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■ Author(s)

Sogut B^I
Sengul T^I
Inci H^I
Sengul Y^I
Ayasan T^{II}

^I Department of Animal Science, Faculty of Agriculture, Bingöl University, Turkey

^{II} Eastern Mediterranean Agricultural Research Institute, Adana, Turkey

■ Mail Address

Corresponding author e-mail address
Dr. Bunyamin Sogut
Department of Animal Science, Faculty of Agriculture, Bingöl University, 12000, Bingöl/TURKEY.
Tel: +904262160030/1141
Email: bunyaminsogut@hotmail.com

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Effect of Transient Treatment with Propylthiouracil on Some Reproduction Traits and Live Weight of Japanese Quails

ABSTRACT

This study was conducted to investigate the effects of transient treatment with propylthiouracil (PTU) on some reproduction traits and live weight of quails. The trial lasted 8 weeks. To accomplish this goal, 700 1-day-old quail chicks were used, randomly divided into 8 groups. PTU was added to feed by 0.1% and 0.5% /wt. The first 4 groups had 0.5% PTU at the age of 2-4, 4-6, 6-8 and 2-8 wk., respectively. The 5th, 6th and 7th groups had 0.1% PTU at the age of 2-4, 4-6 and 6-8 wk., respectively, and the 8th group was the control with no PTU. Quails were bled at 60 days of age. Then right and left testes were taken out and weighed. At the end of the trial, least square means of the live weight of the treatment groups were higher than the control ($p < 0.05$). Similar results ($p < 0.05$) were observed for testis weight, testis diameter and fertility rate. As a result, it can be said that the inclusion of PTU in quail rations positively affects the live weight and reproduction traits of quails.

INTRODUCTION

There is no possibility to make a change on the genotype of a living thing after the zygote is formed. But it is possible to influence the nervous system and endocrine system that regulate metabolic events. In other words, it is possible to provide economic benefit by accelerating or slowing the role played by organisms by decreasing and multiplying the amount of hormones secreted by the endocrine system organs that regulate metabolic events (Ozkan & Bulgurlu 1995). One of these organs is the thyroid gland.

Thyroid gland hormones have important effects on the reproductive mechanism. These hormones are effective by directly stimulating the metabolism of the sexual glands by stimulating and restricting the release of the anterior pituitary hormones, which control sexual function. The normal release of thyroid hormones is necessary for normal sexual function. The release of these hormones more or less causes different effects on the glands (Yilmaz, 1999). In some studies with temporary release of low levels of thyroid hormones, increased sperm production (Kirby & Mankar, 1995) with the development and growth of testes (Cooke *et al.*, 1991, Palmero *et al.*, 1992; Kolaja *et al.*, 2000) were observed. Among the most frequently used substances, methyl, propyl and isopropyl thiouracil can be considered to reduce the function of the thyroid gland. Unlike iodine proteins, these substances reduce metabolic activity by slowing the function of the thyroid gland (hypothyroidism) (Cooke *et al.*, 1993; Kirby & Mankar, 1995).

The main effect of PTU, which is used to slow down the function of the thyroid gland, is to decrease T3 and T4 in blood plasma concentrations, and to increase thyroid function by the thyroid follicle



cells (Bunick *et al.*, 1984). Similar effects are seen in domestic poultry such as chicken (Kai *et al.*, 1993) and turkey (Queen *et al.*, 1997).

The effects of transient PTU application in poultry on fertility, sexual maturity (Marks 1969), immunological system (Kai *et al.*, 1993), testicular weight, volume and sperm production (Kirby & Mankar, 1995, Kirby *et al.*, 1996), developmental hormones (Tsukada *et al.*, 1996) and molting period (Queen *et al.*, 1997) were positive, however, on immunization system (Kai *et al.*, 1993; Schmiedeberg *et al.*, 1996) and ascites syndrome (Luger *et al.*, 2002) were adverse.

