BEHAVIORAL AND PHYSIOLOGICAL CHANGES OF PEKIN DUCKS AFTER TRANSPORTATION

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ABSTRACT

Physiological and behavioral responses to transportation stress were examined on 210 pekin ducks with an average age of 4 months and the average body weight of 2.3 kg. Ducks were randomly assigned to 1 of the 7 treatment groups using a transportation distance as the main effect; unstressed control group, 50m transport inside the farm, 100m transport inside the farm, 50km transport outside the farm, 100km transport outside the farm, 100km transport outside the farm and put them in a dark room immediately after unloading for one hour, and 100km transport outside the farm after adding vitamin C in the drinking water before crating (loading). Results showed that, outside transportation stress-induced the following; behavioral changes (increased water intake and resting time while reduced feed intake and preening time) and physiological effect (high plasma CORT levels and low H/L ratios) changes. While inside transportation didn't affect the ducks' behavior and physiology. Mortality percent and tonic immobility (TI) duration were increased by increasing the transportation distance. Keeping ducks post-transportation in a dark place or adding vitamin C in the drinking water pre-transportation reduced the harm effect of transportation stress. The data indicated that pekin ducks had a low adaptive capability to transportation stress.

Keywords: behavior, pekin duck, plasma CORT, preening, transportation.

INTRODUCTION

Nowadays, duck farms increased in Egypt due to a lot of problems facing poultry industry. Ducks have many advantages in compared with poultry such as easy to raise in cold and hot weather, low vaccinations, long productivity and need a modest housing requirements. Duck productivity was reduced by a variety of stresses associated with duck management as deprivation of food or water and fearfulness from transportation and disturbance by rats ***(Setioko et al., 1985).*** In the egg production industry, ducks are transferred at least 3 times during their life span; from hatchery house to grower house, from grower house to layer house and from layer house to slaughter and processing house. This practice subjects ducks to stress, resulting from an accumulation of stressors during the process, including capturing, loading and unloading, overcrowding, fasting, and withdrawal of water, change of temperatures, vibration, novel environments, restriction of behavior, social disruption and fighting for a dominant position after relocation and mixing ***(Freeman et al., 1984; Carlisle et al., 1998; Warriss et al., 2005; Aksit et al., 2006; Bedanova et al., 2006; Huff et al., 2006; Vecerek et al., 2006).*** These stressors may lead to a deviation from physiological homeostasis, in turn, impairing bird well-being

The welfare of poultry during transportation from hatchery to other sites of production is a matter of concern especially prior and during transportation of birds to avoid exposing to a wide range of those potential stressors. The adverse effect of these factors up on the bird may range from mild distress and aversion to injury and death. It has been reported that 40 % of mortalities in "dead on arrival" broilers are a consequence of stress ***(Bayliss and Hinton, 1990)*** and that mortality increases with the transport length ***(Warriss et al., 1990)*.** Several trials have been attempted to characterize the behavioral and physiological responses of birds to transportation. Harvesting and transport of poultry represents a severe stressor based upon measurements of tonic immobility (TI) and plasma corticosterone concentrations. These findings are supported by studies involving measurements of TI following commercial transportation of broilers and they indicated that transport may greatly increase bird's fearfulness ***(Cashman et al., 1989; Nicol and Scott, 1990)*.** The induction of physiological stress by transportation has been suggested from a number of studies. Plasma corticosterone is elevated following a road journey ***(Freemann et al, 1984; Satterlee et al., 1989)*.** This is consistent with the post-transport increase of heterophil: lymphocyte ratios ***(Satterlee et al., 1989; Mitchell et al., 1992; Maxwell, 1993)*.** The heterophil: lymphocyte ratio (H/L ratio) was used as an index of stress ***(Zulkifli et al., 2000)*.** In addition ***Gross and Siegel (1983)*** compared plasma corticosterone concentration and H/L ratio responses to various stressors and concluded that the H/L ratio is a better indicator of stress in poultry. While tonic immobility (TI) reaction of chickens provides a useful behavioral method of estimating their fearfulness ***(Jones, 1986). Cashman et al. (1989)*** mentioned that both journey duration and waiting time before transport increased the duration of tonic immobility

Crating causes an increase in plasma corticosterone (CORT) levels in both laying hens and broilers ***(Kannan and Mench, 1996)*.** The duration of crating ***(Kannan and Mench, 1996)*** and the method of crating ***(Duncan, 1989)*** can also influence the stress response shown by the bird. Although catching, crating, and loading are the procedures that are most likely to cause physical injuries, transportation has also been reported to be stressful to broilers. ***Duncan (1989),*** for example, found that birds that were crated and transported on a vehicle for 40 min had higher plasma CORT concentrations than birds that were crated and loaded onto the vehicle but not transported. Further, ***Cashman et al. (1989)*** reported that fear levels in birds were mainly determined by transportation and not just by catching and loading.

