Journal of Animal and Veterinary Advances 7 (10): 1190-1195, 2008
ISSN: 1680-5593

The Changes of the Body Weight and Some Blood Parameters of Pekin Ducklings Dependent on Transportation Duration

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Abstract: The effect of transportation on body weight and some blood parameters of hatching Pekin ducklings were investigated. A total of 500 (250 male, 250 female) 1 day-old ducklings (Star 52-Grimaud Freres) were obtained from a commercial hatchery. Upon hatching and on the 4, 8 and 12 h of the transportation, each duckling was weighed to determine their body weights. Before transportation and on the 4, 8 and 12 h of the transportation, necks of 10 male and 10 female ducklings were broken and blood samples were taken. Plasma corticosterone, glucose, cholesterol, triglyceride, AST (Aspartate transaminase), CK (Creatine kinase), total protein, albumin levels and blood H/L (heterophile/lymphocyte) ratios were determined. The body weights, which were 46.1 and 45.7 g for hatching male and female ducklings, fell down to 41.3 and 41.5 g at the end of transportation. During transportation, a total of 4 ducklings died; 1 male and 1 female on the 8 h, 1 male and 1 female on the 12 h. Plasma glucose levels of ducklings decreased up to 8 h of transportation, but increased at 12 h. Plasma corticosterone, cholesterol, triglyceride, AST, total protein, albumin levels and blood H/L ratios increased in transported ducklings due to increasing transportation time.

Key words: Pekin ducklings, transportation, body weight, some blood parameters

INTRODUCTION

In poultry breeding, birds are effected by various stress factors (Freeman, 1985, 1987). During transportation to the pen from hatching house or to the slaughterhouse from pen, the birds are exposed to stress factors such as noise, vibration, air flow, stocking density, temperature, food and water deprivation (Elrom, 2000). Birds are transported to the pen as soon as hatching. Hatching chicks can be transported to long distances for commercial aim. At hatch yolk comprises approximately 20% of the BW of chicks and provides immediate post hatch energy and protein for maintenance and growth (Romanoff, 1960; Sklan and Noy, 2000). Yolk at this time comprises approximately 50% lipids (Noy and Sklan, 2001).

Along with unfavorable environmental factors, prolonged periods of transportation of poultry after hatching change the stress-determining biochemical parameters, leading to the consumption of this nutrient source. In the present study, the effects of increasing transportation time after hatching on body weight and some blood parameters of Pekin ducklings were investigated.

MATERIALS AND METHODS

The ducklings taken out from the incubator at 15.00, were differentiated in terms of sex by examining their cloacae and 250 male and 250 female ducklings were selected for the study. The ducklings were then placed in 4-chambered cardboard boxes with the dimensions of 12 cm height, 50 cm width and 50 cm length, each chamber containing 20 ducklings. The boxes were placed in pair 1 on top of the other into a canvas-covered truck and transported between the hours 16.00-04.00 in June, with an average speed of 80 km h^{-1}. During the transportation, the average temperature and humidity inside the boxes was 29°C and 50 %. Upon hatching and on the 4, 8 and 12 h of the transportation, each duckling was weighed

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to determine their body weights. Before transportation and on the 4, 8 and 12 h of the transportation, necks of 10 male and 10 female ducklings were broken and 2 cc bloods was taken from each duckling into EDTA tubes. Water and feed were not offered to the animals during transportation.

Blood samples were smeared on to a glass slide for the determination of the H/L (heterophile/lymphocyte) ratio. After drying, the smears were stained with May-Grünwald-Giemsa stain. One hundred leucocytes were counted, once on each slide, using a light microscope at x 1000 magnification. The H/L ratios were determined by dividing the number of heterophiles by the number of lymphocytes.

Plasma was separated by centrifuging the blood samples at 3000 rpm for 10-15 min. Plasma was frozen (-20°C) until it was analyzed for corticosterone determination. Plasma corticosterone levels were measured by using the kits Active Rat Corticosterone EIA DSL -10-81100 for IDS double antibody EIA technique, with a Bio-Tek ELX800 gamma counter. Plasma glucose, cholesterol, TG (triglyceride), AST (Aspartate transaminase), CK (Creatine kinase), total protein, albumin levels were determined by using an Olympus AU600 auto analyzer and its accompanying commercial kits.

Statistical analysis: Statistical analyses were performed by using software package SPSS for Windows (SPSS Inc, Chicago, IL. USA). Data were tested for distribution normality and homogeneity of variance. Differences in sex with time were compared by general linear models for repeated measures in body weight. A 2-way ANOVA was used to determine the differences between sex and time and their interactions with respect to the biochemical parameters. When a significant difference was found among groups for post-hoc multiple comparisons, Duncan test was used (Dawson and Trapp, 2001).

