FREE-RANGE REARING SYSTEM AND ITS IMPACT ON PRODUCTION AND CONSUMPTION OF POULTRY: A REVIEW

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ABSTRACT: Over the past few years there is growing trend in the production and consumption of free-range poultry and their products around the globe. In free-range rearing commercial and synthetic feed products including by-products meals etc are not allowed rather birds are reared on organic food only. Moreover, free-range rearing is also preferred due to comparatively lower production cost and better welfare of the birds. Because it is generally considered that meat and eggs of out-door reared birds are superior in their taste and quality compared with indoor-reared birds; though conflicting reports exist which showing non-significant difference between the quality of free-range and intensively-reared birds. However, in this article we have tried to review the available body of literature on the topic and summarized the findings regarding, production, products quality, health, welfare, and economics of free-range reared poultry to find out the strategies for more profitable and sustainable production of poultry in this alternate production system.

Key Words: Poultry, free-range poultry production, rearing systems, forages, meat, eggs, quality,

INTRODUCTION

Natural and organic foods are general source of food in the world and most of this type of food comes from plant and animal origin. Similarly poultry products are also one of the major sources of food of animal origin now-a-days. Currently, there is growing trend worldwide to rear poultry without using antibiotics, animal by-products, and chemicals. Similarly, some poultry producers are raising their birds by giving them outdoor (pasture) access because it is considered that the bird reared in free range rearing system have better sensory qualities of their products (Latter-Dubois, 2000). Castellani *et al.* [1] described that provision of outdoor access to the birds resulted not only in increasing the level of Omega-3 and Omega-6 fatty acids but also increase meat quality by enhancing the levels of higher level of polyunsaturated fatty acid, and have greater health benefits for the consumers [2].

Castellini *et al*., [3] studied the effect of rearing system on meat quality attributes in chicken and found lower abdominal fat contents in free range rearing system compared with the intensive rearing system. Moreover, a considerable increase in the number of semi-intensive and free range farms has also been observed which reflects a rapid increase in the demand of organic products. However, there are some problems in free range production of poultry including higher mortality rate, poor feed conversion ratio, and lower production performance as compared to the indoor/industrial rearing system [4]. Similarly, free rearing system results differ from those of intensive farming and, additionally, genotypes of the hens also affect the production performance in different rearing systems [5]. Many researchers are working to optimize the nutritional requirement of the birds in semi-intensive and free range production systems mainly through modeling with the different levels of energy and protein intakes [6]. But very little amount literature is present on the associated effects of free range rearing system on the performance and carcass yield of chicken.

It has also been observed that comparatively higher mortality rate in deep litter and pasture rearing system are due to greater incidence of viral, bacterial and parasitic infections in those birds compared with the cage system. Moreover, many infectious diseases of poultry are caused by the direct contact of the birds with the germs present in the soil, litter, euipment etc. [7]. Likewise, Histomoniasis is normally occur due to direct contact with soil and has been found in the hens reared on the free-range [7]. Similarly, the presence of *Erysipelothrix rhusiopathiae*, a soil borne microorganism, has been commonly observed in normally found in hens kept on deep litter and free-range rearing systems [8]. However, it has also been suggested that free range rearing system can be improved by the trees, bushes, and synthetic covering arrangements [9] in order to provide shade, and protection to the birds from various predators. But the chocking and impaction of crop due to grass, predation, and drowning in water troughs are associated risks in the free-range rearing of birds.

Additionally, higher rate of cannibalism and feather pecking was observed in free rang rearing system [10] especially in larger flocks where only a small percentage of birds go outside. Mainly due to lack of vegetation, limitation of outdoor area and due to harsh climatic conditions [11]. Nevertheless, it was observed that the conventional cage rearing system provide more protection and better health and welfare to the birds as compared to free range and barn rearing system which usually have bigger flock sizes. It is hypothesized that these bigger flock sizes are the likely causes of higher incidence of feather pecking activity [12].

Effect of rearing systems on growth-related traits

It was observed that birds perform well in environmentally control houses as compare to the free range rearing system where they are experience a varying temperature, greater exercises, which not only increase their nutritional requirements but also affect the feed conversion ratio (FCR). Likewise, lower growth rate and poor feed efficiencies were observed in free range rearing system as compared to the

intensive rearing system [1]. Contrarily, higher body weight (BW) gain was observed in the semi-intensive system compared with the intensive system which might be due to better bird comfort and welfare by [13].

