Effect of ethanol extracted propolis (EEP) on growth performance in the meat type Japanese quails

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Abstract :

The objective of the study was to assess the impact of administration of propolis in water on some production traits in the meat type Japanese quails (Coturnix japonica)

In this experiment 700 Japanese quails were divided into 5 groups with 4 replicates and the groups were : C - control, birds receiving pure water with no addititives E300 - addition of ethanol at a dose of 300 ml.L^{-1} water; P200 - addition of EEP at a dose of 200 ml/l^{-1} water; P250 - addition of EEP at a dose of 250 ml.L^{-1} water; P300 - addition of EEP at a dose of 300 ml.L^{-1} water. The quails in all groups were fed the same feedResults indicated that supplementation of EEP to drinking water significantly increased body weight during the rearing period. The P300 quails were characterised by the highest body weight throughout the consecutive weeks of rearing. Moreover EEP in drinking water caused an increase of feed utilization as well as improvement of carcass quality.

Key words: quail, meat type, growth performance.

تأ ثير المستخلص ألايثانولي للبروبوليس في أداء النمو للسمان الياباني نوع اللحم

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المستخلص:

أستهدفت الدراسة الحالية بيان تاثير أعطاء المستخلص الكحولي للبروبوليس بماء الشرب في الصفات ألانتاجية للسمان الياباني أستخدم في البحث 700 فرخ من أفراخ السمان الياباني، وزعت الافراخ على خمسة مجاميع متساوية وكل مجموعة أحتوت على أربعة مكررات متساوية بحيث رتبت المجاميع كلاتي:

المجموعة ألاولى (مجموعة السيطرة) أعطيت ألافراخ في هذه المجموعة ماء شرب بدون أي أضافة. المجموعة الثانية أعطيت : أيثانول بجرعة قدرها 300 مل. لتر$^{-1}$ ماء شرب . المجموعة الثالثة : أعطيت المستخلص ألايثانولي للبروبولس بجرعة قدرها 200 مل. لتر$^{-1}$ ماء شرب. المجموعة الرابعة: أعطيت المستخلص ألايثانولي للبروبوليس بجرعة قدرها 250 مل. لتر$^{-1}$ماء شرب. المجموعة الخامسة : أعطيت المستخلص ألايثانولي للبروبولس بجرعة قدرها 300 مل. لتر$^{-1}$ ماء شرب.

أشارت نتائج البحث الى وجود زيادة عالية المعنوية في وزن الجسم الحي خلال فترة التربية أذ تميزت المجموعة الخامسة بأعلى ألاوزان الجسمية خلال ألاسابيع المتعاقبة للتجربة فضلا عن أعطاء المستخلص ألايثانولي للبروبولس بماء الشرب أدى الى زيادة أستهلاك العلف وتحسين صفات الذبيحة في طيور السمان الياباني.

الكلمات المفتاحية: السمان، نوع اللحم، الاداء الانتاجي.

Introduction :

