International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(1): 816-819

Received: 06-11-2017
Accepted: 07-12-2017

Ramakrishnan C
M.V. Sc., Scholar
Department of Livestock Products Technology, Meat Science Madras Veterinary College, Chennai, Tamil Nadu, India

R Narendra Babu
Professor, Department of Livestock Products Technology, Meat Science, Madras Veterinary College, Chennai, Tamil Nadu, India

V Appa Rao
Professor, Department of Livestock Products Technology, Meat Science, Madras Veterinary College, Chennai, Tamil Nadu, India

Robinson JJ Abraham
Professor and Head, Department of Livestock Products Technology, Meat Science Madras Veterinary College, Chennai, Tamil Nadu, India

P Tensingh Gnanaraj
Professor and Head, University Research Farm, Madhavaram Milk Colony, Chennai, Tamil Nadu, India

S Wilfred Ruban
Assistant Professor, Department of Livestock Products Technology, Veterinary College, Bengaluru, Karnataka India

Kanchi Bhaskar
M.V. Sc., Scholar
Department of Livestock Products Technology, Meat Science, Madras Veterinary College, Chennai, Tamil Nadu, India

Correspondence
Ramakrishnan C
M.V. Sc., Scholar
Department of Livestock Products Technology, Meat Science Madras Veterinary College, Chennai, Tamil Nadu, India

Economic loss due to live weight shrinkage and mortality during broiler transport in summer and winter season in Chennai city

Ramakrishnan C, R Narendra Babu, V Appa Rao, Robinson JJ Abraham, P Tensingh Gnanaraj, S Wilfred Ruban and Kanchi Bhaskar

Abstract
The aim of the study is to determine the economic impact of live weight losses and mortality due to transport of broilers from farm to wholesale/retail outlets in summer and winter season in Chennai city. Data concerning 24 visits from different farms of integration to wholesale/retail outlet in winter and summer season were collected for the purpose of study. Data were classified into two seasons were winter and summer in that the total number of chickens transported in winter and summer season were 2225.83 ± 82.75, 2246.37 ± 98.88 the live weight shrinkage was 2.36%, 3.01% and mortality percentage were 0.43%, 0.53% and average weight loss per bird (gram) is 55.42 ± 5.65, 70.98 ± 6.01 respectively. The results of the study shows that the average marketing age of transported chickens are 39 days old, average density of the broilers were 2236.25 per truck. The results revealed no significant difference in loss of weight, dead on arrival, types of injuries, tissue shrinkage and duration of transport between summer and winter season. Wetting of birds was practiced and the frequency was higher during summer compared to winter season.

Keywords: live birds, transportation, weight loss, mortality, and tissue shrinkage

Introduction
The broiler meat production in India is around 3,725 thousand metric tonnes (USDA 2015) [1] and the contribution of Southern states in total meat production of India is significant (DAH&D, 2012) [2] Tamil Nadu stands second in poultry meat production in India with 350 thousand MT just behind Andhra Pradesh (2012-13). The Government of Tamil Nadu have launched a scheme for development of poultry clusters in the non-poultry backward regions of the state at a total cost of Rs. 22.35 crores in various districts *viz.*, Villupuram, Cuddalore, Tirunelveli, Thoothukudi, Virudhunagar, Ariyalur and Perambalur.

The most common method of transport of poultry from the site of production to wet markets or processing plant in developing countries were by loose-crates or on modulated lorries and the major welfare issue with this method was the movement of the birds from a relatively stable environment to a lorry which might provide birds with little protection from extreme conditions Weeks (2007) [3].

According to British legislation concerning transportation of poultry (cited by Elrom, 2000) [4] crates/containers must be so designed that, it will protect the bird from injury or unnecessary suffering, provide adequate ventilation, easy to clean, escape proof, permit inspection of the birds and prevent any protrusion of heads, legs or wings. Several crating systems like loose crates (old crating system), fixed crates (birds are carried manually to the fixed crates on the vehicle) and modules, with metal frame that contain 4-16 crates, the frame is unloaded in the broiler house and then transported within one frame to the truck with a fork lift have been recommended for transport of poultry.

Mulder (1996) [5] identified stress factors in poultry during raising, loading and transportation. They observed that stress induced by transport is due to combination of external factors such as crowding, movement, temperature fluctuation, water and feed deprivation all these factors might result in elevated concentration of corticosteroids and decreased strength of gut's wall. Filho *et al*. (2014) [6] studied that Transport of broilers in Brazil during summer high temperature and relative humidity resulted in acute heat stress in birds and that wetting frequently may neutralize latent heat loss by air saturation.

