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Time-Budgets of Turkeys (*Maleagris gallopavo*) Reared Under Confinement and Free Range Rearing Systems

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ABSTRACT

Time budget of turkeys (*Maleagris gallopavo*) reared under free-range and confinement rearing systems was recorded and compared from day old chick to sixth months of age. Throughout the study period, *M. gallopavo* reared under free-range rearing system spent relatively greater time in litter pecking (23.51%) followed by walking (19.99%), feeding (16.33%), preening (13.72%), feather pecking (6.07%), aggression (5.94%), drinking (5.90%), immobility (2.36%), standing (2.29%) and jumping (1.96%). Similarly, the birds reared under confinement rearing system spent relatively greater time in lying (17.82%) followed by litter pecking (15.71), preening (12.93%), walking (11.47%), standing (8.35%), drinking (8.31%), aggression (6.85%), feeding (6.46%), feather pecking (6.04%), immobility (4.59%) and jumping (1.46%) behavior. It was observed during present study that the birds reared under free-range rearing system spent significantly greater time in litter pecking, walking and feeding behaviors as compared to the birds reared under confinements. These behaviors are indicators of good health of the animals, therefore free-range system is recommended over confinement rearing system for farming of *M. gallopavo*.

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Authors' Contributions
I collected and analyzed the data and wrote the article. MA and KJI recorded behavioral observations. SMH helped in interpretation of data. HA statistically analyzed the data. AJ, M. Ashraf and AM supervised the work.

Key words
Free range, Confinement, Feather pecking, Aggression, Litter pecking.

INTRODUCTION

Turkey production is on rise (Marchewka *et al*., 2013) and massive farming of the birds in intensive culture systems have been started in many parts of the world. The stocking density is higher and welfare of the birds is merely focused. Behavioral characteristics are indicators of physiological status of the animals and provide an insight to their welfare aspects leading towards better management strategies for the captive animals. Behavioral observations not only help in better production performance but also in time response to the emerging diseases (Marchewka *et al.*, 2013) and time spent in different life activities can affect survival rate in birds (Shao *et al*., 2015).

An animal needs' index was developed in 1985 by Bartussek and was updated many times since then (Bartussek, 1999). One of the principles of this index system is that unsuitable conditions in one area may be balanced by better situations in another area. Horning *et al.* (2001) assessed housing conditions of 63 hen houses using this index system and concluded that farms with both, a covered run and free-range system scored maximum points followed by free-range system, aviaries and deep litter systems. Outdoor production systems enhance comfort and welfare in birds through stress reduction and selection of strains. In addition, free-range production systems enhance meat flavor than the birds in confinements (Fanatico *et al.*, 2006; Ray *et al.*, 2010). Due to these reasons the birds are raised in outdoor rearing systems. However, growth in these birds may be influenced by genotype, sex, age, density, diet, environment, exercise and pasture (Wang *et al.*, 2009).

In commercial turkey farming, an inverse relationship between the age and activities such as walking, laying, feeding, foraging, drinking, preening and pecking at walls has been observed (Martrenchar *et al.*, 1999; Hocking *et al.*, 1999; Busayi *et al.*, 2006). One of the most common problems in turkey farming is injurious pecking behavior (Classen *et al.*, 1994; Hughes and Grigor, 1996). This behavior often leads to death and culling becomes necessary (Moinard *et al.*, 2001) and therefore is of considerable economic concern (Martrenchar *et al.*, 2001). To overcome the problem, the farmers raise turkeys in very low light intensity that in turn may lead to changes in eye morphology and even partial or complete blindness (Selwyn and Nuland, 2000). Beak trimming is also a tool to reduce pecking, but the

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process is itself panic and leads to sufferings (Gentle, 2011). Similarly, the captive animals in high stocking densities show increased aggression that may result in injuries (Haag-Wackernagel, 2005; Docking *et al.,* 2000). The situation gets worsen for highly competitive species where dominance is established as a result of aggressive encounters (Nicol *et al*., 1999; Keeling and D'Eath, 2003; Buchwalder and Huber-Eicher, 2004). Such encounters may also be observed between turkeys in the wild (Nenno and Healy, 1999).

