Despite of it, the genotype RITO 14 did not show the best results in slaughter analysis. The highest % share of breast muscles and the best dressing percentage was achieved in two-diet program, the highest % share of thighs muscles in three-diet program with 16 % of crude protein in finisher and the lowest % share of abdominal fat was achieved in three-diet program with 15 % of crude protein in finisher. In genotype RITO M the highest live weight and weight gains were achieved in three-diet program with 16 % of crude protein in finisher, but this group showed the worst results of slaughter analysis. % share of thighs muscles, % share of abdominal fat and dressing percentage were the best in two-diet program and % share of breast muscles was best in three-diet program with 15 % of crude protein in finisher.

Males in all studied genotypes reached the best live weight and weight gains in three-diet program with 15 % of crude protein in finisher, but better results in slaughter analysis showed two-diet program. The same was determined in females in all genotypes. Despite of the highest live weight and weight gains were observed in three-diet program with 16 % of crude protein in finisher, the best results in slaughter analysis showed two-diet program.

Feed conversion was the best in three-diet program with 15 % of crude protein in finisher in males in all genotypes, the same was observed in females. Three-diet program and relatively low content of crude protein in finisher improved feed conversion in both sexes and all genotypes.

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Corresponding author:

Prof. Bláha J.
Czech University of Life Sciences Prague
Institute of Tropics and Subtropics
165 21 Prague 6 - Suchdol, The Czech Republic

Composition of the diets **Tab. 1.**

Ingredients:	VKCH 1	VKCH 2	VKCH 3A	VKCH 3B
	%	%	%	%
Maize	23.05	24.90	4.50	4.60
Wheat	42.00	52.00	79.00	81.50
Soybean meal, extrd. (48 % CP)	26.00	16.30	9.80	7.10
Soybean oil	2.00	1.00	0.60	0.40
Fish meal (63-64 % CP)	4.00	2.00	2.00	2.00
Limestone (37,5 % Ca)	0.50	1.20	1.20	1.50
Dicalcium phosphate	1.70	1.80	1.80	1.70
NaCl	0.25	0.30	0.30	0.30
Premix - Aminovitan mikro VKCH plus	0.50 VKCH 1	0.50 VKCH 2	0.50 VKCH 3a	0.50 VKCH 3b
L-lysin	-	-	0.30	0.40
Total	100.00	100.00	100.00	100.00
Nutrients:				
CP g	**225.55**	**181.24**	**163.26**	**153.47**
ME MJ/kg	12.32	12.33	12.22	12.22
Lysine g	12.82	9.62	9.73	9.99
Methionine g	5.05	4.06	4.00	4.07
Methionine+Cystine g	8.84	7.32	6.94	6.67
Threonine g	8.30	6.32	5.38	4.95
Tryptofane g	2.81	2.18	2.01	1.87
Arginine g	14.10	10.52	8.87	8.04
Linoleic acid g	18.15	13.27	10.98	9.96
Ca g	9.26	10.99	10.92	11.74
P g	4.65	4.28	4.35	4.19
Na g	1.84	1.70	1.68	1.67

Note: Premixes VKCH contain: Vitamins, microelements, and amino acids.
VKCH 1 contains: 200 g L – lysine, 260 g DL – methionine (in effective form)
VKCH 2 contains: 260 g L – lysine, 220 DL – methionine (in effective form)
VKCH 3a contains: 260 g DL – methionine (in effective form)
VKCH 3b contains: 300 g DL – methionine (in effective form)

Live weight of ducks (g) - genotypes TTH, RITO 14, RITO M (males) **Tab. 2a**

Age	1 d	21 d	35 d	49 d
	x ± Sd	x ± Sd	x ± Sd	x ± Sd
GROUPS:				
TTH Control	50 ± 3	1422 ± 166	2575 ± 234	3212 ± 293
TTH Exp. 1	49 ± 3	1353 ± 140*	2435 ± 185**	3180 ± 297
TTH Exp. 2	49 ± 4	1400 ± 168	2638 ± 379	3434 ± 273**
RITO 14 Control	51 ± 3	1393 ± 134	2410 ± 242	3050 ± 281
RITO 14 Exp. 3	48 ± 3	1393 ± 161	2369 ± 195	3215 ± 219**
RITO 14 Exp. 4	50 ± 4	1377 ± 157	2543 ± 298*	3341 ± 231**
RITO M Control	48 ± 4	1339 ± 171	2391 ± 261	3022 ± 333
RITO M Exp. 5	48 ± 3	1338 ± 149	2312 ± 178	3094 ± 229
RITO M Exp. 6	50 ± 3	1333 ± 149	2516 ± 268**	3294 ± 224**