Webstar *et al*. (1993) [7] observed that high environmental temperature during transport of broilers from farm to slaughter unit was a significant stress factor resulting in injury and death during transportation.

This study aims to identify the live weight shrinkage and mortality during the stage of transportation from poultry farms to wholesale/retail outlets in Chennai city during winter and summer season.

Materials and Methods

The material of the study consists of pre-developed questionnaire and data obtained from the poultry farms from different districts in Tamil Nadu *viz.,* villupuram, dharmapuri, krishnagiri, pondicherry, vellore, tindivanam etc., during winter and summer season data was documented. The data which containing the total birds transported, no of birds dead on arrival, tissue shrinkage, no and type of injuries, live weight shrinkage, marketing age of broilers, average body weight of broiler, total duration of transport, distance of transport from farm to wholesale/retail outlets, duration of loading, duration of unloading of birds, weight of excreta in trucks were documented. The data was subjected to statistical analysis in SPSS software as per the standard procedure outlined by Snedecor and Cochran (1994) [8] and the percentage values are presented in arcsin √P values.

Results and discussion

In the present study during transport of broilers from farm to wholesale/ retail no significant difference was observed in per cent weight loss during winter and summer season. Findings on the number of birds transported, weight of birds, weight loss of birds and average weight loss per birds are presented in Table 1. A weight loss of 2.36 and 3.01 per cent was recorded during winter and summer seasons. This could be attributed to the fact that in tropical countries like India the variation in temperature during summer and winter is minimal. The results are in agreement with Ritz *et al.* (2005) [9] who opined that broilers compared to other species of poultry have broader zone of comfort in terms of temperature and relative humidity, resulting in lower weight loss during different months of the year.

Findings obtained concerning the per cent of live weight shrinkage during transportation of broilers are given in table 2. The live weight shrinkage of broilers in winter and summer season were 2.36 ± 0.26 and 3.01 ± 0.23 per cent respectively. Dead on arrival were 0.43 ± 0.09, 0.53 ± 0.10 per cent and the live weight shrinkage and dead on arrival is not much difference among the seasons of transport. The dead on arrival level reflects the factors operating before transport of broiler like loading and temperature during transport (Nijdam *et al.,* 2004) [10]. In the present study no significant difference was observed in dead birds on arrival between summer and winter season where as DOA of 0.53 and 0.43 per cent were recorded respectively. The results were in concurrence with Petracci *et al.* (2006) [11] who reported a DOA of 0.47 and 0.28 per cent in poultry transported during the summer and winter. Similarly, Vieira *et al.* (2011) [12] reported a DOA of 0.42 and 0.28 during summer and winter.

The time consumed for transportation of birds from farm to wholesale / retail outlet revealed no significant difference during winter and summer season with an average time consumed between 237 - 248 minutes (approximately 4 hours) during both seasons. Transportation time is one of the major factors that determine mortality rate, weight loss as well as injuries to birds. It has been reported that short transportation time (3.5- 4 hours) of birds resulted in lower mortality and injuries as compared to medium (4-5 hours) and long (> 5 hours) transported time (Bianchi *et al.,* 2005) [13]. The lower incidence of DOA as well as injuries to birds may be due to shorter travel distances. Similarly, Aral *et al.* (2014) [14] observed that loading and transport duration of above 240 minutes resulted in higher live weight loss and mortality rate in broilers.

A highly significant ($P<0.01$) difference in temperature and no significant difference in relative humidity was observed in the farm and transport vehicle between winter and summer season. Filho *et al.* (2014) [6] observed that temperature and relative humidity of the environment at farm during loading and in the vehicle during transport played a major role in determining the level of stress undergone by the birds. They opined that temperature in the range of 25.1 – 25.9°C and a relative humidity of 68-75 percent were found to be optimal for birds resulting in lower weight loss and mortality. In the present study the lower loss in weight and mortality may be correlated to the fact that the temperature and relative humidity of the transport environment were within the comfort zone of the birds. In addition, it was observed that birds were generally transported late night during summer and early morning hours during winter so as to maintain the optimal temperature and relative humidity to prevent losses.