The trend to lead a healthy lifestyle is becoming increasingly popular For this reason, consumers are looking for healthy, organic, and functional foods. To meet the consumers' demands, in 2006, the European Union introduced a total ban on the use of feed antibiotics (27) This prompted breeders to search for substances of natural origin with antibiotic properties (5) These natural feed additives are served as growth promoting which are healthful and improve production performance of animal and poultry without any harmful effect (13) The use of propolis as natural antibacterial and immunostimulating agents seems to be an interesting alternative to the use of pharmaceuticals (25) Propolis means a gum that is gathered by bees from various plants, it may vary in color from light yellow to dark brown (16) It may cause staining of the comb or frame and may be found in extracted honey (36) The precise composition of raw propolis varies with the source (Harnaj, 1978) In general, it is composed of 50% resin and vegetable balsam, 30% wax, 10% essential and aromatic oils, 5% pollen and 5% various other substances, including organic debris (26) The wax and organic debris are removed during processing, creating propolis tincture (9) There is a long history using of propolis at least to 300 before Christ (16) and its use continues to the day in home remedies and personal products because propolis is reputed to have antiseptic antimycotic bacteriostatic astringent cholericspasmolytic anti-inflammatory anaesthetic and antioxidant propertiesthe list of preparations and uses is nearly endless (12) These applications include over–the-counter dermatological items where it has been claimed useful in wound healing , tissue regeneration treatment of burns , neurodermatitis leg ulcers, psoriasis, morphoea, herpes simplex genitalis and activity against dermatophytes (4) It has been marketed as a treatment for rheumatism and sprains and in dental medicine it is claimed to be an anaesthetic five times as effective as cocaine (14) It is used in toothpaste and mouthwash preparations treating gingivitis cheilitis and stomatitis (20) It has also found its way into pharmaceutical and cosmetic products such as face creams (vanishing creams and beauty creams), ointments lotions and solutions (6) It is marketed in tablets, powder and chewing gum (25) (11) observed that weight gain feed intake and feed efficiency were significantly increased when propolis fed in fattening quails (39) noticed that live body weight and feed efficiency were significantly increased when supplemented with propolis into broilers diet (16) reported that inclusion of 500 ppm propolis in broilers improved body weight (20 %) for propolis fed birds in comparison to control group. (15) referred that addition 150 mg propolis in broiler improve the immune status of laying hens via minimizing the residual feed intake. (11) reported that addition of propolis powder at 0.5, 1 and 1.5 g per kg diet increased the growth parameters of quail chicks.

The aim of this study was to evaluate the effects of ethanol extracted propolis EEP supplemented in water on growth performance and body components in the meat type Japanese quail.

Materials and methods:

The experiment was performed with a population of meat-type (line F22) Japanese quail (*Coturnix japonica*) reared at the Didactic Experimental Station of the University of Life Sciences in Lublin. Quails of the F22 line were characterized by body weight (6-week-old males weigh 122- 140 g and females 144- 160 g). Birds were randomly selected from the foundation flocks. Quails were fed a starter quail diet (corn, wheat, soya diet) containing 21% crude protein and 2600 Kcal ME.Kg^{-1} as measured by the Central Laboratory of Agroecology in Lublin. The feed and water were offered adlibitum throughout all experiment. The quails at the first day were weighed tagged, and divided equally into five groups of 140 birds with 4 replecates in each group. The first group was fed basal diet and pure water (C - control); the second group was fed basal diet with 300 mg/l of ethanol as a water additive (E) The third fourth, and fifth groups were fed basal diet with 200 mg.L^{-1} (P200), 250 mg.L^{-1} (P250) and 300 mg.L^{-1} (P300) of propolis as a water additive respectively They were reared in under continuous (artificial) lighting. The rearing temperature was gradually decreased from 38 to 34°C in the first week 33 to 28°C in the second week, and 27 to 22°C in the third week. Afterward, it was maintained between 18 and 20°C. At the 7th day of life the birds were wing banded and kept under similar standard hygienic and environmental conditions. The period of quail rearing was used in the experiment until 6 weeks of age.

Propolis :

Propolis was added to water as a standardized 70% ethanol extracted propolis (EEP) Propolis was obtained from the Apipol Farma Company.

Propolis extract was added in the amount of 20g (P200) 25g (P250) and 30g (P300) respectively, was dissolved in 1000 cm3 ethanol with 70% concentration and applied to 100 l of drinking water Qualitative composition of domestic propolis is shown in Tabel 1 .

Tabel 1: Qualitative composition of domestic propolis after (28) .

