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RESEARCH ARTICLE

Effect of Width and Depth of Bell Drinker and Sex on Fattening Performance and Carcass Characteristics of Pekin Ducks

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Summary

The aim of this study was to determine the effects of width and depth of bell drinker and sex on fattening performance and carcass characteristics of Pekin ducks. A total of sixty male and sixty female ducklings (Star 53 H.Y., Grimaud Freres) were used. Each sex group was randomly allocated into two bell drinker groups (narrow bell drinker with 47 mm water depth and 48 mm water width and wide bell drinker with 78 mm water depth and 90 mm water width) each of 30 ducklings. Groups were located in floor pens of 170 x 94 cm width x length, each of 6 chicks, in a naturally ventilated house. Sex affected the hatching weight (P<0.01), total body weight gain (P<0.001), feed intake (d 22 to 42 and d 1 to 42, P<0.05), feed conversion ratio (d 1 to 21, P<0.05), slaughter weight (P<0.001) and percentages of hot carcass (P<0.05). Wide bell drinker increased the body weight gain (d 22 to 42 and d 1 to 42, P<0.001), feed efficiency (d 22 to 42 and d 1 to 42, P<0.01), slaughter weight (P<0.001) and percentages of breast and wings (P<0.01), however decreased the percentages of skin subcutaneous fat (P<0.01). More width and depth bell drinker was positively contributed to the fattening performance in rearing of Pekin ducks.

Keywords: *Pekin duck, Bell drinker, Sex, Fattening performance, Carcass characteristics*

Pekin Ördeklerinde Farklı Genişlik ve Derinlikteki Askılı Sulukların ve Cinsiyetin Besi Performansı ve Karkas Özelliklerine Etkisi

Özet

Bu çalışmanın amacı Pekin ördeklerinde farklı genişlik ve derinlikteki askılı sulukların ve cinsiyetin besi performansı ve karkas özelliklerine etkisini belirlemektir. Çalışmada toplam 60 erkek ve 60 dişi palaz (Star 53 H.Y., Grimaud Freres) kullanılmıştır. Her cinsiyet grubu her birinde 30 palaz olacak şekilde rastgele iki farklı askılı suluk grubuna (47 mm su derinliği ve 48 mm su genişliğine sahip dar askılı suluk ve 78 mm su derinliği and 90 mm su genişliğine sahip geniş askılı suluk) ayrılmıştır. Çalışma 170 x 94 cm (genişlik x uzunluk) boyutlarındaki yer bölmelerinde 6 palaz bulunacak şekilde doğal havalandırmalı kümeste yapılmıştır. Cinsiyetin çıkım ağırlığı (P<0.01), toplam canlı ağırlık artışı (P<0.001), yem tüketimi (22 ile 42. günler arasında ve 1 ile 42. günler arasında, P<0.05), yemden yararlanma oranı (1 ile 21. günler arasında, P<0.05), kesim ağırlığı (P<0.001) ve sıcak karkas randımanı (P<0.05) üzerine etkisi önemli bulunmuştur. Geniş askılı suluklar canlı ağırlık artışını (22 ile 42. günler arasında ve 1 ile 42. günler arasında, P<0.001), yemden yararlanmayı (22 ile 42. günler arasında ve 1 ile 42. günler arasında, P<0.01), kesim ağırlığını (P<0.001) ve göğüs ile kanat yüzdelerini (P<0.01) artırırken, deri ve deri altı yağ yüzdelerini azaltmıştır (P<0.01). Pekin ördeği yetiştiriciliğinde derinlik ve çapı daha fazla olan askılı sulukların kullanılması besi performansını olumlu yönde etkilemiştir.