Unfortunately, there is dearth of knowledge regarding welfare of turkeys reared in captivity and free-range rearing systems. A comparison of factors affecting welfare and health of these birds will help in better yields. The present study was therefore planned to investigate the behavioral parameters of turkeys *M. gallopavo* in free-range and confinement rearing systems.

MATERIALS AND METHODS

Animal keeping

Present study was conducted at Captive Breeding Facilities for Birds, Department of Wildlife and Ecology, Ravi Campus, University of Veterinary and Animal Sciences, Lahore. A total of 40 birds, were selected and were divided into two groups each containing 20 birds. Group-I birds were reared in free-range and group-II birds in confinement rearing systems. Birds in confinement rearing system were placed into different floor cages having dimensions 6ft × 6 ft × 5ft (length × width × height). These cages were placed in a 20 ft× 20 ft well ventilated room that contained side curtains and fans for ventilation and cooling. Temperature was maintained at 25°C and photoperiod 12h. The birds for free range rearing system were kept in a similar indoor house, but with a free access to grassy paddock (1 bird/m^2). Feeders and drinkers were also placed in free-range rearing system for feeding and drinking purposes. Commercial poultry feed and *ad libitum* water supply was provided to the birds in confinements and free-range rearing systems.

Observation procedure

Behavioral observations for the birds kept under confinement and free-range rearing systems were monitored and compared. These behavioral observations included jumping, aggressiveness, litter pecking, preening, immobility, walking, lying, standing, drinking, feeding and feather pecking (Table I). Behavioral parameters were noted from naked eye through focal scanning/instantaneous-scan sampling following Altman (1974). Each bird was observed for five minutes and time spent in different behavioral activities was recorded in seconds using stopwatches during morning hours (10:00am to 12:00pm) on daily basis. The observer positioned quietly near birds to avoid any disturbance and recorded behavioral parameters for turkeys.

Table I.- Definitions of the behavioral parameters recorded during present study.

Behavioral parameters	Definitions
Jumping	Movement by leaping with all feet off the ground
Aggression	A response that delivers something unpleasant. Gives or receives peck, the giver's beak being above the receiver's head. Follows or is followed by another bird in an aggressive context. Peck on pen's walls.
Preening	Trimming of plumage with beak.
Feather pecking	Peck gently with beak at other bird, non-aggressive.
Walking	Movements of leg in normal speed.
Lying	Animal is lying on the ground and inactive or relaxed state
Standing	Stands alert, neck stretched, eyes open.
Litter pecking	Contact to litter in order to forage
Drinking	At the water containers.
Feeding	At the feed containers.
Body shaking	Rapid quivering of whole body, accompanied by 'fluffing' of feathers.
Wing flapping	Moving wings out from the body and flapping.
Immovability	Animal is not moving and standing
Voice call	Making sounds
Morbidity	Relative incidence of disease
Miscellaneous	Any extraordinary behavior

Statistical analysis

The percentages for time spent in different behavioral activities were computed. The obtained data was subjected to statistical software SAS 9.1 to compare means.

RESULTS AND DISCUSSION

It was observed during present study that *Maleagris gallopavo* reared under confinements spent maximum time in litter pecking during 1st (25.5%), 2nd (22.14%), 3rd (20.3%), 4th (13.53%), 5th (29.63%) and 6th (16.92%) month of age, respectively. Similarly, in free-range rearing system these birds spent maximum time in litter pecking during 1st (14.89%), 2nd (18.17%) and 4th (21.49%) month, respectively however, these birds spent maximum time in lying during 3rd (18.25%), 5th (20.39%) and 6th (19.94%) month of age (Table II).

Table II.- Comparative month vise behavioral time-budget for turkeys in confinement and free range rearing systems.

