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Effect of Gender and Age on Blood Glucose in Japanese Quail (Coturnix Coturnix Japonica)

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Abstract

The aim of this study was to investigate the fasting blood glucose values, which are measured at specified time intervals, of Japanese quails (coturnix coturnix japonica) at different ages and genders. In the study, 20 Japanese quail chicks constituted the animal material. The chicks reaching the age of one week were divided into two groups as male (G1, n:10) and female (G2, n:10) according to gender by taking into account the color difference in their chest area. The groups were taken in separate cages and housed under the same care and feeding conditions. Blood glucose values were measured by blood glucose meter, probes and blood samples taken from the vena subcutenea ulnaris. Glucose measurements were performed on all animals in G1 and G2 at minutes 0, 15, 30, 45, 60, 90, 120 and 150 for 7 weeks with an interval of 7 days from week 1. The data obtained in the study were statistically analyzed. The difference in glucose measurement times was found to be statistically significant in all weeks except weeks 6 and 7 ($p<0.001$). It was determined that the effect of gender interaction with the time of glucose measurement was not significant ($p=0.051$). In conclusion, it was determined that the fasting blood glucose values developing following the food restriction in Japanese quails at different ages and in different genders did not go below the normal limits at the measured time intervals. We believe that the results of this study will be useful for clinician veterinarians and researchers studying Japanese quail.

Key Words: Age, Glucose, Japanese quail

Japon Bıldırcınlarında (Coturnix Coturnix Japonica) Kan Glukozu Üzerine Cinsiyet ve Yaşın Etkisi

Öz

Bu çalışmanın amacı; Japon bıldırcınlarında (coturnix coturnix japonica) Farklı dönemlerde belirlenen zaman aralıklarında ölçülen açlık kan şekeri değerlerinin, cinsiyet ve yaş üzerinde etkilerini araştırmaktır. Çalışmada hayvan materyalini 20 adet Japon bıldırcını civcivi oluşturdu. Bir haftalık yaşa erişen civcivler göğüs bölgesindeki renk farklılığı dikkate alınarak cinsiyetlerine göre, erkek (G1, n:10) ve dişi (G2, n:10) olarak iki gruba ayrıldı. Gruplar ayrı kafeslere alınarak aynı bakım ve besleme koşullarında barındırıldı. Kan glukozu değerleri; kan şekeri ölçüm cihazı ve test çubukları ile bıldırcınların kanat altı venalarından alınan kan örnekleri ile gerçekleştirildi. G1 ve G2'de bulunan tüm hayvanlardan 1. haftadan itibaren 7 gün ara ile 7 hafta boyunca 0., 15., 30., 45., 60., 90., 120., ve 150.dk'larda glukoz ölçümleri gerçekleştirildi. Araştırmada elde edilen veriler istatistiksel olarak analiz edildi. 6. ve 7. hafta dışındaki tüm haftalarda glukoz ölçüm zamanları arasındaki farklılık istatistiksel olarak anlamlı bulundu ($p<0.001$). Glukoz ölçümü yapılan zaman ile cinsiyet arasındaki farkın anlamlı olmadığı belirlendi ($p>0.05$). Sonuç olarak farklı yaş ve cinsiyetteki Japon bıldırcınlarında gıda kısıtlamasını takiben gelişen açlık kan glukoz değerleri ölçülen zaman aralıklarında normal sınırların altına inmediği saptanmıştır. Bu çalışma ile klinisyen hekimlere ve Japon bıldırcınları ile çalışan araştırmacılara sonuçların katkı sağlayacağı kanaatindeyiz.