RESULTS AND DISCUSSION

There is no doubt that weight loss occurs during transportation. Weight loss in poultry depends on several factors as the stocking density, the food and water deprivation, the age and weight of birds, the environmental conditions during the transportation and the duration of transportation (Nijdam *et al*., 2005; Elrom, 2001). In the present study, the body weights, which were 46.1 and 45.7 g for male and female ducklings before the transportation, fell down to 44.6 and 43.4 g on the 4 h, to 42.7 and 42.5 g on the 8 h and to 41.3 and 41.5 g on the 12 h of the transportation, respectively (Table 1). Transportation durations in terms of changes in body weight and the interaction between sex and transportation durations were found to be significant ($p<0.001$). Nijdam *et al.* (2005) reported that feed withdrawal and transport led to decreased body weight. During transportation, a total of 4 ducklings died; 1 male and 1 female on the 8 h, 1 male and 1 female on the 12 h.

The blood parameters obtained in beginning and during the experiment are given in Table 2 and Fig. 1.

Corticosterone is a glucocorticoid secreted under stress in domestic poultry (Freeman, 1985) and increases are expected in the use of glycogen stores, in the blood glucose level and in the glycolysis against a stress factor (Donaldson *et al*., 1991). Previous studies has been showed that plasma corticosterone levels in broilers increase because of stress (Freeman *et al*., 1984; Kannan *et al*., 1997; Carlisle *et al*., 1998; Nijdam *et al*., 2005). In the present study, in duckling, with increasing transportation time, also corticosterone levels increased and these increases reached at significant levels at 12 h of transportation. The corticosterone levels of male duckling were higher than the female ($p<0.05$).

Physical stress causes increased catecholamine secretion resulting in hyperglycemia (Bell, 1971). In addition, neurogenic amines such as adrenaline (epinephrine), noradrenaline and glucocorticoids lead to increases in blood glucose by inducing the breakdown of glycogen to glucose in the liver in variety of avian species (Bell, 1971; Assenmacher, 1973). However, results of the studies on the effects of transportation on plasma glucose levels are in conflict with each other. Some investigators (Freeman, 1984; Carlisle *et al*., 1998) observed a reduction in plasma glucose concentrations after transport, whereas some others (Savenije *et al*., 2002; Yalçin *et al*., 2004; Nijdam *et al*., 2006) claimed that no significant differences were observed in plasma glucose concentration of transported broilers. Freeman *et al.* (1984) and Carlisle *et al.* (1998) attributed the reason of the hypoglycemia formed as a result of transportation to the depletion of hepatic glycogen stores following the increasing need for glucose in broilers. Warris *et al.* (1993) showed that transport of broilers for up to 6 h depleted liver and muscle glycogen, as did fasting for 10 h.

Table 1: The effect of transportation on body weight(g)

Time (h)	Male	Female
0	46.14±0.25^{a}	45.71±0.25^{a}
4	44.60±0.24^{b}	43.38±0.24^{b}
8	42.67±0.23^{c}	42.45±0.23^{c}
12	41.34±0.23^{d}	41.51±0.23^{d}
	F	p-value
Time	65647.755	<0.001
Sex×Time	1502.617	<0.001

Mean±SEM. Sex×time = Sex by time interaction; ^{a,b,c,d}Means within columns with different letters are significantly different ($p<0.05$)