Months	Jumping %	Aggressi-veness %	Feather pecking %	Preening %	Immobility %	Walk %	Standing %	Lying %	Feeding %	Drinking %	Litter Pecking %
Confinement											
1	1.9	4.58	5.61	12.01	4.21	10.54	4.17	9.52	13.42	8.54	25.5
2	1.76	3.06	7.57	11.82	6.68	8.01	5.01	9.53	16.25	8.17	22.14
3	2.92	5.31	7.08	14.21	5.48	4.89	2.25	12.8	15.8	8.96	20.3
4	2.95	9.85	7.7	14.62	5.57	7.74	2.28	10.67	14.98	10.11	13.53
5	1.49	5.00	5.57	8.28	4.43	5.78	4.86	13.51	13.75	7.7	29.63
6	1.91	5.64	7.98	10.27	7.14	7.63	8.06	13.57	11.24	9.64	16.92
Free range											
1	2.74	5.92	5.55	14.84	2.01	13.45	10.77	15.39	8.74	5.70	14.89
2	2.64	1.97	5.83	16.00	2.23	13.42	9.94	16.55	7.61	5.64	18.17
3	3.63	5.67	4.63	15.26	2.08	10.36	8.7	18.25	9.64	4.27	17.51
4	1.55	6.55	6.23	10.17	2.05	14.57	9.08	11.95	10.63	5.73	21.49
5	1.8	8.27	5.19	16.58	2.23	14.56	7.48	20.39	6.01	4.42	13.07
6	1.66	5.97	5.01	12	2.26	12.29	9.17	19.94	7.82	5.72	18.16

Comparative analysis of behavioral aspects of *M. gallopavo* showed that the birds reared under free-range rearing system spent relatively greater time in jumping, litter pecking, preening, walking and feeding behaviors while the birds reared in confinements spent relatively more time in aggression, immobility, standing, drinking and ling behavior (Table III). During present study, *M. gallopavo* reared under free-range rearing system spent 1.96% time in jumping while birds reared under confinements spent 1.46% time in same behavior.

Statistically significant ($p<0.05$) variations were recorded in behavioral aspects between *M. gallopavo* raised under free-range and confinement rearing systems. Birds reared in free-range rearing system spent significantly more time in litter pecking, walking and feeding behaviors while the birds in confinements spent significantly greater time in aggression, preening, immobility, standing, drinking, lying and feather pecking (Table IV).

In confinement rearing system, *M. gallopavo* spent maximum time 2.95% in jumping throughout 4th month of study, similarly, in free range rearing system, the birds spent maximum time 3.63% for jumping during 3rd month of present study (Table II). Goth and Jones (2003) reported time percentage for jumping behavior as 2.3% for confinement rearing system.

During 4th month of present study, turkeys spent 9.85% time for aggressiveness behavior in confinement which is higher than time 8.27% spent for aggressiveness activities of turkeys in free range rearing system (Table II). Jones and Millis (1999) documented that conventionally confined systems lead to animal stress. Marin *et al.* (2001) reported that confinement rearing systems increase physiological and behavioral stress and lead towards poor performance. Lewis *et al.* (1997) also reported that free-range rearing system could decrease stress conditions and may increase bird welfare and comfort. Adams and Boice (1989) reported that physical aspects and social experience of the rearing system play an important role in the expression of aggression in *M. gallopavo*. Aggression was higher in confined birds as lack of space can create competition for food and mating.

In confinement rearing system, average time spent in feather pecking was recorded 7.98% while time budget for feather pecking was 6.23% for the birds reared under free-range rearing system (Table III). Our findings are in line with the results of Riedstra and Groothuis (2004) who documented 7.5% time-budget for feather pecking behavior in turkeys. Applegate and Lilburn (1998) documented that feather pecking is one of the injurious behaviors in almost all commercially confined birds which may lead to economic losses through decrease in egg production and increase in feed intake. Blokhuis and

Table III.- Time budgets (%) of *Maleagris gallopavo* in free range and confinement rearing systems.

Rearing systems	Jumping	Aggre-ssion	Litter Pecking	Preening	Immo-bility	Walk	Standing	Drinking	Lying	Feeding	Feather pecking
Confinement	1.9	4.58	5.61	12.01	4.21	10.54	4.17	9.52	13.42	8.54	25.5
Free range	1.76	3.06	7.57	11.82	6.68	8.01	5.01	9.53	16.25	8.17	22.14

Table IV.- Variations in behavioral aspects of *Maleagris gallopavo* in free-range and confinement rearing systems.