On the ***Kannan and Mench (1997)*** attempted to habituate H/L ratio and level of fearfulness as indicated by TI after broilers to pre-slaughter handling through repeated transportation of broiler chickens at age of marketing and handling during the growing period but they failed. Alternatively, dietary supplementation of ascorbic acid (AA) has yielded some promising results in relation to perturbation of homeostasis in poultry and increase the survivability of poultry under stressful conditions ***(Zulkifli et al., 1996)*** and addition of AA in water dampened. In addition it was shown that addition of AA to the drinking water before handling of broiler decreases the duration of TI ***(Satterlee et al., 1994; Zulkifli et al., 2000)*** and produced lower H/L ratios in response to pre-slaughter handling ***(Zulkifli et al., 2000)*.** Therefore, supplementation of broiler diets with some feed additives may aid in overcome any deficiency and enhance tolerance to stresses concomitantly.

Physiological stress responses and level of fearfulness are used to assess welfare of broiler chickens after their transport in addition to other assessments as dead-on arrivals, physical injuries, carcass characteristics and aversion ***(Nicol and Scott, 1990)*****.** The average mortality in broilers was 0.16% for journey of less than 4hrs and 0.28% for longer journey ***(Warriss et al., 1992)*** while, ***Nicole and Saville, (1993)*** said that journey time appeared to be a very important predictor of mortality than transporting disturbance. Adding vitamin C improved egg productivity in stressed hens ***(Cheng et al., 1990)*****.** Ducks easy to exciting by unusual surroundings and try to escape so some laying birds showed molting by capture and moving from place to place. Owing to ducks are more sensitive to stress, good management must be practiced carefully. Therefore, the aim of this study was planned to examine the behavioral and physiological changes of duck after transportation stress.

MATERIALS AND METHODS

A flock of 210 pekin ducks with an average age of 4 months and the average body weight of 2.3 kg were used in this study into a set of experiments. The ducks were raised under hygienic measures in pens of identical size on a deep litter system with chopped wheat straw floor in a poultry farm at Menofiya governorate, Egypt in April, 2011. The birds had free access to water and fed a ration contained 18% protein and metabolizable energy 2900 kcal/kg in a plastic round feeder with stocking density 3birds/m^2 with 12hrs light/day under an ambient temperature 26 ±3 **°C**. Feed and water were not deprived until transport, and no feed or water was supplied during the transport periods. Ducks were randomly assigned to 1 of the 7 treatment groups with 1 unstressed control group (NS) and 6 stressed groups using a transportation distance as the main effect. The transport-stressed groups were as follows: 1) 50m (T50m) transport inside the farm, 2) 100m (T100m) transport inside the farm, 3) 50km (T50km) transport outside the farm, 4) 100km (T100km) transport outside the farm, 5) 100km (T100kmD) transport outside the farm and put them in a dark room immediately after unloading for one hour, and 6) 100km (T100kmC) transport outside the farm with adding vitamin C (ADWIA CO. CAIRO) in the drinking water before crating (1g vitamin C/L drinking water) to study the effect of transportation on the duck behavior and some physiological parameters. Ducks were transported from place to another place inside the same farm by hand in the morning after eating the breakfast meal. But outside transportation, the ducks were transported to another farm of different distances 50 and 100km in a suitable truck. The journey began at 07.30 am and took around 3hrs for 100 km. After the birds had arrived to the other place, they were housed in a similar condition of the first farm and the same groups and subjected to physiological and behavioral measurements.