In addition, the current practices recorded in the present study revealed that the birds before transportation were wetted by pouring sufficient quantity of water from top of the trucks after loading of birds especially during summer season which might be the major reason for decreased loss of weight during transportation. The practice of wetting was less during winter season as compared to summer. Similar observation was made by Langer *et al.* (2010) [15] who indicated that bird wetting in long distance journeys helped in improving the microclimate of the vehicle in which the birds are transported. Filho *et al.* (2014) [6] also observed in Brazil that during summer high temperature and relative humidity resulted in acute heat stress in birds and that wetting frequently may neutralize latent heat loss by air saturation. However, a numerically higher weight loss was recorded during summer compared to winter.

The results clearly indicate that the current practices followed are optimal for the welfare of the birds thereby resulting in lower DOA during transport. The lower incidence of DOA in the present study may be attributed to shorter travel distance as well as wetting of birds after loading before the actual journey (Oba *et al*., 2009) [16]. However, Vecerek *et al.* (2006) [17] observed that the DOA increased from 0.247 to 0.862 per cent as the distance of travel increased from 150 to 300 Km.

Number and types of injuries were presented in table 3. As can be seen in that injury types are head, wing, breast and leg among that the leg injury is more during transportation of broilers in winter and summer season. No significant difference was observed in the per cent of excreta as well as tissue shrinkage during transportation of birds in winter and summer season. Tissue shrinkage of 0.25 and 0.33 per cent was recorded in the present study and were below the limit of transport shrinkage in food animals of 1.5- 2.0 per cent of their body weight during the first 24 hours of transport (Gracey *et al.* 1999) [18]. The analysis of variance revealed no significant difference in injuries of birds during transport from farm to wholesale / retail outlet during winter and summer season. It was observed that the most common injury during transport in both seasons was in the breast followed by wing, head and leg.

Duration of transport from farm to Chennai, loading and unloading of broilers were presented in table 4. The results of the present study is in agreement with Vecerek *et al.* (2006) [17] and Bianchi *et al.* (2005) [13], who observed that time of travel and stocking density had a significant effect on the type of injuries and they opined that longer journey times resulted in higher per cent of injuries to breast and wings resulting in downgrading during further processing.

Duration of transport, temperature and relative humidity on weight loss in live birds during transport from farm to wholesale / retail outlet and age, weight of market birds were presented in Table 5 & 6. There was no significant difference in average market age and weight in birds during winter and summer season. In the present study the average marketing age irrespective of seasons was 39 days. It has been well documented that the profitability per bird increased from day 35 up to day 40 and reduced thereafter (Samarakoon and Samarasinghe, 2012) [19] and Aral *et al.* (2014) [14] and hence to maximize profitability the recommended age of marketing of broiler was between 35-39 days of age. The average body weight of birds at the time of lifting ranged from 1.95 to 2.0 kg during summer and winter.

Table 1: mean ± S.E values of number of birds, weight of birds and weight losers of birds during transportation in winter and summer season

Season	No of live birds		No of birds dead on arrival	Weight of (kg)				Weight loss (kg)			Avg. weight loss per bird (g)
	Loaded in truck	Unloaded in wholesale / retail		Live birds loaded in truck	Live birds unloaded in wholesale / retail	Dead birds on arrival	Excreta in truck	Live birds	Tissue shrinkage	Total weight loss	
Winter (N = 12)	2225.83 ± 82.75	2216.17 ± 82.56	9.67 ± 2.15	4434.37 ± 148.20	4329.75 ± 144.92	18.26 ± 3.13	7.34± 0.65	104.62 ± 12.52	10.92± 2.83	122.88 ± 12.98	55.42 ± 5.65
Summer (N = 12)	2246.37 ± 98.88	2237.21± 98.53	12.92 ± 2.50	4431.39 ± 219.48	4296.12 ± 212.00	23.76 ± 4.45	8.20± 0.78	135.27 ± 12.55	15.57± 4.23	159.04 ± 13.05	70.98 ± 6.01
F value	0.026^{NS}	0.028^{NS}	0.969^{NS}	0.108^{NS}	0.017^{NS}	1.023^{NS}	0.528^{NS}	2.989^{NS}	1.507^{NS}	3.859^{NS}	0.086^{NS}

Means bearing different superscript between columns (a, b, c) between rows (A, B, C) differ significantly ($p<0.05$) or ($p<0.01$), Values in parentheses are Arcsin √P mean

Table 2: mean ± S.E values of per cent loss of weight in birds during transportation from farm to wholesale / retail outlet