Note: in comparison with control group * P < 0.05 ** P < 0.01

Live weight of ducks (g) - genotypes TTH, RITO 14, RITO M (females) **Tab. 2b**

Age	1 d	21 d	35 d	49 d
	x ± Sd	x ± Sd	x ± Sd	x ± Sd
GROUPS:				
TTH Control	49 ± 4	1308 ± 172	2568 ± 283	3108 ± 232
TTH Exp. 7	48 ± 3	1399 ± 107**	2477 ± 193*	3166 ± 261
TTH Exp. 8	49 ± 3	1367 ± 141*	2404 ± 211**	3152 ± 221
RITO 14 Control	49 ± 4	1317 ± 155	2546 ± 215	3093 ± 268
RITO 14 Exp. 9	48 ± 3	1391 ± 133**	2430 ± 204**	3146 ± 268
RITO 14 Exp. 10	49 ± 3	1398 ± 148**	2401 ± 182**	3141 ± 219
RITO M Control	50 ± 3	1316 ± 116	2492 ± 274	3030 ± 241
RITO M Exp. 11	47 ± 3	1393 ± 134**	2444 ± 203	3213 ± 258**
RITO M Exp. 12	49 ± 4	1353 ± 122	2391 ± 218**	3166 ± 268**

Note: in comparison with control group * P < 0.05 ** P < 0.01

Live weight gains of ducks (g) - genotypes TTH, RITO 14, RITO M (males) **Tab. 3a**

Group	1 - 21 d	22 - 35 d	36 - 49 d	1 – 49 d
	x ± Sd	x ± Sd	x ± Sd	x ± Sd
GROUPS:				
TTH Control	1372 ± 165	1153 ± 225	637 ± 213	3162 ± 293
TTH Exp. 1	1304 ± 140*	1082 ± 173**	763 ± 197	3131 ± 297**
TTH Exp. 2	1343 ± 174	1244 ± 336	796 ± 315**	3384 ± 273**
RITO 14 Control	1343 ± 133	1033 ± 188	630 ± 151	3001 ± 281
RITO 14 Exp. 3	1342 ± 160	975 ± 159**	846 ± 148**	3164 ± 219**
RITO 14 Exp. 4	1326 ± 157	1166 ± 255*	798 ± 253**	3290 ± 231**
RITO M Control	1289 ± 171	1068 ± 242	631 ± 206	2972 ± 332
RITO M Exp. 5	1289 ± 148	974 ± 144*	782 ± 173	3045 ± 228*
RITO M Exp. 6	1284 ± 149	1195 ± 279**	778 ± 238**	3246 ± 223**

Note: in comparison with control group * P < 0.05 ** P < 0.01

Live weight gains of ducks (g) - genotypes TTH, RITO 14, RITO M (females) **Tab. 3b**

Group	1 - 21 d	22 - 35 d	36 - 49 d	1 – 49 d
	x ± Sd	x ± Sd	x ± Sd	x ± Sd
GROUPS:				
TTH Control	1266 ± 161	1259 ± 229	540 ± 216	3058 ± 232
TTH Exp. 7	1347 ± 107**	1087 ± 142*	705 ± 139	3115 ± 261
TTH Exp. 8	1317 ± 141*	1037 ± 161**	747 ± 174	3102 ± 220**
RITO 14 Control	1267 ± 155	1228 ± 195	539 ± 219	3043 ± 267
RITO 14 Exp. 9	1341 ± 132**	1047 ± 144**	729 ± 197	3096 ± 267
RITO 14 Exp. 10	1348 ± 148**	1003 ± 152**	740 ± 173	3091 ± 218
RITO M Control	1267 ± 115	1212 ± 188	547 ± 286	2981 ± 240
RITO M Exp. 11	1344 ± 133**	1057 ± 145**	768 ± 174**	3149 ± 258**
RITO M Exp. 12	1298 ± 130	1043 ± 179**	775 ± 259**	3117 ± 269**