Transport Conditions. Transportation was used as the stress in this study and the ducks were transported on a country road. Ten birds from each group were held in 1 crate (1.3 × 0.7 × 0.25 m). All 18 crates containing birds undergoing the same treatment and marking and were randomly distributed in the truck. The transport period was from 07.30 to 10.30h with an average outside temperature of 21±4°C and inside temperature of 26±2°C. As a result of appropriate ventilation, the average of inside RH remained at about 75% during the transport period with an average speed of 60 km/h. The crates were covered with black plastic sheets during loading, transport, and unloading to protect birds from exposure to bright light and to reduce possible excitement of the birds during these procedures. When crated for experiments, individual birds were picked up in an upright position with both hands and placed in the crates as gently as possible in order to avoid physical damage or stress to the birds due to inverted handling. Only a few minutes from arriving feed was added and water was available for ad *libitum.*

Blood samples were collected after arriving by one hour and in the morning of the next day of unloading for CORT and Heterophil/ lymphocyte (H/L) ratio assessment.

Plasma CORT Analysis: A total of 70 ducks (10 ducks per group) were used for CORT assessment. For each bird, about 5 mL of blood was collected in a 10-mL heparinized centrifuge tube and immediately processed (shaken slightly), and centrifuged at 1500 rpm for 10 min. The resulting plasma sample was stored at −20°C for CORT assessment. Plasma concentrations of CORT, was measured with the CORT RIA kit (Diagnostic Products Corp.).

Heterophil/lymphocyte (H/L) ratio: one hour after arrival, 10 ducks from each group were marked and used for determination of H/L ratio and 0.5 mL blood was obtained. Blood films were air dried (unfixed) and stained in concentrated May-Grunwald stain for 6 min, 1:1 May-Grunwald stain-distilled water for 1.5 min and 1:9 Geisma stain for 15 min **(Robertson and Maxwell, 1990).** Heterophil and lymphocyte were counted (a minimum of 100 cells per film were examined by light microscopy). All blood counts were examined by the same investigator. The results were presented as the percentage of each cell occurred in each film. The H/L ratio was examined by dividing the number of heterophils by the number of lymphocytes **(Gross and Siegel, 1983).** Plasma CORT and H/L ratio were examined again after 24hrs in another 10 ducks from each group.

Tonic immobility (TI) reaction: A total of 35 ducks (5 ducks per group) were tested individually for the duration of tonic immobility after arriving by one hour and in the morning of the next day of unloading. TI reaction was carried out in a separate room having the same conditions as the ducks' room. Birds were out of auditory and visual contact with the other birds. TI was induced by manual restraint. The bird was placed on its back in a U-shaped cradle covered with cloth. The bird was then restrained with one hand on it's sternum for 45 seconds while holding the head and neck by the other hand. Towards the end of the induction period, hand pressure was gradually lifted so that if the bird still moved, another induction period was started immediately, until the movement stopped. After removal of the hands, a stop watch was started. The experimenter then retreated, moving out of sight of the bird and observed the behavior of the bird. The number of induction trials the duration of tonic immobility reaction, that was, the latency until self righting. If the bird righted in less than 20 seconds, it was considered that tonic immobility had not been induced and the restraint procedure was repeated. Conversely, if a bird did not show a righting response over the 10 min test period, a maximum score of 600 seconds was given for duration ***(Ghareeb et al., 2008)*****.** One day later another 5 birds per group were subjected to tonic immobility test to measure the level of fearfulness of birds after the adaptation period of birds to stress had finished.

Behavior Observations: Video camera was set up in the pens of control and transported groups before unloading. The transported birds were recorded immediately after being relocated and in the morning of the next day post transportation. The videotapes were analyzed twice using instantaneous scan sampling at 9-min intervals from immediately after unloading on, 1030 to 1200 h, and again on 0630 to 0800 h in the next morning, during which the birds showed the most activity based on previous 24-h observations of control group. This method resulted in 10 observations per bird (totaling 70 birds' observations per tape). The observations for the 10 birds on a tape at any given interval were simultaneous. The number of birds eating in each of these intervals was recorded. Average instantaneous feeding rates were expressed as the average percentage of birds in each pen that fed at any given instant. For observation purposes, the birds in each group were labeled by markings on their head with a nontoxic permanent marker to facilitate behavioral observations. The behavior recorded was in six categories as follows; eating, drinking, resting, distress cries, dirtiness around eye and nose and preening according to ***Webster (2000)*****.** Also, mortality was recorded.

Statistical analysis: The collected data were analyzed by the analysis of variance technique in completely randomized design. The differences in the means were compared by the Least Significance Difference ***(Steel et al., 1996)*** test.

