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Effects of vehicle-road transport on blood profile in broiler chickens

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Summary

The aim of the study was to determine changes in the blood profile of broiler chickens in relation to transport distance. Investigations were carried out on two flocks from different farms exposed to varied stress levels with regard to slaughterhouse proximity (120 km or 30 km). The following parameters were determined: body weight, hemoglobin, glucose, cholesterol and corticosterone. The time in transit and the distance between the farm and a slaughterhouse contributed to a decrease in blood hemoglobin, and glucose levels in broilers increased cholesterol and corticosterone concentrations in the blood. The results obtained show that rough handling and long journeys have the greatest adverse effects on poultry welfare. In both groups of transported birds there were consistent changes in blood constituents level and loss in live weight after transport.

Keywords: broiler, transportation, hemoglobin, glucose, cholesterol, corticosterone

Due to long distances and poor conditions there is a growing concern about the welfare of broiler chickens during transport (19) and the potential effects that pre-slaughter handling can have on the quality of meat (20). The harvesting, handling and transport of poultry is often stressful (6) for the animals in variety of ways. Two of the most important factors which can cause stress are temperature and humidity during transport. The problem of heat stress is particularly acute during transport and particularly on large distances (21).

Temperatures higher than the thermoneutral temperature result, above all, in dehydration and metabolic exhaustion (5). Various compensative mechanisms (e.g. increased respiration rate) are activated (16). Conditions often become so unsuitable that they may cause death (11). Transport results in fear, which is evident in various behavioural symptoms (4, 12) as well as other associated physiological and biochemical changes indicative of stress (7, 13). Broilers may be transported long distances to processing plants.

The aim of the study was to determine changes in the blood profile in broiler chickens in relation to transport distance.

Material and methods

Commercial male broilers (Arbor Acres) from the same parent stock and hatchery were reared under identical conditions on two farms. Farm A was located 30 km and farm B 120 km from the processing plant. Birds were slaughtered at 6-7 weeks when they weighed about 1.8 kg.

They were transported in vehicles in the early morning (04.00 h) under identical conditions using vehicles provided with side curtains to protect the birds. The transport from Farm A took 45 min, and from Farm B more than 2 hrs. In both experiments chickens of the same breed, parents, hatchery, sex (males), feed and identical rearing technology were used. They were handled in an upright position to prevent additional stress. All the investigated birds were marked individually before transportation.

A sample of 30 individually marked birds in each transport group was weighed and blood was sampled before and after the transport. The crates holding the birds were located in the same part of the vehicle. Blood samples were analyzed for hemoglobin and plasma glucose, cholesterol and corticosterone, which were measured using radio immunoassay. Pre and post-transport live weights and blood values were compared using paired t-tests.

Results and discussion

Changes in live weight and blood composition during transport are given in tab. 1.

The average body weight of broilers in experiment A was 1857 g (1620-2070 g) before transport and 1757 g (1530g-1860 g) after transport. In experiment B the average body weight before and after transport was 1973 g (1660-2150 g) and 1667 g (1480-1980 g), respectively. Transport reduced live weight by 8 to 10%, corresponding to an average body weight loss of 100 g and 220 g in birds from farm A and B, respectively. The loss of body weight during the transport depended on its duration. The time of transport significantly influenced body weight losses as did the catching, handling, transportation and slaughter. The transport lasting 18 hours contributed to a slight decrease of body weight. Loses of the body weight were 7-8% after transport (15). Unsuitable conditions can result on 10% loses of body weight as a result of water evaporation (14).

Stress factors had an effect on the metabolism of lipids, saccharids and proteins (10). Transport also reduced hemoglobin and glucose, and increased cholesterol and corticosterone concentrations in the blood. Table 1 shows the mean results obtained in the study.

The mean level of hemoglobin in 30 broilers (farm A, 30 km) was higher before transport ($P < 0.05$) and lower after transport ($P < 0.05$).