Behavioral Aspects	Free-range rearing system	Confinement rearing system
Jumping	5.37±2.58[a]	5.01±2.97[a]
Aggressiveness	16.28±8.88[b]	23.57±14.11[a]
Litter Pecking	64.43±42.52[a]	54.02±29.25[b]
Preening	37.61±22.81[b]	44.47±24.07[a]
Immobility	6.48±4.04[b]	15.80±8.27[a]
Walk	54.79±29.12[a]	39.46±24.17[b]
Standing	6.29±3.76[b]	28.72±16.56[a]
Drinking	16.17±8.23[b]	28.58±17.31[a]
Lying	5.29±6.39[b]	61.29±42.52[a]
Feeding	44.75±23.21[a]	22.20±18.43[b]
Feather pecking	16.64±9.25[b]	20.76±16.82[a]

Means with different letters in a row are statistically significant at $p<0.05$.

Wiepkema (1998) also reported that feather pecking increased mortality in turkeys.

Time spent in preening behavior in *M. gallopavo* reared in confinements was recorded maximum 14.62% during 4th month of age while it was recorded maximum 16.58% during 5th month in outdoor rearing system (Table II). Our findings are contradictory to the results of Sherwin and Kelland (1998) who documented preening time of 7% during 4th month of age that increased upto 12th week of turkey's age. Similarly, Hughes and Grigor (1996) reported 12% preening time-budget in non-beak trimmed turkeys.

Confined birds spent maximum time 7.14% in immobility during 6th month of age while constant immobility time-budget was recorded throughout the study period for birds reared in free-range rearing system (Table II). Immobility was higher in confined turkeys as compared to free-range birds. Erasmus and Swanson (2014) documented 3.3% time budgets for immobility in turkeys in confinements while during present study the immobility time percentage was recorded 2.36% and 4.59% in *M. gallopavo* reared under free-range and confinement rearing systems, respectively.

Time-budget for walking behavior in confined birds was recorded 10.54% during 1st month of present study, similarly maximum time percentage for walking was recorded as 14.57% and 14.56% during 4th and 5th months of study in turkeys reared in outdoor rearing system (Table II). Noble *et al*. (1996) documented time-budget of 6.48% and 13.23% in turkeys reared in confinement and free range rearing systems, respectively.

Birds reared under confinement rearing system spent maximum time 8.06% in standing behavior during 6th month of study while the birds spent 10.77% time in free-range system (Table II). Hughes and Grigor (1996) reported that time budget for standing decreases until 8 to 10 weeks of age and then increases. Sherwin and Kelland (1998) observed that sitting and standing both occupied 20% to 25% of the budget at 4 weeks. After 10 weeks, standing increased and then remained constant at approximately 25%, whereas sitting decreased between 10 to 17 weeks and then increased.

M. gallopavo reared under free range rearing system spent greater time 19.94% and 20.39% in lying behavior during 5th and 6th months of age, respectively (Table II). Sherwin and Kelland (1998) reported increase in lying behavior to 10th weeks of age in turkeys and turkeys can show scratching during lying (Hale, 1989).

Time spent in feeding behavior 16.25% was maximum during 2nd month of present study but steadily decreased between 5th to 6th months in confined birds (Table II). Sherwin and Kelland (1998) documented that feeding increased after 12 weeks of age; however, Newberry (1991) reported that feeding decreased between 2 to 18 weeks of age.

Time spent in drinking remained constant from 1st to 3rd month of age and then increased up to 10.11% during 4th month of age in in confined conditions. However, birds reared under free range rearing system spent constant time for drinking behavior throughout the study (Table II). Sherwin and Kelland (1998) reported that drinking was constant at approximately 4% to 5% whereas Hughes and Grigor (1996) reported a lower incidence (2% to 4%), which initially decreased and then increased; Newberry (1995) reported a decrease in drinking to 18 weeks of age and an overall lower incidence (2.2%). Birds spent maximum time 29.63% in litter pecking during 5th month of age in confinement rearing system (Table II). Crowe and Forbes (1999) documented non-significant differences between foraging

in free-range and litter pecking in confinement rearing system.

CONCLUSION

It can be concluded from the present study that the birds reared under free-range rearing system spent greater time in feeding and walking that are indicators of good health of the animals, therefore free-range system is recommended over confinement rearing system for farming of *M. gallopavo*.

Statement of conflict of interest

Authors have declared no conflict of interest.