RESULTS

Behavioral changes after transport stress:

It has been established that the behavior of ducks changed rapidly as they settle into a new environment. Ducks' behaviors associated with transportation stress were distress cries especially before adding the drinking water post transportation, dirtiness around eye and nostrils and all activities and displays of ducks were stopped. Ducks showed fear reflex if any person entered the farm. This fear reflex (neophobia) extended for 24hrs and disappeared. Table 1 shows that transport the ducks inside the farm by hand (T50m and T100m) didn't affect the ducks behavior (food and water intake, rest time, preening and other activity) except during handling some distress cries appeared and after relocation the ducks showed fear reflex by running away especially when any person entered the farm. Eating, resting, drinking, and preening behaviors were significantly affected by outside transportation (T50km and T100km). Immediately post transportation, eating, resting and preening, as a comfort behavioral indicator, were significantly (P<0.05) reduced for the birds. Whereas, drinking, dirtiness around eyes and nose and distress cries were significantly (P<0.05) increased post transportation. In the morning period observation time (the next day), eating and preening were significantly increased and returned to normal duck base level. Meanwhile, adding vitamin C in the drinking water before outside transportation (T100kmC) or keeping the ducks in a dark room immediately after transportation (T100kmD) reduced the behavioral changes that occurred by outside transportation. In addition, TI inductions and durations were increased by outside and long transportation. Ducks transported inside the farm by hand for 50 and 100m had no mortalities. But, outside transportation showed that mortality rates among ducks grow with longer distances as the highest mortality was recorded among ducks transported for 100km followed by ducks transported for 50km. Also, these results showed that adding vitamin C or keeping ducks in a dark room after transportation hadn't any mortality.

Physiological changes after transport stress:

Transport the ducks inside the farm by hand (T50m and T100m) didn't show any physiological changes in the CORT concentrations and H:L ratios. But, the baseline concentrations of CORT were significantly ($P<0.05$) increased after outside transportation stress (T50km and T100km) and its level was increasing by the increasing in the distance of transportation (Table 2). The highest level of cortisol returned the normal base level within 24hrs post transportation. On the other hand, the H:L ratios were significantly ($P<0.05$) reduced by outside transportation. The results in Table 2 indicated that holding ducks for 1 hr in a dark quiet place after transport or adding vitamin C in the drinking water before outside transportation reduced the stress response, as indicated by the lower CORT levels and ratios of H:L.

DISCUSSION

There is a growing interest concerning the welfare problems associated with harvesting, transportation and pre-slaughter handling of poultry. Transportation is a multifactor process associated with a variety of stressors which may covertly reduce welfare. The pekin ducks had different responses to transportation stress. Increased water intake post transportation may ensure that the ducks were able to get rehydrated post transportation, which is important to prevent water deprivation stress resulting from transportation and to maintain osmolarity of the extra-cellular fluid. A stable osmolarity is essential for neuroendocrine systems to function properly ***(Saini et al., 1990; Star, 1990; Lane and Feeback, 2002; Sawka et al., 2005)*****.**

Transportation stress could affect the ducks behaviors. Ducks after long journey showed some behavioral responses such as, distress cries especially before putting the drinking water in the new place post transportation, dirtiness around eyes and nostrils and stopping of all ducks' activities and displays. All ducks became tired and took long time in resting. From behavioral point of view, ducks show a considerable activity at daylight such as feeding, preening and sleeping so, water restriction during transportation may be affect these activities. This means that water is a very important in duck farms because it aids in swallowing of food, cleaning of bills, nostrils and eyes and other many functions. Consequently, the drinking water must be in a plenty amount in duck farms. Other explanation might be due to continuous tonicity in the muscle. Ducks can only move in a half-erect posture inside the crate, and the prolonged crating duration could have resulted in continuous tonicity of the thigh muscles and breakdown of muscle glycogen to glucose and lactic acid. However, because transportation resulted in fatigue and hence minimized bird activity ***(Moran and Bilgili, 1995)*** and because ducks primarily showed resting behavior after crating ***(Kannan and Mench, 1996),*** muscle tonicity seems to be an unlikely explanation. A second possibility is that the lower pH is due to feed deprivation during long duration of crating process, the period without feed increased. ***Warriss et al. (1988)*** found that withdrawal of feed had a pronounced effect on glycogen concentrations of the muscle. The extended feed deprivation period would have resulted in the breakdown of glycogen and accumulation of lactic acid in the thigh muscles, and therefore a lower initial pH in the muscle resulting in the ducks unable to move and feed.