The mean level of hemoglobin in experiment B (120 km) was higher before transport.

Statistically significant differences ($P < 0.001$) were recorded between the results obtained in experiment B before and after the transport. The average blood glucose concentration in broilers before the transport was 18.5 mmol.l^{-1}. The time in transit and the distance between the farm and a slaughterhouse contributed to the decrease in blood glucose level in the broilers (11.6 mmol.l^{-1}).

A decrease in glucose levels was expected during the transport because the birds utilize glucose after a decrease in the effect of corticosterone which can prevent such utilization. In fact, the stress already began 6 hours before handling and continued till the slaughter of the birds. Holliday (8) reported observations about the influence of the length of transport on the glucose level. Initial control glucose level reached 156 mg.100 ml^{-1} and then after for 8-16 km of the transport decreased to 133 mg.100 ml^{-1}. A decrease of glucose level after transport has also been described by other authors (3, 15, 17).

The distances between the farms and the processing plant markedly influenced the level of cholesterol. Results obtained in experiments A and B showed an increase in cholesterol levels of about 0.39 mmol.l^{-1} after the transport for 30 km and about 1.71 mmol.l^{-1} after the transport for 120 km.

Blood corticosterone concentrations have been used as a measure of environmental stress and physiological activity in chickens. The content of corticosterone increased significantly ($P < 0.001$) in experiment B, reaching higher values in comparison with experiment A where the average blood corticosterone level was 0.85-1.05 ng.ml^{-1} before transport, 3.20 ng.l^{-1} after 45 min in transit and 6.31 ng.ml^{-1} after more than 2 hrs in transit. Kannan (9) reported that blood corticosterone levels in broilers transported by truck reached 11.7 ng.l^{-1} after 3 hrs.

Animal welfare during and after transport may be assessed by using a range of behavioral, physiological and carcass-quality indicators (1). Transportation is a major complex, multifactor and stressful event for broilers. Handling appears to be the most traumatic part of the procedure. Conditions during the transport, catching and slaughter must comply with the respective legislation or recommendations (2). Unsuitable transport vehicles, prolonged waiting times and rough handling contribute to an increased death rate in farm animals (18). Council Directive 91/628 EEC declares the protection of animals during transport.

Tab. 1. Changes in live weight and blood composition in broilers during the transport from two farms to a slaughterhouse ($\bar{x} \pm s$, n = 30)

Parameters	Farm A		Farm B	
	pre-slaughter	post-transport	pre-slaughter	post-transport
Live weight (g)	1857 ± 30.3	1757 ± 32.6	1973 ± 41.8	1667 ± 26.2
Hemoglobin (g.l^{-1})	109.4 ± 11.0	97.3 ± 11.21	121.5 ± 12.5*	93.4 ± 9.60
Glucose (mmol.l^{-1})	12.2 ± 0.68	10.1 ± 0.77	18.5 ± 1.02**	11.6 ± 1.30
Cholesterol (mmol.l^{-1})	1.30 ± 0.08	1.69 ± 0.22	1.28 ± 0.10	2.99 ± 0.25
Corticosterone (ng.ml^{-1})	1.05 ± 0.09	3.20 ± 0.53	0.85 ± 0.10**	6.31 ± 0.23

Explanations: * – $P < 0.05$, ** – $P < 0.01$ – differ significantly at comparison group pre--slaughter and post-transport in Farm B

Conclusion

Longer journeys and longer waiting before slaughter lead to poorer quality of meat, lower glucose level in blood and lower hemoglobin levels. The results obtained show that rough handling and long journeys have the greatest adverse effects on poultry welfare. In both groups of transported birds there were consistent changes in the level of blood constituents and loss in live weight after transport. These changes were relatively large, implying the major influence of transport on the bird's physiology. The changes in corticosterone in particular suggest that transport was very distressing to the birds and may have compromised their welfare. It may be concluded that the length of transport time is important and that shorter periods of time are desirable in terms of animal welfare.

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