These studies on poultry suggest that the application of PTU will affect the reproductive traits in quails. It is also a fact that the findings obtained with this study will contribute to artificial insemination practices in quails. The main objective of this study in the light of studies mentioned above was to figure out the effect of PTU added in the diet in different level on growth and testis traits of quail.

MATERIAL AND METHODS

This experiment was done at the Facility of Faculty of Agriculture, in Bingol University. In total 700 1 day old Japanese quails were fed with 24% crude protein and 3100 kcal/kg ME commercial chick diet for the first 14 days, without gender discrimination. After the 13 days of age, 480 male animals were subjected to PTU treatment by gender discrimination. The remaining 220 female animals were fed to investigate the effect of PTU administration on incubation performance.

PTU was added in the diet by 0.1 and 0.5% of the feed. Rations were fed to groups of 2-4, 4-6, 6-8 and 2-8 weeks, for two weeks in order to determine the age at which the PTU was more effective (1g PTU per kg feed). There were 3 replications in each group and 20 birds in each replicate. In the second treatment group, the dose effect (5g PTU at 1 kg feed) was added between 2-4, 4-6 and 6-8 weeks of age to measure the

effect. Control groups were fed only with commercial quail growing feed with no PTU. During the trial, the animals were weighed on a weekly basis with a 1g sensitive scale, both individually and group averages were taken. Deaths were recorded daily. Special jar type water bottles and plastic feeders were used in the floor type pens. Wood shave was used as litter material. Birds were allowed to the feeds and water *ad libitum* during the treatment. At 60 days of age, accepted maturation in general, 10 birds from each group were sacrificed and testicular characteristics were examined (testis weights, wide and narrow diameters of testis). Wide and narrow of testes were measured by caliper. After incubation all non-hatched eggs were broken then if no embryo was observed, the egg was accepted as not fertilized. Fertility rate was calculated as follow:

% fertility = number of fertile eggs/number of total eggs set in incubation.

The obtained data set were analyzed in SAS (1998) statistical package program. Pdiff command was used to compare mean of treatment differences.

RESULTS

Live weight and carcass weight

Live weight and carcass weight means of treatment and control groups is given in Table 1.

Depending on the time, Table 1 shows how PTU treatment affects the live weights of quails by week. The live weights of the control and treatment groups were similar at 2 weeks, differentiated from the 4th week of age, and differences between the 6th, 7th and 8th weeks were statistically significant. At the fourth week, the highest live weight average was obtained (95.0 g) between 2-8 weeks with 0.1% PTU added. At the sixth week, the highest live weight averages were observed in groups that were 0.5% PTU between 2-4 weeks, 0.1% PTU between 2-4 weeks and 0.1% PTU between 2-8 weeks. At week 7, the differences between the groups were found to be significant

Table 1 – Effects of PTU on live weight (g) and carcass weight (g) in quails.

	0.1% PTU				0.5% PTU			
Wk.	Process time				Process time			Control
	2-4 wk	4-6 wk	6-8 wk	2-8 wk	2-4 wk	4-6 wk	6-8 wk	
2	32.3±0.6 ^{ab}	33.2±0.6 ^b	32.4±0.5 ^{ab}	32.8±0.3 ^b	33.3±0.5 ^b	32.0±0.4 ^a	31.9±0.5 ^a	31.4±0.6 ^a
4	83.2±1.4 ^a	73.8±1.2 ^a	75.8±1.1 ^a	95.0±0.7 ^c	94.1±1.5 ^b	77.4±1.0 ^a	71.2±1.5 ^a	74.7±1.3 ^a
6	130.7±1.6 ^c	126.2±1.5 ^a	124.2±1.5 ^{ac}	130.1±1.1 ^c	132.6±1.4 ^c	130.1±1.6 ^b	123.7±2.1 ^a	124.6±1.9 ^a
7	150.3±2.1 ^{cd}	144.4±1.7 ^c	129.8±1.8 ^a	135.4±1.0 ^a	162.4±1.4 ^d	154.7±1.4 ^d	137.7±2.0 ^b	145.2±2.2 ^c
8	172.8±1.6 ^e	164.9±1.4 ^c	157.5±1.5 ^c	159.5±1.0 ^c	167.4±1.2 ^d	165.6±1.3 ^d	149.4±1.6 ^b	147.0±1.8 ^a
Carcass weight	122.0± 0.7 ^e	109.8±0.7 ^{cd}	101.7±0.3 ^b	94.6±0.1 ^a	113.2±0.1 ^b	103.1±0.1 ^c	99.5±0.1 ^b	103.87±0.1 ^c