Transport the bird from hatchery to production sites caused stress to birds that carries the risk of death of the birds, injury, health impairment, and stress manifestations ***(Knowles and Broom, 1990; Mitchell and Kettlewell, 1994; Bedanova et al., 2006).*** The effects of travel distances on the mortality rate of ducks transported from place to place are given in Table 1. The increase in ducks mortality with the increase in the travel distance showed that longer transport distances caused higher bird mortality Death rate was recorded only when ducks were transported over distances up to 50 km, considerably higher death rates of up to 6.66% were found when travel distances was 100 km. This was less **(**8.46%) than DOA results reported by ***Nijdam et al. (2004)*** and higher value than that were reported by ***Gregory and Austin (1992) and Warriss et al. (1992***; 0.19 and 0.19%, respectively). Dead on arrival figures were very important from the ethical point of view as an indicator of poor welfare during loading and transport of ducks to production sites and also from the economic point of view as a loss to producers. These results demonstrate that conditions under which ducks were shipped get worse with the increase of transport distances. Not only the poor welfare during transport caused an increase in birds mortality but also, damaged the birds ***(Alshawabkeh and Tabbaa, 1997).***

The adrenal system has been considered to be one of the final common pathways to control animal adaptability in response to various stressors ***(Siegel, 1995)***. The effects of CORT on stress-induced responsiveness of an organism may depend on its levels (i.e., a level slightly or excessively changed from its physiological basis), which could protect or destruct the coping capability of the organism ***(Sapolsky and Meaney, 1986; Jones and Satterlee, 1996).*** In the present experiments, there was no significant effect of transport inside the same farm by hand (50-100m) on plasma CORT concentrations. While, outside transportation (50-100km) increased the plasma corticosterone levels. These results are in the agreement with ***Freeman et al., (1984)*** who observed that transporting of boilers for 2-4hrs over a distance up to 224km induced a consistent increase in plasma corticosterone. ***Wingfield (2002)*** also indicated that CORT acts in maximizing fitness by ensuring immediate survival of a potentially catastrophic event but suppresses activities concerned with long-term survival and production. On the assumption that plasma corticosterone and related behavioral response would return to normal after 2 days following stress and that carryover effects associated with previous handling and transportation would be minimized ***(Kannan and Mench, 1996).***

In general, animals respond to transport stress by increasing the number of total WBC and specific types of WBC (heterophils, eosinophils, and mononuclear cells) in circulation ***(Kent and Ewbank, 1986a,b).*** Decreasing lymphocyte numbers, accompanied by increasing numbers of heterophils, resulted in an increase in the H/L ratio ***(Kent and Ewbank, 1986a,b; Murata and Hirose, 1991),*** which is a sensitive index of stress. Ratio of H/L has be used as physiological indicators of stress in evaluation of chicken responsiveness to novel environments and various stressors ***(Gross and Siegel, 1983; Beuving et al., 1989; Maxwell, 1993;***

Siegel, 1995; Puvadolpirod and Thaxton, 2000). The transportation (50-100km) stress decreased H/L ratio (P<0.05). This may suggest that the pekin ducks had a low adaptive capability to transportation stress. The most robust measures of fearfulness in poultry are the variables of tonic immobility (TI) reaction ***(Jones, 1986)*** which is defined as an unlearned state of reduced responsiveness to external stimulation and induced by gentle physical restraint. Both the duration of tonic immobility and the ease of being induced represent a useful behavioral index of fear ***(Faure and Mills, 1998).*** The duration of TI was considered to be a measure of the fear level of a bird immediately preceding its induction into TI and of the underlying fearfulness of a bird ***(Jones, 1990)*** under the assumption that the bird is more frightened and more fearful when TI is easily induced and remained immobile for longer duration ***(Jones, 1992; Scott and Moran, 1993).*** In the present study, there was a significant effect of transportation (P>0.05) on fearfulness of ducks as measured by tonic immobility reactions (TI) after transportation stress. As, TI duration was longer (P<0.05) after long (50-100km) transportation of ducks for >90 min. Furthermore, the number of induction to achieve TI reaction was increased(P<0.05)for the transported ducks suggesting that transportation increases the level of fearfulness of ducks and the susceptibility of ducks to TI (to be frightened by external stimulation). Indeed, relatively high overall fear levels were indicated as the number of inductions required to achieve TI reaction was increased by transportation. This prolongation of TI duration and the ease of its induction represented the higher level of bird underlying fearfulness after transportation. These results are in agreement with the observations of ***Cashman et al. (1989)*** in broiler chickens and ***Scott et al. (1998)*** in laying hens. The catching, crating and transport of ducks was a novel stimulus because the birds are not routinely treated in this manner. Novelty is the stimulus characterized most often with fear.