Anahtar sözcükler: *Pekin ördeği, Askılı suluk, Cinsiyet, Besi performansı, Karkas özellikleri*

INTRODUCTION

Genetic selection and improvements in nutrition and husbandry techniques have made the shorter growing periods in Pekin ducks [1]. Within the years the final market weight has increased from 2400 g at 56 d of age [2] to nearly 4000 g within a 43 d growing period [3]. Also the proportion of breast muscle in the carcass increased from 9% [2] to 16.6% [4].

In recent years increasing attention has been focused on animal welfare. The Council of EUROPE [5] recommends

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that ducks should also be able to dip their heads in water and spread water over their feathers. Ducks are waterfowl, but they grow under intensive system without water for swimming. They do not do their natural behavior in intensive system. In general intensive system offer advantages such as controlled conditions and lower environmental impact, but they may also have disadvantages for the animals' welfare, the main concern being the lack of access to bathing water [6]. Studies have shown that easily accessible open water (in the form of troughs, baths or showers) seems to be beneficial for the welfare, including the health, of the birds and that it encourages the display of natural bathing behaviours [3,7]. Erişir et al.[8] determined that the Pekin ducks reared with swimming pool reached higher live weights than those with nonswimming pool and effects of swimming pool on carcass characteristics were not statistically significant in their study. However in an intensive system access to pool had a negative effect on duck body weight. The authors claimed that open water in intensive system resulted in negative environmental consequences such as increased ammonia concentration and poor litter quality. This problem should be solved by constructed drainage area to minimize contamination of bedding with excess water [3] or by used different width and depth of drinkers. For duck production, nipple or narrow bell drinkers are used generally in intensive system. But nipple and narrow bell drinkers do not provide an opportunity for ducks to immerse any parts of their body [3]. Therefore width and depth of bell drinker is important for the natural behaviour. Wide bell drinkers may positively affect the basic duck behaviour due to providing an opportunity immerse any parts of their body. However, available literature on the topic provides no information regarding the effects of bell drinker systems according to the different water depth and width on growth and carcass characteristics in male and female Pekin ducks. Therefore the aim of this study was to determine the effects of width and depth of bell drinker systems on growth and carcass characteristics in male and female Pekin ducks.

MATERIAL and METHODS

This study was approved by Ankara University Animal Care and Use Committee (2011/112/423). Sixty male and sixty female ducklings (Star 53 H.Y., Grimaud Freres) were obtained from the local hatchery (Köy-Tav, Turkey). Each sex group was randomly allocated into two bell drinker groups (narrow bell drinker with 47 mm water depth and 48 mm water width and wide bell drinker with 78 mm water depth and 90 mm water width) each of 30 ducklings. Treatments were subdivided into 5 replicates of 6 chicks each, located in floor pens of 170 x 94 cm width x length in a naturally ventilated house. Each pen had wood shavings litter. During the first week each pen was equipped with one bell drinker and one chick feeder and the other weeks each pen was equipped with one bell drinker and one hanging suspended feeder. Birds were fed with a starter diet from 1 to 21 day of age (2830 kcal/kg metabolizable energy and 18.2% crude protein) and grower diet from 22 to 42 day of age (2720 kcal/kg metabolizable energy and 17.3% crude protein). Food and water were offered *ad libitum* during the experiment. Birds were provided with continuous light. Fattening duration was 42 days.

Ducklings were weighed at the beginning of the experimental period and weekly to determine body weight and body weight gain by pen. Feed intake was recorded weekly and expressed as g per duck per week and the feed conversion ratio was calculated as g feed per g body weight gain. After final weighing at 42 day of age, feed was removed 6 h prior to slaughter. Slaughtering was conducted by a commercial slaughterhouse. Slaughter weight was determined before slaughtering. Hot carcass, gizzard, liver and heart were weighed. These weights were also expressed as percentages of slaughter weight. The carcasses were stored at 4°C for 24 h by hanging. Cold carcass weights were recorded and were expressed as percentage of slaughter weight as cold carcass yield. Each carcass was cut into the neck and wings with skin and legs and breast without skin and subcutaneous fat and weighed. Abdominal fat and total of skin with subcutaneous fat were separately weighted. They were expressed as a percentage of cold carcass weight.