Flavonoids:	Fatty acids:
Nocembrin	Oleic
pinobanksin acetate	Stearic
4-methoxypinocembrin	Terpenes:
Gallamine	β-eudesmol
Chrysene	Aromatic compounds of:
Acids:	phenyl methyl alcohol
aliphatic:	phenyl methyl ketone
propionic acid	Phenylpropanol
3,4-dihydroxybutyric acid	phenylpropenone-2,6-dihydroxy-4-methoxy-phenol
3- hydroxybutyric acid	Phenolic acids:
4- hydroxybutyric acid	benzoic acid derivatives:
3-hydroxy-3-methylbutyric acid	4-hydroxybenzoic acid
3-hydroxy-3-methoxybutyric acid	vanillic acid
2-hydroxycaproic acid	protocatechuic acid
aromatic:	gentisic acid
benzoic acid	cinnamic acid derivatives:
cinnamic acid	4-hydroxyhydrocinnamic acid
anisic acid	p-coumaric (cis and trans) acid
mandelic acid	ferulic acid
hydrocinnamic acid	caffeic acid
4-methoxycinnamic acid	3,4-dihydroxycinnamic kwas
3,4-dimethoxycinnamic acid	Allergenic compounds:
2-amino-3-methoxybenzoic acid	caffeic acid phenethyl ester
Phenols:	caffeic acid 1,1-dimethylallyl ester
Pyrocatechol	Benzopyrans:
Hydroquinone	2-phenyl-4-on-5-hydroxy-7-methoxy-4H-1-benzopyran
1,4-dimethylhydroquinone	2-phenyl-4-on-2,3-dihydro-5,7-dihydroxy-4H-1- benzopyran
4-methoxyphenol	
4-hydroxybenzene aldehyde	
Vanillin	
3-hydroxyacetophenon	
Phenetol	

Body weight (BW) of birds from each group were individually recorded to the nearest gram at the 1st day of life and weekly from the 1st to 6th weeks of age by electronic balance works on electricity.

Feed intake was calculated every week for each group. It was then averaged and expressed in gram per bird for each experimental group.

At slaughter, 6 weeks of age, 40 birds randomly chosen from each group (20 males and 20 females) were individually weighed after a fasting period of 8 h, stunned, and decapitated. Stunning was performed by a percussive blow to the back part of the head (occiput), and decapitation was performed with scissors between the cervical vertebrae and the base of the skull according to the EU regulations on the protection of animals at the time of euthenizing. After plucking and eviscerating, carcasses were weighed and dissecated (legs, breast, wings, giblets, back abdominal fat, and their percentages were calculated based on hot carcass weight). Statistical analysis was performed using (29).

Results and discussion:

50and 300 mg propolis .L^{-1} was added compared with the control group There were no significant differences between the weights of males in the first week of age, but there were significant The effects of EEP on the body weight in Japanese quail from the first to sixth week of age are shown in Tabal 2. The addition of propolis in the water significantly ($P \leq 0.01$) increased body weight from the first until the sixth week of age. The results obtained here indicated that addition of 300 mg propolis .L^{-1} water led up improved quail performance. Higher body weight from the first until the sixth week of age was recorded in the P300 group while lower value was found in the other expermintal groups. There were no significant differences ($P \leq 0.05$) between C, E300, and the group supplemented with 200 mg propolis.L^{-1} during this period Higher body weights were obtained in the P300 group. It may be inferred that due to a specific antibacterial effect and the presence of several micronutrients with positive effects on health and metabolism so propolis improved the body weight of the quails. Results were corroborated with the findings reported by (11) who noted that quails received from 0.5 to 1.5 g.kg^{-1} propolis in feed had significantly higher body weights than those fed a non-supplemented diet. The results were also in agreement with the findings shown by other authors (19, 30, 31, 32) which indicated a significant increase in body weight with the supplementation of propolis. (37) also noted an increase (by almost 10%) in body weights of broiler chickens given propolis at a dose of 2.5 mg.kg^{-1} diet, in comparison with the control group. Tabel 2 also shows a significant effect on the body weight in male quails when 200, 2differences between the weights of males in all groups in the second, third, fourth, fifith and sixth week of age. Higher body weight in second week was in P300 while lower was in P200 group, but there were no significant differences between the weights of males in C, P200 and P250 group, as there were no significant differences between the weights of males in P250 and P300 group. In the third week of males age there were significant differences between groups, higher body weight was in P300 while lower was in E300 group. There were significant differences between control and experimental groups in fourth week of males age, higher body weight was in P300 while lower was in P200 group. In fifth week of males age there were significant differences between groups, higher body weight was in P300 while lower was in P200 group. Higher body weight in males at sixth week was in P300 group while lower was in E300 group, but there were no significant differences between the weights of males in C and P250 group, as there were no significant differences between the weights of males in E300 and P200 group. Tabal2 also shows a significant effect on the body weight in female quails when 200, 250 and 300 mg propolis.L^{-1} was added compared with the control group. There were significant differences between the weights of females in groups. Higher body weight in females at first week was in P250 while lower was in C group, but there were no significant differences between E300, P200, P250 and P300 group. In second week of females age higher body weight was in P250 while lower was in C group, but there were no significant differences between C, E300, P200 and P300 group. Higher body weight in females at third week was in P250 while lower was in C group, but there were no significant differences between C and E300 group, and there were no significant differences between P200 and P300 group, as there were no significant differences between P250 and P300 group. In fourth week of females age higher body weight was in P250 while lower was in C group, but there were no significant differences between P200, P250 and P300 group, as there were no significant differences between E300, P200 group. Higher body weight in females at fifth week of age was in P300 while lower was in C group, but there were no significant differences between E300, P200 and P250 group, and there were no significant differences between E300, P250 and P300 group. There were significant differences between groups in sixth week of females age, higher body weight was in P300 while lower was in C group, but there were no significant differences between E300 and P200 group, as there were no significant differences between P250 and P300 group. Propolis had a beneficial effect on body weight, probably because of its components exhibited antimicrobial properties, resulting in better intestinal health and improved digestion and absorption (3, 22). Chemical analyses of propolis have shown that it is rich in vitamins and minerals (18) and contains large amounts of flavonoids and proteins (17) which may improve the weight and feed efficiency in quails. Results are consistent with the findings reported by other authors (3, 33) who indicated a significant increase in live body weight with supplementation of propolis. Results agree with (21) who observed a significant difference in the body weights of male and female broiler chickens from the 3^{rd} week of age (887.4 g and 859.4 g) until the end of the experiment (2921.1 g and 2479.8 g). These results were also similar to those of (2) in Muscovy broiler ducks. In contrast, (24) observed that Chinese propolis supplementation had adverse effects on performance of broiler chickens. They found that feeding propolis at 2.5 $g.kg^{-1}$ diet depressed growth, and this negative effect was not compensated for by the end of the experiment The effects of EEP on feed intake in Japanese quail from the first to sixth week of age are shown in Tab. 3. The results show that there were no significant differences ($P \leq 0.05$) between the control and experimental groups in the 0-1, 1-2, 3-4 week of age. The Tab. 3 shows that there was a significant effect of (EEP) in the 2-3, 4-5, 5-6 week of age. Higher feed intake in the 2-3 and 4-5 week was noted in P300 throughout the rearing period and lower was in the E300 group. Higher feed intake in the 5-6 week of age was in P300 while lower was in the C group. This increase in feed intake in the experimental group had led to improve productive performance of quails such as body weight. (32) suggested that higher weight gain in propolis fed chickens is probably associated with higher feed intake. Results are in agreement with (35) who reported that addition of 1000 ppm propolis to diet had a positive effect on feed consumption. Similarly (11) reported that the addition of 1 $g.kg^{-1}$ propolis to the diet of quail resulted in significantly better feed efficiency, compared with the control group. Controversially, these findings were in disagreement with the results of (28) who indicated that addition of (EEP) to Japanese quail diets did not affect feed intake and the feed conversion ratio. (3) observed that propolis supplementation at doses of 500 or 2000 ppm did not significantly increase body weight or feed intake in male broilers. (34) mentioned that feed intake in quail was decreased by 10% in a group receiving propolis (5 mg.kg $^{-1}$) in the diet, compared with the control group.