Note: in comparison with control group * P < 0.05 ** P < 0.01

Feed conversion (kg) - genotypes TTH, RITO 14, RITO M (males) **Tab. 4a**

Group	1 - 21 d	22 - 35 d	22 – 49 d	36 - 49 d	1 – 49 d
	x ± Sd	x ± Sd	x ± Sd	x ± Sd	x ± Sd
GROUPS:					
TTH Control	2.18	-	3.30	-	2.85
TTH Exp. 1	2.11	2.62	-	3.47	2.60
TTH Exp. 2	2.10	2.84	-	3.11	2.58
RITO 14 Control	2.20		3.36	-	2.89
RITO 14 Exp. 3	2.15	2.71	-	3.42	2.63
RITO 14 Exp. 4	2.11	2.86	-	3.09	2.60
RITO M Control	2.22		3.33	-	2.92
RITO M Exp. 5	2.16	2.70	-	3.44	2.65
RITO M Exp. 6	2.13	2.88	-	3.15	2.63

Feed conversion (kg) - genotypes TTH, RITO 14, RITO M (females) **Tab. 4b**

Group	1 - 21 d	22 - 35 d	22 – 49 d	36 - 49 d	1 – 49 d
	x ± Sd	x ± Sd	x ± Sd	x ± Sd	x ± Sd
GROUPS:					
TTH Control	2.29	-	3.51	-	2.95
TTH Exp. 7	2.19	3.14	-	3.55	2.83
TTH Exp. 8	2.22	3.28	-	3.15	2.81
RITO 14 Control	2.26	-	3.48	-	2.91
RITO 14 Exp. 9	2.20	3.11	-	3.50	2.79
RITO 14 Exp. 10	2.24	3.20	-	3.14	2.76
RITO M Control	2.19	-	3.47	-	2.88
RITO M Exp. 11	2.17	3.08	-	3.46	2.79
RITO M Exp. 12	2.14	3.21	-	3.09	2.70

Mortality of ducks (%)- genotypes TTH, RITO 14, RITO M (males) **Tab. 5a**

Period 1 – 49 d	No	%
GROUPS:		
TTH Control	0	0.00
TTH Exp. 1	1	1.52
TTH Exp. 2	0	0.00
RITO 14 Control	1	1.52
RITO 14 Exp. 3	0	0.00
RITO 14 Exp. 4	0	0.00
RITO M Control	1	1.52
RITO M Exp. 5	1	1.49
RITO M Exp. 6	1	1.49

Mortality of ducks (%) - genotypes TTH, RITO 14, RITO M (females) **Tab. 5b**

Period 1 – 49 d	No	%
GROUPS:		
TTH Control	0	0.00
TTH Exp. 7	0	0.00
TTH Exp. 8	1	1.69
RITO 14 Control	0	0.00
RITO 14 Exp. 9	0	0.00
RITO 14 Exp. 10	0	0.00
RITO M Control	0	0.00
RITO M Exp. 11	0	0.00
RITO M Exp. 12	2	3.03

Results of slaughter analysis of genotype TTH **Tab. 6a**

Parameters	Groups of males		
	Control	Exp. 1	Exp. 2
Weight before slaughter (g)	3213.33	3216.66	3436.66
Weight of carcass (g)	2049.33	2005.00	2160.00**
Weight of giblets (g)	293.00	291.33	297.33*
Weight of abdominal fat (g)	57.00	56.33*	60.33*
Weight of thighs with skin (g)	429.00	421.00	396.00*
Weight of breast with skin (g)	525.66	494.00*	538.00
Weight of thighs without skin (g)	289.66	245.33**	242.00**
Weight of breast without skin (g)	266.00	273.66*	263.66
% share of thighs muscles in live weight	13.35	13.09	11.52
% share of breast muscles in live weight	16.36	15.36	15.65
% share of abdominal fat in live weight	1.77	1.75	1.76
Dressing percentage (%)	72.89	71.38	71.50
Slaughter value (%)	63.77	62.33	62.85

Note: in comparison with control group * $P < 0.05$ ** $P < 0.01$

Results of slaughter analysis of genotype RITO 14 **Tab. 6b**

Parameters	Groups of males		
	Control	Exp. 3	Exp. 4
Weight before slaughter (g)	3152.50	3247.50	3397.50
Weight of carcass (g)	2010.00	2079.50	2097.75
Weight of giblets (g)	294.25	282.25*	278.50*
Weight of abdominal fat (g)	61.25	69.75*	77.25**
Weight of thighs with skin (g)	426.00	433.00	419.00
Weight of breast with skin (g)	525.50	569.25**	494.00**
Weight of thighs without skin (g)	236.50	270.75**	251.00*
Weight of breast without skin (g)	286.00	283.50	240.75**
% share of thighs muscles in live weight	13.51	13.33	12.33
% share of breast muscles in live weight	16.67	17.53	14.54
% share of abdominal fat in live weight	1.94	2.15	2.27
Dressing percentage (%)	73.09	72.72	69.94
Slaughter value (%)	63.76	64.03	61.74