Effect of rearing system on carcass yield

A conflict in the literature exists on the rearing system and their effect on carcass. It has been observed that lower stocking density in the free-range rearing system had no significant effect on the proportion of carcass, breast, thigh, and wing yield as compared to the intensive and semi-intensive rearing system [14]. Contrarily, Castellini at al., [1] observed higher breast and thigh meat yield in free-range reared birds with reduced stocking density which might be due to higher exercise of the birds. There are a number of factors like environment, exercise, nutrition, genetic makeup of the birds, stocking density, male and female ratio and forages which can affect the performance of the birds[15]. In many studies, no significant difference was observed in live weight of birds, dressed cold carcass weight, yield of primary cuts, abdominal fat, breast, thighs and drumstick tissues in intensive and free range rearing system [16]. It has also been observed that these parameter are more dependent on sex as compared to the rearing system. However, it has also been reported that the rearing system significantly affect the shear force of breast, thighs and drumstick tissues shown by more tender tibias of free-range reared birds compared with indoor production of birds. In contrast, results of Fanatico *et al*. [14] showed that the lower stocking density of birds and greater exercise in free range rearing system had tougher bones. Moreover, tender tibias in the unconfined rearing system might be due to less availability of calcium in the free range system compared with the intensive and conventional rearing system.

Effect of free range rearing system on meat quality traits

Appearance, consumer conception and eating quality

Meat quality is mainly assessed by its appearance, texture, flavor, and juiciness [17]. However, organic or free range reared chicken meat is generally considered firmer and strongly flavored than indoor-reared broiler. Moreover, it has also been reported that increase in the age of the bird is is also associated in augmenting the meat flavor and odor in broiler chicken [17] particularly for legs and wings meat [18]. Touraille et al. [19] reported that due to higher demand for organic meat people prefer older birds meat as compared to the younger birds meat due to better taste.

There are several factors which can affect the carcass and meat quality like fluctuating environmental conditions. Like prolonged exposure of birds to the high temperature can cause increased accumulation of body fat [15] whereas, cold temperature usually results in less deposition of fat and meat on the bird. Castellini et al. [20] reported that a significant decrease in the breast meat and drumsticks of broiler raised in organic rearing system compared with the conventional rearing. Moreover, Lewis et al., [21] compared the chicken breast from different rearing system (free range and corn fed) and showed that tenderness and toughness and taste detect by sensory panel.

Nutritional requirement of free range rearing system

Nutrition is a process of digestion, absorption and conversion of large food molecule into energy and tissues growth. Therefore, it is considered that nutrition as well as rearing system has substantial effects on the production and quality of poultry meat and eggs. Rural poultry are mainly fed on worms, mollusks, insects, grasses and food wastes and by products. Whereas supplemented feed also given to the birds (i.e.) cereal wastes or some other wastes [22]. However, it has been observed that nutrition of laying hens is affected by shifting birds from cages to free range rearing system. When birds are shifted from intensive rearing system to free range and use forages it affect their nutrition [23]. Additionally, supplemented feed is provided to free range reared birds because though pasture-rearing save the feed cost but there is always a threat of unbalance diet. It is also reported that diet of the birds affect the fatty acid profile and level of carotenoid and vitamin E contents in the meat and eggs of the birds[24]. Karadas et al., [25] found non-significant effects of forage-feeding on meat texture in free-range reared birds. Furthermore, temperature and light periods are also known to directly affect the growth and feed intake of the birds[15].

Effect of genetics on rearing system

A wide range of variations in the quality of poultry products have been observed which is attributable to a number of factors including age, breed-type, feed ingredients, and rearing systems. In addition to this more space is given in free range rearing system and birds spare much time outside as compared to the intensive rearing system and it is also observed that free-range and organic production systems use pure feed ingredient and avoid the use of chemical feed additives and genetically modified organisms as feed ingredients [13, 17]. However, genetics (strain) is key factors from all other factors. Fast growing strains of poultry are preferred by the free-range producers in most of the parts of the world [26]. Because the fast-growing strains are considered to achieve higher live weight and carcass conformation as compared to slow growing strains. However, slow-growing strains are also used organic production of poultry in some countries.