Table 2: The effect of transportation on some blood parameters

Sex	Time (h)	Cortocostero ng mL^{-1}	Glucose mg dL^{-1}	Cholesterol mg dL^{-1}	TG mg dL^{-1}	AST U L^{-1}	CK U L^{-1}	Total protein g dL^{-1}	Albumin g dL^{-1}	H L^{-1}
Male	0	440±29	173±5	584±31	117±10	39±4	3936±214	3.1±0.1	1.06±0.06	0.48±0.03
	4	430±29	156±5	735±31	135±10	42±4	1995±214	3.8±0.1	1.45±0.06	0.42±0.03
	8	505±29	139±5	676±31	154±10	34±4	2380±214	3.4±0.1	1.22±0.06	0.57±0.03
	12	521±29	180±5	770±31	213±10	50±4	3066±214	3.5±0.1	1.32±0.06	0.85±0.03
Female	0	385±29	175±5	604±31	111±10	40±4	2945±214	3.1±0.1	1.03±0.06	0.52±0.03
	4	415±29	168±5	608±31	99±10	41±4	2874±214	3.4±0.1	1.28±0.06	0.46±0.03
	8	392±29	130±5	640±31	163±10	41±4	2811±214	3.4±0.1	1.38±0.06	0.53±0.03
	12	504±29	190±5	685±31	182±10	51±4	2837±214	3.6±0.1	1.34±0.06	0.82±0.03
Total										
Male		474±15^{x}	162±3	691±15^{x}	155±5^{x}	41±2	2844±107	3.4±0.1	1.26±0.03	0.58±0.02
Female		424±15^{y}	166±3	634±15^{y}	139±5^{y}	43±2	2867±107	3.4±0.1	1.26±0.03	0.58±0.02
	0	412±21^{b}	174±4^{b}	594±22^{c}	114±7^{c}	39±3^{b}	3441±151^{a}	3.1±0.1^{b}	1.05±0.04^{b}	0.50±0.02^{b}
	4	422±21^{b}	162±4^{c}	671±22^{ab}	117±7^{c}	42±3^{b}	2435±151^{c}	3.6±0.1^{a}	1.37±0.04^{a}	0.44±0.02^{c}
	8	448±21^{b}	135±4^{d}	658±22^{b}	159±7^{b}	38±3^{b}	2595±151^{bc}	3.4±0.1^{a}	1.30±0.04^{a}	0.55±0.02^{b}
	12	512±21^{a}	185±4^{a}	728±22^{a}	197±7^{a}	51±3^{a}	2951±151^{b}	3.6±0.1^{a}	1.33±0.04^{a}	0.84±0.02^{a}
Two-way ANOVA (p)										
Sex		0.019	0.272	0.010	0.030	0.505	0.882	0.399	0.951	0.834
Time		0.004	0.000	0.001	0.000	0.004	0.000	0.001	0.000	0.000
Sex×time		0.307	0.155	0.102	0.098	0.787	0.000	0.259	0.070	0.406

Mean±SEM; Sex×time = Sex by time interaction; $^{x, y, a, b, c, d}$ Means within columns with different letters are significantly different ($p<0.05$)

Cashman *et al*. (1989) and Warris *et al*. (1999) reported that duration of transportation was a major stress factor. Plasma glucose level of duckling decreased up to 8 h of transportation, but increased at 12 h. The decrease in the glucose level on the 4 and 8 h of the transportation might be resulted from the fact that the hungry poultry consumed the glucose in the egg yolk, which leads to the depletion of glycogen stores. The rise in glucose in parallel to the increase in corticosterone on the 12 h of the transportation might be related to the effect of corticosterone which increases gluconeogenesis. It has been reported that there was no change in the plasma glucose levels in the case of very short transport times (Savenije *et al*., 2002; Yalçin *et al*., 2004; Nijdam *et al*., 2006). The glucose levels in the plasma of male duckling were found higher than the female ($p<0.05$).

Evaluations of plasma levels of cholesterol and triglycerides are in agrement with metabolic changes associated with stress in chickens (Mickey *et al*., 1996; Puvadolpirod and Thaxton, 2000 a, b; Olanrewaju *et al*., 2006). Transport increases nonesterified fatty acid (Freeman *et al*., 1984; Nijdam *et al*., 2005, 2006) and cholesterol levels in plasma of broilers and causes a marked hiperlipidemia (Freeman *et al*., 1984). In transported duckling, with increasing transport time, plasma cholesterol and triglyceride levels also increased significantly. The present increases are consistent with increases in the plasma coticosterone level where it is an indicator of an increase in adrenal cortical activity. The triglyceride levels in the plasma of male duckling were found higher than the female ($p<0.05$).

Plasma intracellular enzyme activity (i.e., plasma creatine kinase) has been used as an indicator of tissue damage due to stress (Itoh *et al*., 1993). It has been determined that plasma CK activity in broilers is elevated significantly after transportation (Mitchell *et al*., 1992; Mitchell and Kettlewell, 1998; Carlisle *et al*., 1998; Yalçin *et al*., 2004). In the present study, significant increases in the plasma levels of AST have been found due to the transportation. Transport stress-induced tissue dysfunction and damage are reflected by increased plasma activity of intracellular muscle enzymes, including creatine kinase (Scholtyssek and Ehinger, 1976; Mitchell, 1992). The high level of CK observed in the study upon hatching might be due to the straining of neck muscles as the chicks attempted to hatch out from the egg. Increased CK could be due to the fact that this value continued to decline until the 4 h; however, with the prolonged transportation duration, water intake was delayed and thus, degeneration of muscle mass, which was accompanied by unfavorable environmental conditions such as shaking during transportation was stimulated. The fact of AST being similar to CK in this study supports this suggestion. However, plasma total protein and albumin levels increased due to the transportation. An increase in plasma albumin level after 1 h transportation in the broilers was reported by Yalçin *et al*. (2004).