Note: in comparison with control group * $P < 0.05$ ** $P < 0.01$

Results of slaughter analysis of genotype RITO M **Tab. 6c**

Parameters	Groups of males		
	Control	Exp. 5	Exp. 6
Weight before slaughter (g)	3203.33	3260.00	3363.33
Weight of carcass (g)	1949.66	2043.33**	2103.66**
Weight of giblets (g)	304.33	306.33	291.00
Weight of abdominal fat (g)	53.33	59.33*	56.66*
Weight of thighs with skin (g)	443.66	464.00	465.66
Weight of breast with skin (g)	485.00	499.00	521.33*
Weight of thighs without skin (g)	261.00	269.00	270.66
Weight of breast without skin (g)	269.00	259.33	265.33
% share of thighs muscles in live weight	13.85	14.23	13.85
% share of breast muscles in live weight	15.14	15.31	15.50
% share of abdominal fat in live weight	1.66	1.82	1.68
Dressing percentage (%)	70.36	72.07	71.19
Slaughter value (%)	60.86	62.67	62.54

Note: in comparison with control group * $P < 0.05$ ** $P < 0.01$

Results of slaughter analysis of genotype TTH **Tab. 6d**

Parameters	Groups of females		
	Control	Exp. 7	Exp. 8
Weight before slaughter (g)	3260,00	3226.66	3223.33
Weight of carcass (g)	2116.66	2041.00*	2090.00*
Weight of giblets (g)	244.00	262.00*	272.66**
Weight of abdominal fat (g)	66.00	82.00**	65.00*
Weight of thighs with skin (g)	415.66	435.66*	431.66*
Weight of breast with skin (g)	586.33	553.33*	565.66
Weight of thighs without skin (g)	233.66	240.66	245.66
Weight of breast without skin (g)	307.33	286.66	297.00
% share of thighs muscles in live weight	12.75	13.50	13.39
% share of breast muscles in live weight	17.99	17.15	17.55
% share of abdominal fat in live weight	2.02	2.54	2.03
Dressing percentage (%)	72.41	71.37	73.29
Slaughter value (%)	64.92	63.23	64.83

Note: in comparison with control group * P < 0.05 ** P < 0.01

Results of slaughter analysis of genotype RITO 14 **Tab. 6e**

Parameters	Groups of females		
	Control	Exp. 9	Exp. 10
Weight before slaughter (g)	3145.00	3273.33	3250.00
Weight of carcass (g)	2136.25	2202.33*	2097.66
Weight of giblets (g)	272.75	257.66	247.66*
Weight of abdominal fat (g)	93.75	76.00*	66.66**
Weight of thighs with skin (g)	451.50	482.33*	478.66*
Weight of breast with skin (g)	589.00	572.00	586.33
Weight of thighs without skin (g)	255.25	257.66	279.33*
Weight of breast without skin (g)	327.75	295.00*	318.66
% share of thighs muscles in live weight	14.36	14.74	14.73
% share of breast muscles in live weight	18.73	17.47	18.04
% share of abdominal fat in live weight	2.98	2.32	2.05
Dressing percentage (%)	76.59	75.15	72.16
Slaughter value (%)	67.92	67.28	64.54

Note: in comparison with control group * P < 0.05 ** P < 0.01

Results of slaughter analysis of genotype RITO M **Tab. 6f**

Parameters	Groups of females		
	Control	Exp. 11	Exp. 12
Weight before slaughter (g)	3126.66	3265.00	3155.00
Weight of carcass (g)	2081.33	2051.25	2104.50
Weight of giblets (g)	303.66	259.75*	268.75
Weight of abdominal fat (g)	59.66	68.25*	69.50*
Weight of thighs with skin (g)	450.66	433.75	440.75
Weight of breast with skin (g)	549.66	560.75	574.50*
Weight of thighs without skin (g)	272.00	248.75*	248.25*
Weight of breast without skin (g)	282.33	282.50	304.25*
% share of thighs muscles in live weight	14.41	13.28	13.97
% share of breast muscles in live weight	17.58	17.17	18.21
% share of abdominal fat in live weight	1.91	2.09	2.20
Dressing percentage (%)	76.27	70.78	75.22
Slaughter value (%)	66.46	64.45	65.35

Note: in comparison with control group * P < 0.05 ** P < 0.01