Recently it has been observed that the slow growing strains perform better in free range production system compared with the fast-growing strains [14]which might be due to enhanced adaptation of slow growing genotypes. Moreover, higher weight gain in fast-growing strains is known to be associated with certain problems like leg health and high rate of mortality [27].

From the welfare point of view slow-growing strains are preferred in some parts of the world [27]. Fanatico *et al.* [14] showed that the slow-growing birds had the lower pH of their meat compared with fast-growing strains, at the same body weight. Moreover, higher lipid content and lower protein contents were observed in breast of the fast-growing strains content followed by slow-growing genotypes [28]. Additionally, rigor mortis is also reported to develop more rapidly in the breast muscle of slow-growing genotypes [29].

CONCLUSION

On the basis of the available literature, related to the topic, it can be concluded that major reason for the consumer preference for the organic poultry product is their superior flavor; moreover, extensive rearing system is considered suitable from birds welfare point of view. However, the free-range reared birds had lower growth performance and poor feed efficiency as compared to the indoor-rearing system which might be attributable to higher chances of predators, parasitic load, and worst climatic conditions than indoor-rearing system. The protein contents of leg muscle are significantly higher in free-range birds whereas, abdominal fat contents are found generally higher in intensively-reared birds. It is also considered that slow-growing strains perform well in free-range as compared to the indoor-rearing system; and spend more time on pasture and foraging behavior and are more resistant to different stressors.

REFERENCES

[1] C. Castellini, C. Muginai, and A. Dal-Bosco, "Effect of organic production system on broiler carcass and meat quality," *Meat Sciences,* vol. 60, pp. 219-225, 2002.

[2] M. Betti, T. I. Perez, M. J. Zuidhof *et al.*, "Omega-3-enriched broiler meat: 3. Fatty acid distribution between triacylglycerol and phospholipid classes," *Poultry*
Science, vol. 88, no. 8, pp. 1740–1754, 2009.

[3] C. Castellini, E. Mourvaki, B. Sartini *et al.*, "In vitro toxic effects of metal compounds on kinetic traits and ultrastructure of rabbit spermatozoa," *Reprod Toxicol,* vol. 27, no. 1, pp. 46-54, 2009.

[4] N. H. C. Sparks, M. A. Conroy, and V. Sandilands, "Socio-economic drivers for UK organic pullet rearers and the implications for poultry health," *Br Poult Sci,* vol. 49, no. 5, pp. 525-532, 2008.

[5] H. Glawatz, J. Kjaer, L. Schrader *et al.*, "Herkunftsvergleiche von Legehennen in Station und Feld unter besonderer Beru¨cksichtigung o¨kologischer Haltungsverfahren.," *Zu¨chtungskunde,* vol. 79, pp. 198-208, 2007.

[6] R. M. Gous, and T. Morris, "Nutritional interventions in alleviating the effects of high temperatures in broiler production," *World's Poultry Science Journal,* vol. 61, pp. 463-475, 2005.

[7] C. Esquenet, P. D. Herdt, H. D. Bosschere *et al.*, "An outbreak of histomoniasis in free-range layer hens.," *Avian Pathol,* vol. 32, pp. 305-308, 2003.

[8] A. Mazeherii, M. Lierz, and H. M. Hafez, " Investigation on the pathogenicity of Erysipelothrix rhusiopathiae in laying hens," *Avian Dis,* vol. 49, pp. 574–576., 2005.

[9] E. Zeltner, and H. Hirt, "Factors involved in the improvement of the use of hen runs.," *Appl. Anim. Behav Science,* vol. 114, pp. 395-408, 2008.

[10] O. Swarbrick, N. J. Garden, and S. A. Lister, "Nutritional encephalomalacia in red legged partridges," *Vet Rec,* vol. 118, no. 26, pp. 727-728, 1986.

[11] L. J. Hegelund, J. Sorensen, B. Kjaer *et al.*, "Use of the range area in organic egg production systems: Effect of climatic factors, flock size, age and artificial cover. ," *Br. Poultry Science,* vol. 46, pp. 1-8, 2005.