Holding crated ducks for a period in a dark quiet place after transport can reduce their post transportation stress response. However, the level of stress could also vary with such factors as the weather conditions prevailing during transportation and holding. For instance, holding after transport during very hot weather could be very stressful to the birds. It was reported that supplementation of vitamin C in the drinking water modulated both physiological stress response (H/L ratios) and underlying fearfulness (TI duration) after pre-slaughter handling of broilers suggesting that supplemental vitamin C may offer a feasible method for alleviating fear and stress responses and enhancing poultry welfare ***(Satterlee et al., 1994; Zulkifli et al., 2000)*.** While, different results were obtained by ***Satterlee et al., (1993)*** who reported that treatment of quail by vitamin C failed to stimulate the adenocortical response to coop environmental stress. This difference may be attributed to breed difference and nature of stress. The differences may also underlie the higher survivability, sedate and passive behaviors, and better coping to social, handling, and environmental stressors, as reported previously ***(Hester et al., 1996a,b)***. These results indicated that long distance of transportation had a behavioral and physiological response. Adding vitamin C in the drinking water before transportation or keeping the bird in a dark room after transportation reduced the effect of transport-stress.

Table (1): Different behavioral changes in ducks after transportation stress.

	T50m		T100m		T50km		T100km		T100kmD		T100kmC		NS	
	IAT	**SDAT**	**IAT**	**SDAT**	**IAT**	**SDAT**	**IAT**	**SDAT**	**IAT**	**SDAT**	**IAT**	**SDAT**	**IAT**	**SDAT**
Feed intake (g)	195^{a}	200^{a}	198^{a}	200^{a}	150^{c}	189^{b}	120^{d}	186^{b}	181^{b}	199^{a}	180^{b}	198^{a}	200^{a}	200^{a}
Water intake (ml)	255^{d}	254^{d}	245^{d}	250^{d}	305^{b}	257^{d}	320^{a}	260^{d}	285^{c}	255^{d}	280^{c}	254^{d}	250^{d}	249^{d}
Preening (s)	120^{b}	130^{a}	130^{a}	125^{a}	80^{e}	120^{b}	60^{f}	123^{b}	110^{d}	120^{b}	115^{c}	124^{b}	120^{b}	122^{b}
Rest time (m)	7^{d}	8^{d}	8^{d}	9^{d}	23^{b}	9^{d}	44^{a}	10^{d}	12^{c}	9^{d}	13^{c}	9^{d}	8^{d}	9^{d}
Distress cries time (s)	2^{e}	1^{e}	4^{d}	2^{e}	68^{b}	4^{d}	80^{a}	5^{d}	20^{c}	3^{d}	22^{c}	3^{d}	2^{e}	2^{e}
Dirtiness around eye and nose (%)	0^{c}	0^{c}	0^{c}	0^{c}	1^{b}	0^{c}	2^{a}	0^{c}	2^{a}	0^{c}	2^{a}	0^{c}	0^{c}	0^{c}
TI inductions	1.1^{e}	1.1^{e}	1.2^{d}	1.2^{d}	1.4^{b}	1.2^{d}	1.5^{a}	1.1^{e}	1.3^{c}	1.1^{e}	1.3^{c}	1.1^{e}	1.2^{d}	1.2^{d}
TI duration (S)	122^{c}	122^{c}	123^{c}	121^{c}	333^{b}	130^{c}	382^{a}	132^{c}	313^{b}	125^{c}	315^{b}	128^{c}	121^{c}	122^{c}
Mortality %	0^{c}	0^{c}	0^{c}	0^{c}	3.33^{b}	3.33^{b}	6.66^{a}	3.33^{b}	0^{c}	0^{c}	0^{c}	0^{c}	0^{c}	0^{c}

Mean value within the same row with different superscript are significantly different ($P<0.05$).