REFERENCES

Adams, N. and Boice, R., 1989. Development of dominance in domestic rats in laboratory and seminatural environments. *Behav. Process*., **19:** 127-42.

Altmann, J., 1974. Observational study of behavior: sampling methods. *Behaviour*, **49:** 227-266.

Applegate, T.J. and Lilburn, M.S., 1998. Effect of hen age, body weight, and age at photostimulation. 1. Egg, incubation, and poult characteristics of commercial turkeys. *Poult. Sci.*, **77:** 433-438.

Bartussek, H., 1999. A review of the animal needs index (ANI) for the assessment of animals' well-being in the housing systems for Austrian proprietary products and legislation. *Livest. Prod. Sci.*, **61:**179-192.

Blokhuis, H.J. and Wiepkema, P.R., 1998. Studies of feather pecking in poultry. *Vet. Quart.* **20:** 6-9.

Buchwalder, T. and Huber-Eicher, B., 2004. Effect of increased floor space on aggressive behaviour in male turkeys (*Meleagris gallopavo*). *Appl. Anim. Behav. Sci*., **89:** 207-214.

Busayi, R.M., Channing, C.E. and Hocking, P.M., 2006. Comparisons of damaging feather pecking and time budgets in male and female turkeys of a traditional breed and a genetically selected male line. *Appl. Anim. Behav. Sci.*, **96:**281-292.

Classen, H.L., Riddell, C., Robinson, F.E., Shand, P.J. and McCurdy, A.R., 1994.Effect of lighting treatment on the productivity, health, behaviour and sexual maturity of heavy male turkeys. *Br. Poult. Sci*., **35:** 215-225.

Crowe, R. and Forbes, J. M., 1999. Effects of four different environmental enrichment treatments on pecking behaviour in turkeys. *Br. Poult. Sci.*, **40:**11-12.

Docking, C.M., Kay, R.M., Whittaker, X., Burfoot, A. and Day, J.E.L., 2000. The effects of stocking density and pen shape on the behaviour, incidence of aggression and subsequent skin damage of sows mixed in a specialised mixing pen. *Proc. Br. Soc. Anim. Sci.*, pp. 46.

Erasmus, M. and Swanson, J., 2014. Temperamental turkeys: Reliability of behavioural responses to four tests of fear. *Appl. Anim. Behav. Sci.*, **157:** 100-108.

Fanatico, A.C., Cavitt, L.C., Pillai, P.B., Emmert, J.L. and Owens, C.M., 2006. Evaluation of slower-growing broiler genotypes grown with and without outdoor access: meat quality. *Poult. Sci*., **84:** 1785-1790.

Gentle, M.J., 2011. Pain issues in poultry. *Appl. Anim. Behav. Sci.*, **135:** 252-258.

Goth, A. and Jones, D.N., 2003.Ontogeny of social behavior in the megapode Australian brush-turkey (*Alecturalathami*). *J. comp. Psychol*., **117:** 36.

Haag-Wackernagel, D., 2005. Parasites from feral pigeons as a health hazard for humans. *Annls. appl. Biol.*, **147:** 203-210.

Hale, E.B., 1989. *Domestication and the evolution of behaviour. The behaviour of domestic animals*, 2nd Edition (Ed. by ESE Hafez). pp. 22-42.

Hocking, P.M., 1999. Welfare of food restricted male and female turkeys. *Br. Poult. Sci.*, **40:**19-29.

Horning, S.J., Negrin, R.S., Hoppe, R.T., Rosenberg, S.A., Chao, N.J., Long, G.D. and Blume, K.G., 2001. High-dose therapy and autologous bone marrow transplantation for follicular lymphoma in first complete or partial remission: results of a phase II clinical trial. *Blood*, **97:** 404-409.

Hughes, B.O. and Grigor, P.N., 1996. Behavioural time-budgets and beak related behaviour in floor-housed turkeys. *Anim. Welf*., **5:** 189-198.

Jones, D.N. and Goth, A., 2003. Ontogeny of social behavior in the megapode Australian brush-turkey (*Alecturalathami*). *J. comp. Psychol.*, **117:** 36-43.

Jones, M. and Millis, A.D., 1999. Divergent selection for social reinstatement and behaviors in Japanese quail: Effects on sociality and social discrimination. *Poult. Avian Biol. Rev.*, **10:** 213-223.