Anahtar Kelimeler: Glukoz, Japon bıldırcını, Yaş

INTRODUCTION

Japanese quail (coturnix coturnix japonica) has become an important laboratory animal for researchers due to its small body size, reaching sexual maturity in 6-7 weeks and the high reproductivity rate (1, 2). Japanese quail, which was the subject of interest both for production and as a model animal for a small number of researchers in the beginning, has become a model animal that is dealt and studied by numerous researchers, who have limited research opportunities (3). Although a number of experi-

mental studies with quails aimed obtaining information that can be used in breeding with regard to improving the features that are economically important, a significant portion of these studies was directed at clarifying the basic issues that apply to other domestic poultry animals (4, 5). It is necessary to carry out researches on Japanese quail breeding, which has been becoming increasingly widespread in our country. Thus, accumulation of technical knowledge will be provided on the possibilities of making more use of this poultry species (6). Glucose (GLU), which is among the blood metabolites, is an important source of energy for the cells. As the blood glucose consumption of the cells will increase significantly in the case of poultry animal's exposure to acute stress, the liver releases glucose, which it stores in the blood to keep the blood glucose level stable (200-400 mg / dl), to the blood in the form of glycogen (7). It is known that insulin, glucagon and thyroid hormones play regulatory roles in glucose metabolism in mammals (8). It has been reported that, after feed intake, blood glucose levels increase suddenly, while it requires a longer time to decrease to the same level (9, 10).

There are studies showing effects of the age and gender (8, 11-15) on blood glucose and on biochemical parameters in many animal species. Although there are many studies on healthy Japanese quails, no detailed studies have been found on the effect of gender and age on fasting blood glucose.

The purpose of this study is to investigate the fasting blood glucose values, which are measured at specified time intervals, of Japanese quails at different ages and genders.

MATERIALS and METHODS

This study was approved by the Siirt University Animal Research Local Ethics Committee (Approval number: 2016/12)

Animals and adaptation period (housing, feeding and general health)

Animal material in the study was constituted of 20 Japanese quail (coturnix coturnix japonica) broods. The broods were divided into two groups according to their gender as; male (n: 10) and female (n: 10), regarding the color difference in the chest region. Groups were taken in separate cages and were held the same care and feeding conditions. Quails were kept in cages that provide illumination environment under white fluorescent light at 35°C at 30% humidity for 1 week starting from the hatching; and they were held in cages with 30% humidity and 30°C in the same illumination environment during the second week. The quails were fed with 5% sugared water for 4 to 6 hours after the hatching, and then with broiler chick feed until reaching 3 weeks of age. The animals included in the study were fed with grounded feed for 3 weeks, and in the following days, they were fed with the same feed without being grounded until the end of the study.

Experimental design and experimentation

The study was constituted of two groups as; males (G1, n: 10) and females (G2, n: 10) separated by gender from the first week. Animals were not restricted in food or water consumption before the measurements; and no feed and water were given during the measurements.

The measurements of blood glucose values were carried out with the 0.5µl blood samples taken from the quails' veins under their wings with blood glucose measuring device (VıvaChekTM Eco) and the test rods produced via "glucose oxidase peroxidase method". Fasting glucose measurements were performed at 0, 15, 30, 45, 60, 90, 120, and 150th mins in 7 days intervals for 7 weeks starting from the 1st week on all animals in G1 and G2.

Statistical analysis

Variance analysis on repeated measures was performed to evaluate the difference of weekly weight

values regarding the weeks and gender, and the difference of glucose measurement values regarding the measurement times (min) and gender. Descriptive statistics were given as Mean ± standart deviation. Statistical analyzes were performed with the IBM SPSS 20 program and $p < 0.05$ was interpreted as significant in the results.

RESULTS

At 1st, 2nd, 3rd, 4th and 5thweek, the difference between the GLU measurement times was found to be statistically significant ($p < 0.001$). At 6th week, the difference between the GLU measurement times was not found to be statistically significant ($p=0.076$). At 7th week, the difference between the GLU measurement times was not found to be statistically significant ($p=0.130$) (Table 1). It was determined that the effect of gender interaction and the measurement time were not significant (1st week; $p = 0.090$, 2nd week; $p = 0.458$, 3rd week; $p= 0.253$, 4th week; $p = 0.481$, 5th week; $p = 0.278$, 6th week; $p=0.076$, 7th week; $p = 0.743$) (Table 1). It was determined that the weight values have shown significant differences between the weeks ($p < 0.001$) (Table 2). It was observed that the measurement values did not show difference in 5th week and 6th week ($p = 1.000$), 5th week and 7th week ($p = 0.741$), and 6th week and 7th week ($p = 1.000$); while all other weeks were statistically different from each other. It was determined that the effect of gender interaction and the measurement time were not significant ($p = 0.051$).