The effects of EEP on carcass characteristics in Japanese quail at slaughter are shown in Tabel 4 In the present study, the results showed that there were no significant differences (P≤0.05) in carcass characteristics between the control and experimental groups, except in the weight of the back. As shown by the statistical analysis results, the propolis supplementation had no significant effect (P≤0.05) on the carcass yield, the weight of carcass, breast, thigh, shank, wing, fat and edible parts at slaughter. Propolis had a significant effect on the back weight. There were significant differences between the P250 P300 and E300, P200 groups. Higher value of back weight was found in the P250 group and lower was in the E300 group. Tab. 4 shows the results for the groups, higher value of carcass weight found in P300, and the lowest was in C group. Results are in line with the findings reported by (11) who indicated that addition of propolis and flavomycine to quail diets did not affect carcass characteristics. The results were also in agreement with the findings demonstrated by other authors (7, 10,30, 38) who indicated that supplementation of propolis in broiler chickens diet had no significant effects on carcass weight in quail, broiler chickens, hens, and rabbits. The results were in disagreement with the finding reported by (31) and (19) who found that propolis supplementation in broiler diet had significant effects on carcass weight at 42 days of age due to an increase in bird weight and increased feed consumption. Ethanol extracted propolis added in water was not effective in carcass and internal parts. This may be attributed to the lower dose of propolis and to the fact that the quails were kept in hygienic conditions in cages where there were no challenging factors affecting the gastrointestinal health of the birds. Tabel 4 shows the effect of propolis on carcass characteristics in quail males at slaughter. There were no significant differences (P≤0.05) between groups on carcass yield, the weight of carcass, breast, thigh, shank, wings, liver, heart and gizzard when EEP was added in water, except for the weight of back and fat, there were significant differences (P≤0.05) between males. Higher value of back weight was found in males (36.07 g) than males (32.56 g) in the P250 and E300 groups respectively but there were no significant differences between C, E300 P200 and P300 group. There were significant differences between P200 with C and other experimental groups, higher fat weight was in males (2.31 g) than males (0.00 g) in E300 and P200 groups respectively Tab 4 shows the effect of propolis on carcass characteristics in quail females at slaughter. No significant effect (P≤0.05) on carcass yield, the weight of breast, thigh, shank wings liver heart gizzard and fat was found between groups when EEP was added in water. Except for the weight of carcass and back there were significant differences between females. Higher value of carcass was noted in females (96.65 g) than females (90.41 g) in the P250 and C groups respectively, but there were no significant differences between C, E300 and P200 group, as there were no significant differences between P250 and P300 group. There were significant differences between groups in back weight. Higher value of back weight was found in females

(40.60 g) than females (35.67 g) in the P250 and C group respectively but there were no significant differences between C, E300 and P200 group as there were no significant differences between P250 and P300 group. The ethanol extracted of propolis was not effective in carcass characteristics. This may be attributed to the lower dose of propolis and to the fact that birds were kept in hygienic conditions in cages where there were no challenging factors affecting the gastrointestinal health of the birds. However propolis may show advantageous effects under poor hygienic conditions thanks to its antibacterial antifungal antiviral, hepatoprotective, and anti-inflammatory properties increasing body’s natural resistance to infections and in treatment of gastroduodenal ulcers (8) Similarly (28) found that addition of EEP (5%) at a level of 6 or 12 ml in diet did not affect carcass characteristics in quails, except carcass yield. Results are in disagreement with the findings reported by (1) who found no effect on carcass, relative weight or length of the intestine or cecum carcass length, and the relative weight of the gizzard heart liver spleen or bursa of fabricius at the end of the study, in which broiler chickens received three dietary treatments with propolis at 0.5, 1.5 and 2.5 $g.kg^{-1}$ diets. These results are consistent with those of (11) who noted no differences in quail liver gizzard or intestinal weight or intestinal length in a group receiving 0.5 1 and 1.5 $g.kg^{-1}$ propolis in the diet, compared with the control group. Propolis supplementation at doses of 100, 250, 500, and 750 mg/kg diet did not significantly affect carcass characteristics in Ross broilers (24). In contrast to our results (19) found that the addition of 400 mg/kg diet propolis improved the relative weight of the liver heart, and thighs, and the dressing percentage of broilers (23) showed that dietary supplementation with (EEP) improved carcass yield in broilers It was conclude that addition of EEP in the drinking water led up to improve live body weight and increased feed consumption with improvement of carcass quality of males and females in meat type of Japanese quails.