^{a,b,c,d,e}. Differences between means indicated by different letters in the same row are important. $p < 0.05$.



and the highest live weights were determined in groups supplemented with 0.5% PTU between 2-4 and 4-6 weeks. At the eighth week, the differences between the groups were statistically significant, with the highest live weight average being obtained from the group to which 0.1% PTU was added between 2-4 weeks (172.8 g) and the lowest value was in the control group (147.0 g). When the average of the carcass weight of quails was examined, significant differences were found between the groups. The highest carcass weight (122.0 g) was obtained from the group to which 0.1% PTU was added between 2-4 weeks.

The effects of different levels of PTU on the live weights of male quails during the fattening period are shown in Table 2.

Table 2 – Effects of PTU on live weight of male quails.

Week	Live weights (g)		
	0.1% PTU	0.5% PTU	Control
2	32.7±0.1	33.1±0.1	33.1± 0.1
4	81.5±0.1 ^a	79.1±0.1 ^{ab}	77.8 ± 0.1 ^b
6	125.9±0.1 ^b	129.7±0.1 ^a	126.4 ± 0.2 ^b
7	140.1±0.1 ^a	150.0±0.1 ^b	146.5 ± 0.1 ^b
8	166.9±0.1 ^c	156.1±0.1 ^b	146.9 ± 0.1 ^a

^{a,b,c}: Differences between means indicated by different letters in the same row are important. ($p<0.05$).

In Table 2, while there was no significant difference between the control group and PTU treatment groups at week 2, the situation changed from the 4th week of age and PTU effect started. At the 4th week, the live weight average was obtained from the 0.1% PTU group with the highest results, the lowest value was obtained from the control group. At week 6, live weight average values were changed and the lowest value was obtained from the 0.1% PTU group. At week 7, differences between the groups were also significant, but the lowest mean live weight was observed in the 0.1% PTU supplement group. At the 8th week, the differences between the treatment and control groups were statistically significant ($p<0.05$) and the lowest and the highest values were found in the control and 0.1% PTU group.

Testis traits

The testis traits of the quail, PTU added to the ration, and the effects of PTU on the fertility rate are given in Table 3.

The testis weights were significantly ($p<0.05$) affected by the ration added PTU, and the treatment groups had a higher average than the control group. The highest values for testicular weight were obtained from the groups supplemented with 0.5% PTU. The PTU added to the ration also had a significant effect on the testicular diameter ($p<0.05$) and the treatment groups had higher values than the control group.

The PTU was observed to be effective in terms of the fertility rate. While the lowest value for the fertility rate was obtained from the control group (76.7%), the highest values were observed in groups supplemented with 0.5% PTU addition (85.0%) between 2-4 weeks, 0.1% PTU (84.3%) between 4-6 weeks, and 0.1% PTU at 6-8 weeks (85.1%).

DISCUSSION

In this study, the effects of 0.1% and 0.5% PTU in quail ration at 2-4, 4-6, 6-8 and 2-8 week time intervals were investigated in terms of live weight and some reproductive characteristics after 8 weeks of growth period.

When the quail's live weight changes were examined at different periods, the effect of PTU started from the 4th week until the end of the fattening period (Table 1). In general, treatment groups had a higher live weight than the control group, because the treatment groups had statistically higher mean than the control group, indicating that PTU has a positive effect on body weight. In general, treatment groups were better than the control group (Table 2) when evaluated only for different PTU addition levels. The highest effect of the PTU has been in weeks 7 and 8, because a very significant increase has been observed in these weeks.