Table 1. Glucose (mg / dl) values between the measurement times of the animals in the study per week (Mean±SD)

Week	Gender (n:10)	0.minute	15. minute	30. minute	45. minute	60. minute	90. minute	120. minute	150. minute	P
1	Female	242.60±18.53^{a}	257.90±30.16^{b}	257.50±18.57^{c}	274.0±37.44^{d}	287.90±49.84^{e}	286.20±39.64^{f}	314.0±40.28^{g}	295.90±17.69^{h}	p <0.001
	Male	277.20±24.59^{a}	289.30±29.33^{b}	284.20±35.52^{c}	300.40±49.83^{d}	284.10±41.21^{e}	286.50±25.62^{f}	308.0±44.59^{g}	330.80±45.46^{h}	
2	Female	258.30±20.58^{a}	267.00±12.26^{b}	276.30±18.60^{c}	271.60±24.87^{d}	275.70±24.69^{e}	278.20±27.78^{f}	286.80±31.56^{g}	298.00±34.85^{h}	p <0.001
	Male	245.20±24.16^{a}	270.50±40.93^{b}	273.90±29.36^{c}	279.30±26.50^{d}	285.50±26.65^{e}	275.00±42.88^{f}	306.00±55.41^{g}	309.60±50.10^{h}	
3	Female	251.80±16.45^{a}	241.50±17.84^{b}	247.60±26.79^{c}	246.70±23.49^{d}	245.50±25.97^{e}	268.20±26.90^{f}	287.10±17.84^{g}	285.80±16.17^{h}	p <0.001
	Male	265.10±42.96^{a}	242.50±28.72^{b}	239.10±32.50^{c}	243.00±30.01^{d}	245.00±21.44^{e}	265.40±20.69^{f}	268.50±22.63^{g}	278.10±19.05^{h}	
4	Female	251.50±19.71^{a}	268.90±31.61^{b}	275.60±30.03^{c}	294.40±53.61^{d}	297.30±51.20^{e}	304.70±46.31^{f}	303.40±47.46^{g}	299.50±47.85^{h}	p <0.001
	Male	239.20±22.42^{a}	247.20±23.96^{b}	246.80±26.13^{c}	264.90±48.37^{d}	252.20±18.10^{e}	283.40±20.92^{f}	286.50±28.58^{g}	275.30±29.91^{h}	
5	Female	229.10±11.57^{a}	237.50±11.39^{b}	238.00±18.12^{c}	242.80±26.27^{d}	248.20±32.96^{e}	268.70±26.14^{f}	264.90±37.68^{g}	256.40±26.06^{h}	p <0.001
	Male	201.11±67.68^{a}	239.66±18.80^{b}	237.77±12.98^{c}	242.77±19.30^{d}	240.4±23.27^{e}	243.88±10.24^{f}	262.11±18.00^{g}	261.66±11.73^{h}	
6	Female	236.80±17.09^{a}	245.60±17.39^{b}	245.30±21.14^{c}	245.90±20.90^{d}	243.00±28.99^{e}	248.00±24.89^{f}	250.50±21.86^{g}	250.10±21.47^{h}	p=0.076
	Male	259.30±23.14^{a}	261.70±34.42^{b}	272.40±46.59^{c}	275.40±36.16^{d}	275.30±34.82^{e}	275.80±37.51^{f}	279.40±43.19^{g}	272.10±40.20^{h}	
7	Female	236.40±21.09^{a}	241.40±18.41^{b}	237.40±33.23^{c}	234.00±26.72^{d}	245.10±37.42^{e}	243.30±32.07^{f}	245.50±32.88^{g}	244.80±28.09^{h}	p=0.130
	Male	224.30±9.41^{a}	245.90±35.69^{b}	239.90±17.11^{c}	233.00±23.66^{d}	245.50±23.08^{e}	242.80±28.60^{f}	244.80±27.53^{g}	240.40±23.76^{h}	

^{a,b,c,d,e,f,g,h}: There is a statistical difference between the different letters on the same line.