In the birds, the indicator of the activity of Hypothalamo-adenohy Pophyseal-Adrenocortical (HPA) axis and the classical indicator of stress is the H/L ratio, which changes depending on the stress intensity (Mitchell and Kettlewell, 1998). The high H/L ratio observed during hatching might be considered as a result of stress caused by the environment outside the egg and the effort of reaching to this environment. Soon after hatching, these negative factors disappeared and from the 4 h onwards, another stress factor, i.e. transportation

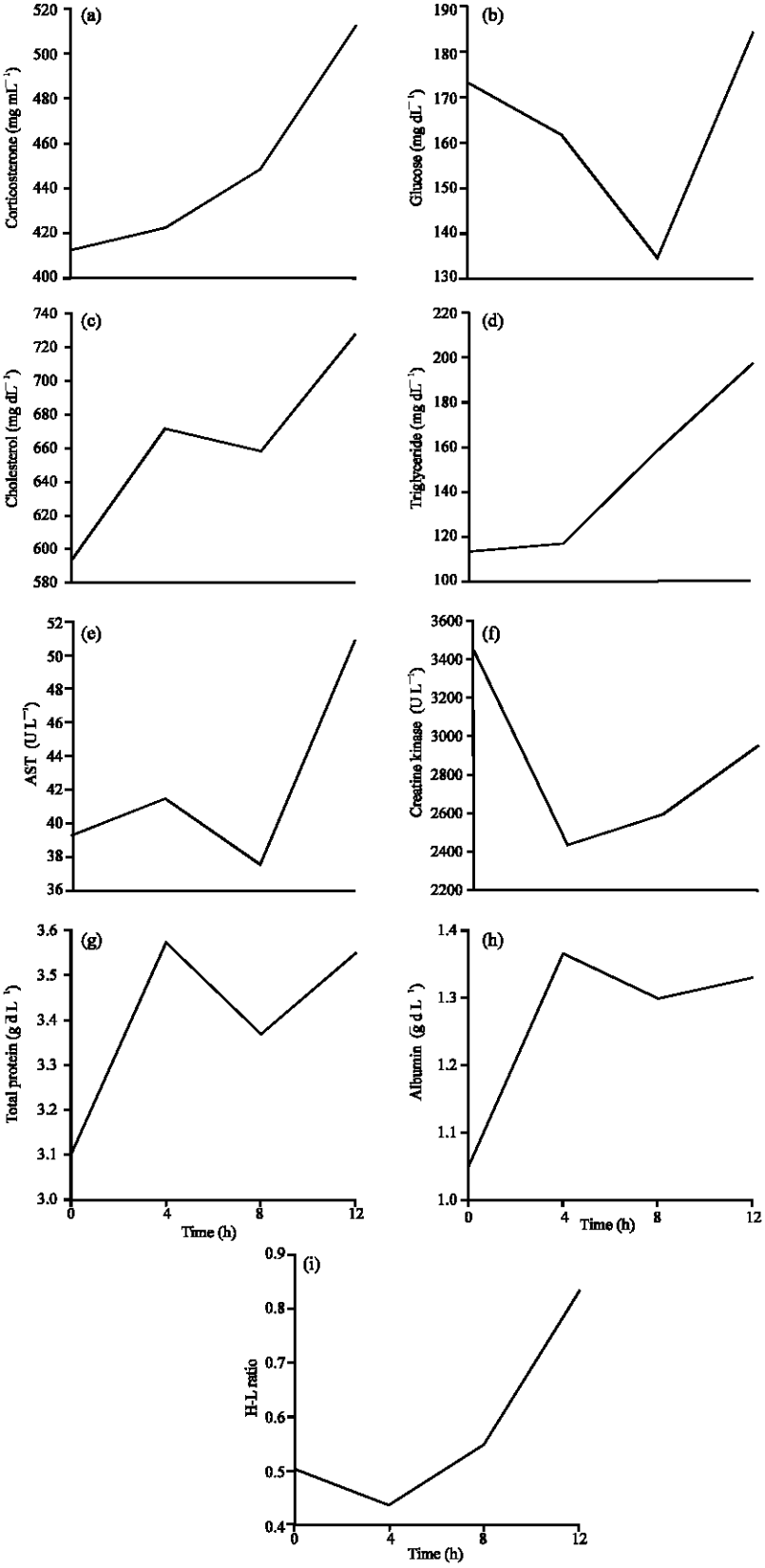

Fig. 1: The effect of transportation on some blood parameters

stress, started. In the present study, a significant increase in the H/L ratio at the 12 h of transportation is consistent with corticosterone increase indicating the HPA activation. Mitchell *et al.* (1992) reported a significant increase in H/L ratio in broilers after 3 h transportation.

In the present study, attempted to determine the stress level caused by transportation duration in ducklings after hatching, it was observed that the hatching itself (the 0 h) was also a source of stress. It was determined that shorter transportation durations eliminated this stress; however, if this duration exceeded 8 h in particular, stress caused by transportation considerably affected the ducklings.

CONCLUSION

Therefore, it was concluded that transportation should not take longer than 8 h and it would be useful to conduct a further study to determine the levels of this effect on productivity.

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