Tabel 2: Effect of EEP on body weight in Japanese quail during rearing period (Mean ± SE)

Group	Sex	BW1 (g)		BW2 (g)		BW3 (g)		BW4 (g)		BW5 (g)		BW6 (g)	
		group	sex	Group	sex	group	sex	group	sex	group	sex	group	sex
C	♂	13.75 ±0.68 B	14.80^{AB} ±0.95	32.40 ±1.26 AB	32.80^{B} ±1.98	56.62 ±1.94 B	55.90^{C} ±2.41	85.57 ±2.56 B	86.40^{D} ±2.96	112.51 ±2.86 C	112.60^{F} ±2.47	135.05 ±3.02 B	131.40^{D} ±2.79
	♀		12.71^{B} ±0.57		32.00^{B} ±1.54		57.35^{C} ±2.27		85.14^{D} ±2.93		112.42^{F} ±4.05		138.71^{C} ±4.76
E300	♂	13.93 ±0.65 B	13.33^{B} ±0.79	32.31 ±1.21 AB	30.53^{BC} ±1.50	54.56 ±1.86 B	51.40^{D} ±2.64	85.85 ±2.46 B	80.80^{C} ±3.50	115.63 ±2.74 CD	108.00^{D} ±4.31	134.93 ±2.89 B	125.33^{F} ±3.88
	♀		14.54^{AB} ±0.54		34.09^{AB} ±1.17		57.72^{C} ±3.37		90.90^{B} ±3.26		123.27^{AB} ±3.78		144.54^{B} ±4.27
P200	♂	15.17 ±0.74 AB	14.50^{AB} ±1.40	31.02 ±1.37 B	29.75^{BC} ±3.14	59.03 ±2.10 AB	55.00^{C} ±4.17	86.75 ±1.78 B	80.75^{C} ±5.76	112.72 ±3.11 C	107.75^{D} ±7.00	133.75 ±3.27 B	125.60^{F} ±7.16
	♀		15.84^{AB} ±0.89		32.30^{B} ±2.08		63.07^{B} ±2.89		92.76^{AB} ±4.04		119.69^{BC} ±4.61		142.00^{B} ±4.73
P250	♂	16.41 ±0.61 AB	15.16^{AB} ±1.05	35.97 ±1.14 AB	34.50^{AB} ±1.68	65.24 ±1.74 A	63.33^{B} ±2.60	93.44 ±2.31 A	91.33^{AB} ±3.31	120.66 ±2.58 B	117.00^{C} ±3.21	140.72 ±2.71 A	132.66^{D} ±3.53
	♀		17.66^{A} ±0.87		37.44^{A} ±1.47		67.66^{A} ±2.25		95.55^{A} ±3.10		124.33^{AB} ±3.21		148.77^{A} ±3.53
P300	♂	17.02 ±0.70 A	16.71^{AB} ±1.10	37.33 ±1.30 A	38.00^{A} ±1.42	65.50 ±2.00 A	64.71^{AB} ±2.51	93.64 ±2.64 A	93.28^{A} ±3.12	124.73 ±2.95 A	122.57^{B} ±2.63	143.74 ±3.11 A	135.71^{C} ±2.94
	♀		17.33^{A} ±1.24		36.66^{AB} ±1.73		65.77^{AB} ±2.89		94.00^{A} ±3.41		126.88^{A} ±3.69		151.77^{A} ±5.02