Table 2. Mean body weight (gr) values at 7 weeks of study animals (Mean ± SD)

	Weeks						
Gender (n:10)	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Female	47.50±4.84	79.50±6.43	117.00±16.86	158.50±21.86	190.00±27.98	192.00±24.51	192.50±25.08
Male	45.20±4.87	68.00±6.32	112.00±7.88	144.50±13.06	163.00±13.16	161.00±27.66	173.50±20.00

DISCUSSION

In this study, which was conducted to detect fasting blood glucose in quails, the date of sexual maturity was determined as 49th day, have applied an illumination program to the quails as 16 hours of light and 8 hours of darkness as in the study, reported that the first sexual maturity date for the quails was 43rd day (16). Similarly, it has been found that it is in accordance with the value that is between 45 and 72 days, which is reported by Cerit and Altınel (1998).

As the blood GLU concentration associated with genetic predisposition can be altered by the release of catecholamines, the GLU can also secondarily be increased in myopathy and hypoxia-induced stress of muscle and liver enzymes (18). Therefore, the levels of hematological and biochemical parameters measured in clinically normal animals may be in considerably broad limits. In some studies on wild birds such as chukar partridge and Black Francolin, due to the use of GLU as an immediately available energy source for flight, and the animals' stress about being caught, the GLU levels were reported to be higher than other domestic poultry animals (18-20). While some researchers have stated that the GLU level was not affected by the gender factor in partridges, in ostriches and broilers suggested that blood glucose levels are closely related to the nutritional status (18, 20-26). Some researchers suggested that the relative low level of GLU occurring in male ostriches may be due to malnutrition of these animals (24). Similarly, studies on Quails, Mallards and Flamingoes found that GLU levels were higher in females than males (27-29). Some researchers suggested that the growth hormone, which plays role in the faster growth of male Flamingos than females, may appear as the result of the excessive use of GLU and may result in an indirect decrease of GLU in the bloods of male Flamingos (28). On the contrary, Scholtz ve ark. (2009) found that GLU levels in males were higher than females in a study carried out on Japanese quails. While Rodríguez ve ark. (2006) reported that GLU values in partridges may change due to circadian rhythm; Özbey and Esen (2007) reported that they observed increases in GLU levels of partridges due to the effect of a stress factor related to the breeding style. In parallel with the findings of Menon ve ark. (2013) and Bowes ve ark. (1989) in our study, it was statistically determined that the GLU levels were not affected by the gender factor, and no statistical difference was found. Again Scholtz ve ark. (2009) and Keskin ve ark. (1995) found that GLU levels were higher in females than males in their studies on quails, which is inconsistent with the presented study, because, in the study, it was determined that the effect of gender interaction was not significant for all of the weeks.

Blood glucose, an important source of energy, is in the range of 200-400 mg/dl in birds (7). There was a significant difference found between the blood glucose measurement times of all of the weeks except for 6th and 7th weeks of the study. Blood glucose values were found between 200 and 400 mg/dl for all of the weeks and they are within the normal limits. In many studies, applications of food restriction before anesthesia in Japanese quails were reported (34-37). Although, the blood glucose measurement in the presented study was statistically different for the values between 0 min and 150th min, it was determined to be within the normal limits; and it was found in scientific studies and clinical cases that applying food restrictions for a certain period of time is not effective for Japanese quails, in contrast with the performed studies.

As a result of this study; it was determined that, following the food restriction application to the Japanese quails at different ages and genders, fasting blood glucose values did not decrease below the normal limits at the measured time intervals. We believe that the results of this study will contribute to the clinician veterinarians and the researchers working with Japanese quails.

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