Statistical analyses were performed using the software package SPSS for Windows (SPSS Inc., Chicago, IL). Data were tested for distribution normality and homogeneity of variance. A two-way ANOVA was used to determine the differences between sex and bell drinker groups as well as their interactions with respect to the studied parameters. When a significant difference was found among groups for post-hoc multiple comparisons, Duncan test was used [9]. A value of $P<0.05$ was considered statistically significant.

RESULTS

Duckling weight at hatch and body weight gain in Pekin ducks according to the drinker system and sex are summarized in the *Table 1*. In this study hatching weights were 50.3 g and 46.7 g in male and female ducklings, respectively. Type of bell drinkers affected the body weight gain from d 22 to 42 and from d 1 to 42 ($P<0.001$), however sex affected the body weight in all examined period ($P<0.01$). The feed intake and feed conversion ratio of groups are shown in *Table 2*. Sex also affected the feed intake (d 22 to 42 and d 1 to 42, $P<0.05$) and feed conversion ratio (d 1 to 21, $P<0.05$). Wide bell drinker decreased the feed conversion ratio (d 22 to 42 and d 1 to 42, $P<0.01$). As shown in *Table 3* and *4*, slaughter weight, hot carcass yield, relative organ weights and carcass characteristics of Pekin ducks were summarized. Sex affected the slaughter weight ($P<0.001$) and percentages of hot carcass ($P<0.05$).

Table 1. *Effects of drinker system and sex on duckling weight at hatch (DW) and body weight gain (BWG) of Pekin ducks (n=5)*
Tablo 1. *Pekin ördeklerinde suluk sistemi ve cinsiyetin çıkım ağırlığına ve canlı ağırlık artışına etkisi (n=5)*

Type of Bell Drinkers	Sex	DW (g)	BWG (g/duck) d 1 to 21	BWG (g/duck) d 22 to 42	BWG (g/duck) d 1 to 42
Narrow bell drinker	Female	46.5	1143	1790	2932
	Male	50.2	1344	1860	3203
Wide bell drinker	Female	47.0	1255	1893	3148
	Male	50.4	1312	2093	3405
Main effect mean					
Narrow bell drinker		48.3	1243	1825	3068
Wide bell drinker		48.7	1284	1993	3277
Female		46.7	1199	1841	3040
Male		50.3	1328	1976	3304
Pool SEM		0.59	12.53	17.89	15.97
Significance		P[1]			
Type of bell drinkers		NS	NS	***	***
Sex		**	***	**	***
Type of bell drinkers X Sex		NS	*	NS	NS

[1] *Statistical significance, *** P<0.001, ** P<0.01, * P<0.05,* ***NS:*** *Non-significant*

Table 2. *Effects of drinker system and sex on feed intake (FI) and feed conversion ratio (FCR) of Pekin ducks (n=5)*
Tablo 2. *Pekin ördeklerinde suluk sistemi ve cinsiyetin yem tüketimi ve yemden yararlanma oranına etkisi (n=5)*

Type of Bell Drinkers	Sex	FI (g/duck) d 1 to 21	FI (g/duck) d 22 to 42	FI (g/duck) d 1 to 42	FCR (g/g) d 1 to 21	FCR (g/g) d 22 to 42	FCR (g/g) d 1 to 42
Narrow bell drinker	Female	1845	4713	6558	1.62	2.63	2.24
	Male	1891	4901	6791	1.41	2.64	2.12
Wide bell drinker	Female	1809	4573	6382	1.44	2.43	2.03
	Male	1898	4763	6662	1.45	2.28	1.96
Main effect mean							
Narrow bell drinker		1868	4807	6674	1.51	2.64	2.18
Wide bell drinker		1854	4668	6522	1.45	2.35	2.00
Female		1827	4643	6470	1.53	2.53	2.13
Male		1894	4832	6726	1.43	2.46	2.04
Pool SEM		24.62	42.04	60.10	0.02	0.04	0.03
Significance		P[1]					
Type of bell drinkers		NS	NS	NS	NS	**	**
Sex		NS	*	*	*	NS	NS
Type of bell drinkers X Sex		NS	NS	NS	*	NS	NS