Season	Per cent weight loss (%)				Weight loss per bird (%)
	Live birds	Dead on arrival	Tissue shrinkage	Total weight loss	
Winter (N = 12)	2.36 ± 0.26 (0.15 ± 0.008)	0.43 ± 0.09 (0.06 ± 0.006)	0.25 ± 0.07 (0.038 ± 0.006)	2.77 ± 0.27 (0.17 ± 0.01)	2.75 ± 0.27 (0.16 ± 0.008)
Summer (N = 12)	3.01 ± 0.23 (0.17 ± 0.007)	0.53 ± 0.10 (0.07 ± 0.006)	0.33 ± 0.09 (0.044 ± 0.006)	3.53 ± 0.22 (0.19 ± 0.01)	3.60 ± 0.24 (0.19 ± 0.006)
F value	0.490^{NS}	0.137^{NS}	0.510^{NS}	1.497^{NS}	5.942^{NS}

Means bearing different superscript between columns (a, b, c) between rows (A, B, C) differ significantly ($p<0.05$)* or ($p<0.01$)**

Table 3: mean ± S.E values of number and types of injuries during transportation of birds at winter and summer season

Seasons	Head	Wing	Breast	Leg	Total no of injuries
Winter (N = 12)	0.11 ± 0.02 (0.03 ± 0.003)	0.13 ± 0.02 (0.04 ± 0.003)	0.08 ± 0.01 (0.03 ± 0.002)	0.21 ± 0.03 (0.04 ± 0.003)	0.49 ± 0.05 (0.07 ± 0.003)
Summer (N = 12)	0.12 ± 0.02 (0.03 ± 0.003)	0.17 ± 0.02 (0.04 ± 0.003)	0.08 ± 0.01 (0.03 ± 0.001)	0.23 ± 0.04 (0.05 ± 0.004)	0.55 ± 0.07 (0.07 ± 0.004)
F value	0.041^{NS}	0.070^{NS}	0.856^{NS}	1.638^{NS}	0.286^{NS}

Means bearing different superscript between columns (a, b, c) between rows (A, B, C) differ significantly ($p<0.05$) or ($p<0.01$), Values in parentheses are Arcsin √P mean

Table 4: mean ± S.E values of time consumed (minutes) for transportation of birds from farm to wholesale / retail level

Seasons	Duration of unloading of empty crates (mins)	Duration of loading of birds in crates (mins)	Duration of loading of filled crates into vehicle (mins)	Duration of transport from farm to wholesale / retail (mins)
Winter (N = 12)	37.92 ± 2.97	69.08 ± 4.35	28.00 ± 1.91	237.58 ± 14.06
Summer (N = 12)	31.25 ± 2.82	72.92 ± 3.35	30.50 ± 2.44	248.42 ± 17.99
F value	0.00^{NS}	0.481^{NS}	1.111^{NS}	0.016^{NS}

Means bearing different superscript between columns (a, b, c) between rows (A, B, C) differ significantly ($p<0.05$) or ($p<0.01$), Values in parentheses are Arcsin √P mean

Table 5: mean ± S.E values of time, temperature and relative humidity on weight loss in live birds during transport from farm to wholesale / retail outlet

Seasons	Distance from farm to market / retail (Km)	Period of transport (Minutes)	Temperature in farm in loading (^{0}C)	Temperature in vehicle (^{0}C)	Relative humidity in farm during loading (%)	Relative humidity in vehicle (%)	Amount of water used for wetting of birds (liter)	Total weight loss (%)
Winter (N = 12)	182.33± 13.99	237.58± 14.05	24.95 ± 0.25	27.23 ± 0.55	88.75 ± 1.21	81.50 ± 1.58	238.00 ± 10.19	2.77 ± 0.27 (0.17 ± 0.01)
Summer (N = 12)	202.17± 18.11	248.42± 17.99	26.08 ± 0.50	29.01 ± 0.48	77.42 ± 1.27	69.17 ± 1.32	265.00 ± 12.88	3.53 ± 0.22 (0.19 ± 0.01)
F value	0.724^{NS}	0.235^{NS}	4.556*	0.957^{NS}	0.375^{NS}	1.112^{NS}	1.319^{NS}	1.498^{NS}

Means bearing different superscript between columns (a, b, c) between rows (A, B, C) differ significantly ($p<0.05$) or ($p<0.01$), Values in parentheses are Arcsin √P mean