IAT= immediately after transportation. SDAT= second day after transportation.

Table (2): Effect of transportation on ducks' blood CORT concentration and H/L ratio.

	T50m		T100m		T50km		T100km		T100kmD		T100kmC		NS	
	IAT	**SDAT**	**IAT**	**SDAT**	**IAT**	**SDAT**	**IAT**	**SDAT**	**IAT**	**SDAT**	**IAT**	**SDAT**	**IAT**	**SDAT**
CORT ng/ml	33.38^{d}	33^{d}	34.36^{c}	34^{d}	37.89^{b}	34^{d}	40.26^{a}	35^{c}	35.65^{c}	33^{d}	33.38^{d}	33^{d}	32.89^{e}	32^{e}
Heterophils (H)%	49^{a}	49^{a}	48^{b}	47^{c}	47^{c}	48^{b}	43^{d}	47^{c}	43^{d}	48^{b}	45^{d}	49^{a}	48^{b}	48^{b}
Lymphocytes (L)%	43^{b}	43^{b}	43^{b}	44^{b}	51^{a}	44^{b}	51^{a}	43^{b}	52^{a}	43^{b}	50^{a}	44^{b}	42^{b}	43^{b}
H/L ratio	1.14^{a}	1.14^{a}	1.12^{a}	1.07^{b}	0.92^{c}	1.09^{b}	0.84^{c}	1.09^{b}	0.83^{c}	1.12^{a}	0.9^{c}	1.11^{a}	1.14^{a}	1.12^{a}

Mean value within the same row with different superscript are significantly different ($P<0.05$).

IAT= immediately after transportation. SDAT= second day after transportation.

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التغيرات السلوكية والفسيولوجية للبط البكينى بعد النقل

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أجريت هذه الدراسة فى مزرعة دواجن بمحافظة المنوفية – مصر على 210 بطة بكين متوسط أعمارها 4 شهور ومتوسط أوزانها 2.3 كجم تم تقسيمها الى سبع مجموعات على النحو التالى:

- مجموعة ضابطة لم تنقل من مكانها
- المجموعة الثانية والثالثة تم نقلهم من مكان الى اخر داخل نفس المزرعة الى مسافة 50 و 100 متر على الترتيب
- المجموعة الرابعة والخامسة تم نقلهم خارج المزرعة الى مزرعة اخرى لمسافة 50 و 100 كم على الترتيب
- المجموعة السادسة نقلت الى مزرعة اخرى لمسافة 100 كم بعد إضافة فيتامين ج (1 جم لكل لتر مياه شرب) فى مياه الشرب امامها قبل النقل
- المجموعة السابعة نقلت الى مزرعة اخرى لمسافة 100 كم وبعد الوصول تم وضع البط فى مكان مظلم لمدة ساعة بعد الوصول مباشرة

<u>وأظهرت النتائج الاتى:</u>

- النقل الداخلى للبط لم يؤثر على سلوكيات وفسيولوجية البط
- النقل الخارجي غير في سلوكيات وفسيولوجية البط

- حيث زاد معدل شرب الماء وفترة الراحة ومستوى هرمون الكورتيزون بينما قل معدل تناول الغذاء وتنظيف الريش بالمنقار وأيضاً انخفضت نسبة الهتيروفيل إلى اللمفوسايت
- ظهرت أماكن غير نظيفة حول العين والأنف في البط المنقول لمسافات 50 و100كم خارج المزرعة.
- ارتفع معدل الخوف عند البط وخصوصا عند دخول اى شخص فى المزرعة.
- زادت نسبة نفوق البط مع زيادة المسافة المنقول لها البط.
- إضافة فيتامين ج قبل النقل او وضع البط بعد النقل فى مكان مظلم لمدة ساعة يقلل من الآثار الضارة للنقل.

ويمكن ان نستخلص من هذه الدراسة الاتى:

- يمكن نقل الطيور داخل المزرعة بدون أي تأثير ضار عليها
- إذا أُريد نقل الطيور خارج المزرعة يجب إضافة فيتامين ج في مياه الشرب قبل النقل او على الأقل وضع الطيور المنقولة في المكان الجديد مع إظلام المكان بعد النقل مباشرة لمدة ساعة على الأقل لتخفيف أثار النقل الضارة.
- الآثار الضارة للنقل تزداد بزيادة المسافة المقطوعة في النقل.