Keeling, L.J. and D'Eath, R.B., 2003. Social discrimination and aggression by laying hens in large groups: from peck orders to social tolerance. *Appl. Anim. Behav. Sci.*, **84:** 197-212.

Lewis, P.D., Perry, G.C., Farmer, L.J. and Patterson, R.L.S., 1997. Responses of two genotypes of chicken to the diets and stocking densities typical of UK and "label rouge" systems: I. Performance, behaviour and carcass composition. *Meat Sci*., **45:** 501-516.

Marchewka, J., Watanabe, T.T.N., Ferrante, V. and Estevez, I., 2013. Review of the social and environmental factors affecting the behavior and welfare of turkeys (*Meleagrisgallopavo*). *Poult Sci*., **92:** 1467-1473.

Marin, R.H., Fretes, P., Gusman, D. and Jones, R.B., 2001.Effects of an acute stressor on fear and on the social reinstatement responses of domestic chicks to cage mates and strangers. *Appl. Anim. Behav. Sci*., **71:** 57-66.

Martrenchar, A., Huonnic, D. and Cotte, J.P., 2001. Influence of

environmental enrichment on injurious pecking and perching behaviour in young turkeys. *Br. Poult. Sci.*, **42:**161-170.

Martrenchar, A., Huonnic, D., Cotte, J.P., Boilletot, E. and Morisse, J.P., 1999. Influence of stocking density on behavioural, health and productivity traits of turkeys in large flocks. *Br. Poult. Sci.*, **40:**323-331.

Moinard, C., Lewis, P.D., Perry, G.C. and Sherwin, C.M., 2001. The effects of light intensity and light source on injuries due to pecking of male domestic turkeys (*Maleagris gallopavo*). *Anim. Welf.*, **10:** 131-139.

Nenno, E.S. and Healy, W.M., 1999. Effects of radio packages on behavior of wild turkey hens. *J. Wildl. Manage.*, **43:** 760-765.

Newberry, R.C., 1991. Increasing photo-period and toe clipping alter time budgets of heavy tom turkeys. *Appl. Anim. Behav. Sci.*, 71: 91-92.

Newberry, R.C., 1995. Environmental enrichment: increasing the biological relevance of captive environments. *Appl. Anim. Behav. Sci.*, **44:** 229-243.

Nicol, C.J., Gregory, N.G., Knowles, T.G., Parkman, I.D. and Wilkins, L.J., 1999. Differential effects of increased stocking density, mediated by increased flock size, on feather pecking and aggression in laying hens. *Appl. Anim. Behav. Sci.*, **65:** 137-152.

Noble, D.O., Krueger, K.K. and Nestor, K.E., 1996. The effect of altering feed and water location and of activity on growth, performance, behavior, and walking ability of hens from two strains of commercial turkeys. *Poult. Sci.*, **75:** 833-837.

Ray, A.J., Lewis, B.L., Browdy, C.L. and Leffler, J.W., 2010. Suspended solids removal to improve shrimp (*Litopenaeusvannamei*) production and an evaluation of a plant-based feed in minimal-exchange, superintensive culture systems. *Aquaculture*, **299:** 89-98.

Riedstra, B. and Groothuis, T.G.G., 2004. Prenatal light exposure affects early feather-pecking behaviour in the domestic chick. *Anim. Behav.*, **67:** 1037-1042.

Selwyn, P.A. and Nuland, S.B., 2000. *Surviving the fall: The personal journey of an AIDS doctor*. Yale University Press.

Shao, M., Hong, G., Peng, C. and Binhua, H., 2015. Preliminary study on time budget and foraging strategy of wintering Oriental white stork at Poyang Lake, Jiangxi Province, China. *Pakistan J. Zool.*, **47:** 71-78.

Sherwin, C.M. and Kelland, A., 1998. Time-budgets, comfort behaviours and injurious pecking of turkeys housed in pairs. *Br. Poult. Sci.*, **39:** 325-332.

Wang, K.H., Shi, S.R., Dou, T.C. and Sun, H.J., 2009. Effect of a free-range raising system on growth performance, carcass yield, and meat quality of slow-growing chicken. *Poult. Sci.*, **88:** 2219-2223.