Table 6: mean ± S.E values of marketing criteria of birds

Seasons	Marketing age of broilers (days)	Body weight during marketing (kg)
Winter (N = 12)	39.2 ± 0.71	2.00 ± 0.09
Summer (N = 12)	39.00 ± 0.78	1.95 ± 0.11
Overall	39.23 ± 0.52	1.98 ± 0.07

Means bearing different superscript between columns (a, b, c) between rows (A, B, C) differ significantly ($p<0.05$) or ($p<0.01$)

Conclusion

The current practices adopted by the processors for transport of birds from farms to wholesale / retail outlets have been found to cause losses in weight as well as injuries. This can be effectively reduced by either setting up of central processing facilities near the major production sites or by proper designing of crates and vehicle so as to minimize losses and increase profitability.

Reference

1. USDA, Livestock and poultry: world market and trade. foreign agricultural service, 2015. http.apps.fas.usda.gov/psdonline/circulars/livestock_poultry.pdf.
2. Department of Animal Husbandary and Dairying, 19 th Livestock census, 2012.
3. Weeks, C.A. Poultry handling and transport. Livestock Handling and Transport. 3rd ed. T. Grandin, ed. CABI International, Wallingford, UK, 2007, 295-311,
4. Elrom K. Handling and transportation of broiler welfare, stress, fear and meat quality Part IV: Handling of birds. Isr Jor Vet Med. 2000; 55(4):1-7.
5. Mulder RWAW. Impact of transport on the incidence of human pathogens in poultry. Misset. World Poult. 1996; 12:18-19.
6. Filho JADB, Queiroz MLV, Brasil DDF, Vieirea FMC, Silva IJO. Transport of broilers: load microclimate during Brazilian summer. Eng Agri. 2014; 34(3):405-412.
7. Webstar AJ, Tuddenham A, Saville CA, Scott GB. Thermal stress on chicken in transit. Bri Pou Sci. 1993; 34:267-277.
8. Snedecor GW, Cochran WG. Statistical methods. VII Edn. Lowa state University Press, Ames, Lowa, 1989.
9. Ritz CW, Webstar AJ, Czarick M. Evaluation of hot weather thermal environment and incidence of mortality associated with broiler livehaul. Jou App Pou Res. 2005; 14:594-602.
10. Nijdam E, Arens P, Lambooij E, Decuypere E, Stegeman JA. Factors influencing bruises and mortality of broilers during catching, transport and lairage. Poult Sci. 2004; 83:1610-1615.
11. Petracci M, Bianchi M, Cavani C, Gaspari Lavazza P. Pre-slaughter mortality in broiler chickens, turkeys, and spent hens under commercial slaughtering. Poult Sci. 2006; 85:1660-1664**.**
12. Vieira FMC, Silva IJO, Filho JA, Vieira AMC, Broom DM. Pre-slaughter mortality of broilers in relation to lairage and season in a subtropical climate. J poult sci. 2011; 90:2127-2133.
13. Bianchi M, Petracci M, Cavani C. The influence of genotype, market live weight, transportation, and holding conditions prior to slaughter on broilers breast meat color. Poultry Science. 2005; 85:123-128.
14. Aral Y, Arikan MS, Akin AC, Kaya Kuyululu CY, Guloglu SC, Sakarya E. Economic losses due to live weight shrinkage and mortality during the broiler transport. Ankara Univ Vet Fak Derg. 2014; 61:205-210.
15. Langer RS, Simoes RGS, Soares AL, Oba A, Rossa A, Shimokomaki M, *et al*. Broiler transportation conditions in a brazilian commercial line and the occurrence of breast PSE (pale, soft, exudative) meat and DFD-like (dark, firm, dry) meat. J Braz. Arch. Biotech. 2010; 53(5):1161-1167.
16. Oba A, Almeida MD, Pinheiro JW, Ida EI, Marchi DF, AL, *et al*. The effect of management of transport and lairage conditions on broiler chicken breast meat quality and DOA. Arch. Biol. Technol. 2009; 52:205-211.
17. Vecerek V, Grbalova S, Voslarova E, Janackova B, Malena. Effect of travel distance and season of year on death rates in broilers transported to poultry processing plants. Pou Sci. 2006; 85:1881-1884.
18. Gracey JF, Collins DS, Huey RI. Meat hygiene, 10th edition, W.B. Saunders Company Ltd, 1999, 359.
19. Samarakoon SMR, Samarasinghe K. Strategies to improve the cost effectiveness of broiler production. Trop Agri Res. 2012; 23(4):338-346.