A, B, C, D – Means in columns are significantly different at P≤ 0.05
BW1-BW6 – Body Weight in Japanese quail in consecutive weeks from the first to sixth week of age
SE – Standard Error

Tabel 3: Effect of EEP on feed intake in Japanese quail during rearing period (Mean ± SE)

Group \ Week	0-1	1-2	2-3	3-4	4-5	5-6
	(g.day^{-1}bird^{-1})					
C	5.25 ±0.62 A	13.12 ±1.93 A	20.11 ±1.67 AB	19.29 ±1.99 A	20.13 ±2.15 AB	20.27 ±0.56 B
E300	5.17 ±0.59 A	12.85 ±1.76 A	18.78 ±1.53 B	19.42 ±1.98 A	18.24 ±0.64 B	23.97 ±0.72 AB
P200	5.22 ±0.65 A	13.70 ±1.74 A	20.77 ±1.71 AB	20.13 ±2.17 A	18.55 ±1.29 B	22.12 ±0.88 AB
P250	4.89 ±0.53 A	12.91 ±1.77 A	21.85 ±1.68 AB	19.78 ±2.09 A	20.26 ±1.08 AB	23.79 ±0.67 AB
P300	5.34 ±0.76 A	14.06 ±1.89 A	23.64 ±1.68 A	20.89 ±1.64 A	23.42 ±1.22 A	24.99 ±0.69 A

A, B, C, D - Means in columns are significantly different at P≤ 0.05
SE – Standard Error

Tabel 4: Effect of EEP on carcass characteristics at slaughter (Mean ± SE)

Group	Sex	Carcass (g)		Carcass yield (%)		Shank (g)		Breast (g)		Thigh (g)	
		Group	sex	group	Sex	group	sex	group	sex	group	sex
C	♂	87.80 ±2.32A	85.19^{C} ±2.71	73.91 ±1.55 A	74.86^{AB} ±1.02	8.48 ±0.29 A	8.36^{A} ±0.23	24.71 ±0.82 A	24.55^{A} ±0.54	12.33 ±0.53 A	12.09^{A} ±0.29
	♀		90.41^{B} ±1.59		72.96^{BC} ±1.18		8.59^{A} ±0.35		24.87^{A} ±1.06		12.56^{A} ±0.59
E300	♂	88.19 ±2.94 A	85.43^{C} ±3.03	72.75 ±1.22 A	73.93^{ABC} ±1.29	8.70 ±0.36 A	8.47^{A} ±0.21	25.22 ±0.90 A	24.65^{A} ±0.97	13.27 ±0.68 A	12.92^{A} ±0.50
	♀		91.72^{B} ±3.45		71.57^{BC} ±1.21		8.93^{A} ±0.27		25.78^{A} ±1.16		13.61^{A} ±0.60
P200	♂	87.81 ±2.48 A	84.22^{C} ±4.22	73.79 ±1.72 A	74.43^{AB} ±1.48	8.16 ±0.28 A	8.18^{A} ±0.55	24.50 ±0.73 A	23.46^{A} ±1.01	12.96 ±0.56 A	12.06^{A} ±.0.98
	♀		91.39^{B} ±2.47		73.15^{ABC} ±1.35		8.15^{A} ±0.48		25.54^{A} ±0.58		13.85^{A} ±0.39
P250	♂	90.88 ±2.96 A	86.29^{C} ±1.95	72.37 ±1.49 A	73.81^{ABC} ±1.14	8.55 ±0.34 A	7.99^{A} ±0.27	24.71 ±0.83 A	23.06^{A} ±0.73	12.71 ±0.44 A	12.05^{A} ±0.50
	♀		96.65^{A} ±3.60		70.94^{C} ±1.29		9.12^{A} ±0.27		26.35^{A} ±0.83		13.36^{A} ±0.60
P300	♂	90.96 ±2.75 A	85.69^{C} ±1.13	73.98 ±1.67 A	75.68^{A} ±1.85	8.64 ±0.23 A	8.08^{A} ±0.14	24.94 ±0.87 A	23.46^{A} ±0.43	12.70 ±0.69 A	12.11^{A} ±0.32
	♀		96.24^{A} ±2.96		72.29^{BC} ±1.76		9.00^{A} ±0.18		26.42^{A} ±0.97		13.28^{A} ±0.37