[1] *Statistical significance, ** P<0.01, * P<0.05,* ***NS:*** *Non-significant*

Wide bell drinker increased the slaughter weight (P<0.001) and percentages of breast and wings (P<0.01), however decreased the percentages of skin subcutaneous fat (P<0.01).

DISCUSSION

Hatching weight of 1-d-old ducklings was statistically different between sex group (P<0.01). Male ducklings were heavier than female ducklings at hatch and under all the examined weeks body weight gain of male ducklings were higher than female ducklings (P<0.01). This data demonstrate that the effects of hatching weights of different sex are noticeable when ducks reached to market weights. Also male ducklings consumed totally more food than females (P<0.05). This result is consistent with previous reports for body weight of male and female ducks [10-12]. Feed conversion ratio was only statistically significant (P<0.05) in the three weeks of rearing. This statistically difference might be explained that body weight gain in the first three weeks was higher in males than females.

Table 3. *Effects of drinker system and sex on slaughter weight, hot carcass yield and relative organ weights of Pekin ducks (n=30)*
Tablo 3. *Pekin ördeklerinde suluk sistemi ve cinsiyetin kesim ağırlığı ile sıcak karkas ve organ yüzdelerine etkisi (n=30)*

Type of Bell Drinkers	Sex	Slaughter Weight (g)	Hot Carcass Yield (%)	Liver (%)	Heart (%)	Gizzard (%)
Narrow bell drinker	Female	2768	70.9	1.71	0.72	3.05
	Male	3035	72.1	1,62	0.70	3.00
Wide bell drinker	Female	3004	72.0	1,69	0.69	2.95
	Male	3182	72.4	1,68	0.64	2,94
Main effect mean						
Narrow bell drinker		2901	71.5	1,66	0.71	3.00
Wide bell drinker		3093	72.2	1,68	0.66	2.94
Female		2886	71.5	1,70	0.70	3.00
Male		3109	72.3	1,65	0.67	2.94
Pool SEM		15.97	0.171	0.024	0.012	0.041
Significance		P[1]				
Type of bell drinkers		***	NS	NS	NS	NS
Sex		***	*	NS	NS	NS
Type of bell drinkers X Sex		NS	NS	NS	NS	NS

*[1] Statistical significance, *** P<0.001, * P<0.05,* ***NS:*** *Non-significant*

Table 4. *Effects of drinker system and sex on carcass characteristics of Pekin ducks (n=5)*
Tablo 4. *Pekin ördeklerinde suluk sistemi ve cinsiyetin karkas özelliklerine etkisi (n=5)*

Type of Bell Drinkers	Sex	Neck[1] (%)	Breast[1] (%)	Legs[1] (%)	Wings[2] (%)	Skin with Subcutaneous Fat (%)	Abdominal Fat (%)
Narrow bell drinker	Female	6.69	28.37	18.61	12.71	21.58	1.36
	Male	7.08	29.08	16.81	12.45	21.30	1.30
Wide bell drinker	Female	6.89	30.13	16.83	12.86	19.95	1.26
	Male	6.67	30.04	16.98	13.20	19.78	1.38
Main effect mean							
Narrow bell drinker		6.89	28.73	17.71	12.58	21.44	1.33
Wide bell drinker		6.78	30.09	16.90	13.03	19.86	1.32
Female		6.79	29.25	17.72	12.78	20.76	1.31
Male		6.88	29.56	16.90	12.82	20.54	1.34
Pool SEM		0.093	0.206	0.213	0.075	0.222	0.032
Significance		P[3]					
Type of bell drinkers		NS	**	NS	**	**	NS
Sex		NS	NS	NS	NS	NS	NS
Type of bell drinkers X Sex		NS	NS	*	NS	NS	NS