[12] B. Bilcik, and L. J. Keeling, "Relationship between feather pecking and ground pecking in laying Hens and the effect of group size," *Applied Animal Behavior Science,* vol. 68, no. 55-66, 2000.

[13] A. Santos, N. Sakomura, E. R. Freitas *et al.*, "Comparison of free range broiler chicken strains raised in confined and semi-confined systems.," *Revista Brasileira d Ciencia Avicola,* vol. 7, pp. 85-92, 2005.

[14] A. C. Fanatico, L. C. Cavitt, P. B. Pillai *et al.*, "Evaluation of slower-growing broiler genotypes grown with and without outdoor access: meat quality," *Poult Sci,* vol. 84, no. 11, pp. 1785-1790, 2005.

[15] S. H. Gordon, and R. Charles, "Niche and Organic Chicken Products," 2002.

[16] S. Bogosavljevic-Boskovic, V. Kurcubic, M. D. Petrovic *et al.*, "The effect of sex and the rearing system on the carcass composition and cut yields of broiler chickens.," *Czech Journal of Animal Sciences,* vol. 51, pp. 31-38, 2007.

[17] K. Jahan, A. Paterson, and J. R. Piggott, "Sensory quality in retailed organic, free range and corn fed chicken breast.," *Food Research International,* vol. 38, pp. 495–503, 2005.

[18] J. R. Chambers, A. Fortin, D. A. Mackie *et al.*, "Comparison of sensory properties of meat from broilers of modern stocks and experimental strains differing in growth and fatness.," *Canadian Institute of Food Science and Technology Journal,* vol. 22, pp. 253-358, 1989.

[19] C. Touraille, J. Kopp, C. Valin *et al.*, "Chicken meat quality 1. Influence of age and growth rate on physico-chemcial and sensory characteristics of the meat.," *Arch. Geflugelkd,* vol. 45, pp. 69-76, 1981.

[20] C. Castellini, C. Berri, E. Lebihan-Duval *et al.*, "Qualitative attributes and consumer perception of organic and free-range poultry meat," *World's Poultry Science Journal,* vol. 64, pp. 500-512, 2008.

[21] P. D. Lewis, G. C. Perry, L. J. Farmer *et al.*, "Responses of two genotypes of chicken to the diets and stocking densities typical of UK and label rouge production systems; Performance.Behavior and carcass composition.," *Meat Sciences,* vol. 47, pp. 501-516, 1997.

[22] A. Bessadok, I. Khochle, and M. El-gazzah, "Etat des resources génétiques de la population locale du poulet de Tunisie,," *Tropicul,* vol. 21, no. 4, pp. 167-172, 2003.

[23] K. Horsted, and J. E. Hermanseri, "Whole wheat versus mixed, layer diet as supplementary feed to

layers foraging a sequence of different forage crops," *Animal,* vol. 1, pp. 575–585, 2007.

[24] S. Fredriksson, K. Elwingerl, and J. Pickova, " Fatty acid and carotenoid composition of egg.Yolk as an effect of microalga addition to feed formula for laying hens.," *Food Chemistry,* vol. 99, pp. 530-537, 2006.

[25] F. Karadas, N. A. R. Wood, P. F. Surai *et al.*, "Tissue-specific distribution of carotenoids and vitamin E in tissues of newly hatched chicks from various avian species," *Comp Biochem Physiol A Mol Integr Physiol,* vol. 140, no. 4, pp. 506-511, 2005.

[26] V. Lund, and B. Algers, "Research on animal health and welfare in organic farming: a literature review," *Livestock Production Science,* vol. 80, pp. 55-68, 2003.

[27] C. Castellini, A. Dal-Bosco, C. Mugnai *et al.*, "Performance and behavior of chickens with different growing rate reared according to the organic system.," *Italian Journal Animal Science,* vol. 1, pp. 291-298, 2003.

[28] S. M. Lonargen, Deeb, N., Fedler, C. A., Lamonts, J. (2003) ., 82: 1990–1994, "Breast meat quality and composition in unique chicken populations," *Poultry Science,* vol. 82, pp. 1990-1994, 2003.

[29] J. Culioli, Touraille, P. Bordes *et al.*, "Carcass and meat characteristics of "Label Fermier" chickens," *Archiv für Geflügelkunde,* vol. 53, pp. 237-245, 1990.