A, B, C, D - Means in columns are significantly different at $P \leq 0.05$

SE Standard Error

Tabel 4: Effect of EEP on carcass characteristics at slaughter (Mean ± SE)

Group	Sex	Wings (g)		Back (g)		Liver (g)		Heart (g)		Gizzard (g)		Fat (g)	
		grou	sex	group	sex	Group	sex	group	sex	group	sex	group	sex
C	♂	7.04 ±0.24 A	6.79^{A} ±0.13	35.22 ±2.03 AB	34.77^{BC} ±0.78	3.58 ±0.39 A	3.14^{B} ±0.17	1.30 ±0.07 A	1.29^{A} ±0.14	3.16 ±0.17 A	3.04^{AB} ±0.13	2.52 ±0.66 A	1.46^{A} ±0.00
	♀		7.29^{A} ±0.20		35.67^{BC} ±1.78		4.02^{A} ±0.82		1.31^{A} ±0.28		3.19^{AB} ±0.11		3.57^{A} ±0.52
E300	♂	7.13 ±0.26 A	7.08^{A} ±0.22	34.31 ±1.89 B	32.56^{C} ±1.80	3.70 ±0.43 A	3.58^{B} ±0.21	1.28 ±0.05 A	1.20^{A} ±0.03	3.16 ±0.18 A	2.95^{B} ±0.12	1.38 ±0.56 A	2.31^{A} ±0.18
	♀		7.18^{A} ±0.16		36.05^{BC} ±2.16		3.80^{A} ±0.16		1.35^{A} ±0.07		3.36^{A} ±0.12		0.45^{A} ±0.00
P20 0	♂	6.68 ±0.17 A	6.32^{A} ±0.40	34.90 ±2.05 B	32.91^{C} ±2.19	3.61 ±0.38 A	3.37^{B} ±0.18	1.29 ±0.06 A	1.22^{A} ±0.07	3.04 ±0.12 A	2.88^{AB} ±0.20	1.42 ±0.49 A	0.00^{B} ±0.00
	♀		7.03^{A} ±0.31		36.89^{BC} ±1.39		3.84^{A} ±0.27		1.35^{A} ±0.05		3.20^{A} ±0.17		2.84^{A} ±0.31
P250	♂	6.96 ±0.19 A	6.60^{A} ±0.24	38.33 ±1.92 A	36.07^{AB} ±1.18	3.45 ±0.37 A	3.17^{B} ±0.15	1.34 ±0.08 A	1.32^{A} ±0.07	2.94 ±0.10 A	2.58^{AB} ±0.17	2.22 ±0.65 A	1.41^{A} ±0.08
	♀		7.31^{A} ±0.20		40.60^{A} ±2.19		3.72^{AB} ±0.20		1.36^{A} ±0.06		3.28^{A} ±0.17		3.03^{A} ±0.85
P300	♂	6.86 ±0.16 A	6.43^{A} ±0.17	37.64 ±2.06 A	34.96^{BC} ±0.91	3.70 ±0.42 A	3.05^{B} ±0.20	1.33 ±0.07 A	1.25^{A} ±0.04	3.12 ±0.14 A	2.95^{B} ±0.10	1.55 ±0.58 A	1.29^{A} ±0.25
	♀		7.27^{A} ±0.34		40.31^{A} ±1.46		4.34^{A} ±0.28		1.41^{A} ±0.04		3.29^{A} ±0.11		1.80^{A} ±0.3 4

A, B, C, D - Means in columns are significantly different at P≤ 0.05
SE Standard Error

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