*[1] Without skin and subcutaneous fat, [2] With skin, [3] Statistical significance, ** P<0.01, * P<0.05,* ***NS:*** *Non-significant*

In the first three week, the average body weight gains were statistically similar in different bell drinker systems; however, after three weeks of rearing ducklings used wide bell drinkers were higher weight gain than used narrow bell drinkers (P<0.001). This result showed that after the three weeks of rearing, wide bell drinker system contributed to higher body weight gain of ducklings. Similarly İpek et al.[13] reported that broilers in the groups on round type drinkers reached higher body weight gain compared with those in the groups in which nipple type drinkers after the age of 3 weeks. O'Driscoll and Broom [3] examined the effects of different access to water (narrow bell drinker, trough and bath) on body weight. They showed that body weight of Pekin ducks at 43 d in the trough treatment was significantly higher (P<0.05) than in the narrow bell drinker treatment. In our study feed intakes in all examined weeks were statistically similar. Drinking system affected the feed conversion ratio from d 22 to 42 and from d 1 to 42 (P<0.01). And wide bell drinker positively affected the feed efficiency in these weeks. These differences may be due to the less food consumption but higher weight gain in reared with wide bell drinkers than the other group. Food is partitioned between body functions, including maintenance, growth and health. In healthy animals, 10%

of food ingredients consumed are used to maintain health. In negative conditions, most of the consumed food is used to cope with unpleasant conditions [14]. In the present study, this condition may be explained that wide drinker system positively affects the weight gain and feed efficiency. Mortality was not seen in examined groups during the experiment.

Slaughter weight and hot carcass yield were affected by the sex. These characteristics were higher in male ducklings. Wide bell drinkers increased the slaughter weight. Percentages of liver, heart and gizzard were not affected from the examined parameters.

Sex did not affect the examined percentages of carcass parts including neck, breast, legs, wings, abdominal fat and skin with subcutaneous fat. Similarly Sarı et al.[15] concluded that breast percentages were not different in sex groups. Slaughter age may be important in these parts. Bochno et al.[11] reported that the deposition of fat and skin increased significantly up to 10 weeks of age (from 98 g in 2-week-old birds to 843 g in 10-weeks-old ones). However types of bell drinkers only affected the percentages of breast, wings and skin with subcutaneous fat. Percentages of breast and wings were increased, but skin with subcutaneous fat was decreased in ducklings with rearing wide bell drinkers. Leg muscles of hatching duckling are more developed than breast muscles. Leg muscles grow very quickly to the age of 2 weeks, and breast muscles to about 7 weeks [11,16,17]. A rapid growth rate of wing muscles in Pekin ducks to about 5 weeks is worth noting [11]. These knowledge explained our results. Results of carcass parts were similar with results in body weight gain and feed efficiency. Wide bell drinker was important after the three weeks of rearing according to our results of body weight gain and feed efficiency therefore the percentages of legs were not statistically different in bell drinking groups because the first growing part is legs. The second growing parts are breast and wings, therefore these parts were different bell drinker groups. However, these growing parts may be affected by slaughter age. The interactions of sex and type of bell drinker were found for body weight gain and feed conversion ratio in the first three week and for the percentage of legs ($P<0.05$).

As a conclusion, we said that sex and bell drinker system are important for some examined parameters. Sex affected the hatching weight, body weight gain, feed intake (d 22 to 42 and d 1 to 42), feed conversion ratio (d 1 to 21), slaughter weight and the percentages of hot carcass. Wide bell drinker increased the body weight gain, feed efficiency (d 22 to 42 and d 1 to 42), slaughter weight and the percentages of breast and wings and decreased the percentages of skin with subcutaneous fat. Wide bell drinker system was positively contributed to the fattening performance in both sex. If pool were not used in duck production, wide bell drinkers should be used. Further studies should be carried out to investigate the different access to water on production, behaviour, welfare and economics.