In terms of carcass weight, there were significant differences between control and treatment groups, generally treatment groups (except 2 groups) had

Table 3 – Effects of PTU on testis weight, testis diameter and fertility rate in quails.

Traits	Control	0.1% PTU				0.5% PTU		
		Process time				Process time		
		2-4 wk	4-6 wk	6-8 wk	2-8 wk	2-4 wk	4-6 wk	6-8 wk
Testis weight, g	1.42±0.2a	2.42±0.0b	2.37±0.1b	2.49±0.0bc	2.56±0.1c	2.58±0.0c	2.59±0.0c	2.61±0.0c
Testis diameter, mm	12.7±0.6a	19.6±0.1bc	18.0±0.1b	18.2±0.2b	22.5±0.2c	19.5±0.1bc	20.0±0.4bc	19.2±0.0bc
Fertility rate, %	76.7±0.7a	81.0±0.8b	84.3±0.7c	85.1±0.6c	87.6±0.7d	85.0±0.7c	81.1±0.7b	80.0±0.7b

^{a,b,c}: Differences between means indicated by different letters in the same row are important. ($p<0.05$).



higher carcass weight. It can be said that the addition of the PTU has a positive effect on the carcass weight.

The role of thyroid hormones on reproductive physiology has been clearly demonstrated in many animal species. The positive effects of PTU, an anti-thyroid drug, on sexual maturation and reproductive performance may depend on the time and the timing of treatment. Indeed, in this study, testis weight and testis diameter of quails were significantly influenced by PTU addition in ration (Table 3). When looking at the values of the quails in the eighth week, the treatment groups in terms of characteristics in question, had higher values than the control group. Observing the highest testicular weight in groups with 0.5% PTU added, indicating an increase in PTU dose and an increase in testicle weight.

The results obtained in this study agree with the result of Kirby *et al.* (1992). The results obtained in the testis diameter were similar to those of the testis weight. In terms of this feature, the control group has the lowest value. The testis diameter was also increased in relation to the increase of the PTU level. Cooke *et al.* (1991) reported that PTU increased testis development in rats. PTU reached approximately twice the testicular volume in rats (Kirby *et al.*, 1992). PTU was more effective on testicular weight at 8-16 weeks of age in chickens than 0-8 weeks of age (Knowlton *et al.*, 1999). In order to minimize the possible side effects of PTU, applying a low dose (0.1%) on turkey's diet was suggested as more appropriate (Babacanoglu & Sogut, 2004). Again, Kirby *et al.* (1996) reported that more sperm production could be achieved with increasing testicular volume when PTU was given at appropriate times to the poultry. Akhlaghi and Zamiri (2007) reported that the effect of age on body weight, semen volume, sperm motility, percentage of live sperm, sperm concentration, total number of live sperm, and serum testosterone and thyroxine (T4) levels was significant ($p < 0.01$). Transient treatment of PTU had adverse effects on live body weight of white rats; while the Control groups were 443.14 g, Hypothyroid group had 347 g after 6 weeks of treatment (Kandir & Keskin, 2015). This result was consistent with the findings of Kirby *et al.* (1996), and the fertility rate of eggs obtained from quails with PTU added to their diet was found to be higher than the control group

As a result, transient treatment of PTU had adverse effect on body weight of chicken, turkey and rats, however it was not seen in the quail because in this study a positive effect of PTU adding to the diet by transient treatment was observed on the live weight

and carcass weight of quails during different growth periods. In addition, the expected positive effect of PTU in quails was also observed in testicular weight, testicular diameter and fertility rate of the eggs as reproductive traits. It can be said that the appropriate PTU level for quails is 0.1%, however, other studies may also need to be undertaken to achieve a definitive result.

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