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REFERENCES

1. Adeola O: Recent advances in duck nutrition. *24th Western Nutrition Conference, 10-11 September, the Fairmont Hotel, Winnipeg, Manitoba, Canada,* pp.191-204 2003.

2. Pingel H, Bock M, Schweizer W, Mertens H: Untersuchungen über die Mast- und Schlachtleistung von Pekingenten und die Möglichkeit zur Erhöhung ihres Brustfleischansatzes. *Arch Geflügelz Kleintierk,* 18, 151-168,1969.

3. O'Driscoll KKM, Broom DM: Does access to open water affect the health of Pekin ducks *(Anas platyrhynchos)*? *Poult Sci,* 90, 299-307, 2011.

4. Timmler R, Jeroch H: Nutrition of meat type ducks-latest advances and development trends. *Proceedings 1st World Waterfowl Conference, Taiwan,* pp.283-291, 1999.

5. Anonymous: Council of Europe Recommendation concerning domestic ducks. https://wcd.coe.int/ViewDoc.jsp?id=261425, 2001, *Accessed:* 10.12.2012.

6. Liste G, Kirkden RD, Broom DM: Effect of water depth on pool choice and bathing behaviour in commercial Pekin ducks. *Appl Anim Behav Sci,*139, 123-133, 2012.

7. Waitt C, Jones T, Dawkins MS: Behaviour, synchrony and welfare of Pekin ducks in relation to water use. *Appl Anim Behav Sci*, 121, 184-189, 2009.

8. Erisir Z, Poyraz Ö, Onbaşılar EE, Erdem E, Öksüztepe GA: Effects of housing system, swimming pool and slaughter age on duck performance, carcass and meat characteristics. *J Anim Vet Adv*, 8, 1864-1869, 2009

9. Dawson B, Trapp RG: Basic and Clinical Biostatistics. 3rd ed., Lange Medical Books/McGraw-Hill Medical Publishing Division, New York, 2001.

10. Onbaşılar EE, Erdem E, Gürcan İS, Poyraz Ö: Body weight and body measurements of male and female Pekin ducks obtained from breeder flocks of different age. *Arch fur Gef,* 75, 268-272, 2011.

11. Bochno R, Brzozowski W, Murawska D: Age-related changes in distribution of lean, fat with skin and bones in duck carcasses. *Br Poult Sci,* 2, 199-203, 2005.

12. Witkiewicz K, Kontecka H, Ksiazkiewicz J: Basic element of eviscerated carcass and chemical composition of pectoral muscle in selected and unselected ducks. *Archiv Tierz,* 49, 502-507, 2006.

13. İpek A, Şahan Ü, Yılmaz B: The effect of drinker type and drinker height on the performance of broiler cockerels. *Czech J Animl Sci,* 47, 460-466, 2002.

14. Siegel PB, Gross WB: Livestock Handling and Transport. **In,** Grandin T (Ed): General Principles of Stress and Well-being, 2nd ed., CAB International, Wallingham, pp.27-41, 2000.

15. Sarı M, Önk K, Tilki M, Aksoy AR: Ördeklerde kesim ve karkas özelliklerine cinsiyet ve ırkın etkisi. *Kafkas Univ Vet Fak Derg,* 18 (3): 437-441, 2012.

16. Gille U, Salomon FV: Muscle growth in wild and domestic ducks. *Br Poult Sci,* 39, 500-505, 1998.

17. Wiederhold S, Pingel H: Growth of breast and leg muscules of waterfowl. *Proceedings 11th European Symposium on Waterfowl, Nantes, France,* 8th to 10th September, pp.541-547, 1997.