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Effect of Wet Feeding on Feed Conversion Efficiency in Laying Hens during Summer Season

Research Article

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ABSTRACT

The aim of this study was to investigate the effect of wet feeding on feed conversion efficiency in laying hens during summer season. The study was carried out on 192 pullets of eight weeks age (distributed to four groups). The feed offered to chicks consisted of starter diet up to 8 weeks of age and grower diet up to 20 weeks of age. From 20 weeks onwards, birds were provided with layer diet up to the end of the experiment. Birds of control group (T1) were offered dry feed. Water was mixed with feed in T2 (700 mL/kg), T3 (800 mL/kg) and T4 (900 mL/kg) groups. The study lasted for 100 days. Results indicated that wet feeding improves feed utilization (FCR) in terms of kg of feed per dozen of eggs and kg of feed per kg egg mass as compared to control. Overall, the results indicate an improvement in feed conversion efficiency in all groups as compared to control but it was highly significant ($P<0.05$) in T3 group in which water supplementation was made at a level of 800 mL/kg feed.

KEY WORDS feed, feed conversion efficiency, heat stress, laying hens, wet feeding.

INTRODUCTION

Poultry is universally accepted as the most economic converter of agro- industrial products into a superior quality, nutritionally balanced and cheap source of animal protein fortified with vitamins, minerals and lipid elements that fulfill human requirement of balanced diet. Poultry plays an important role in human nutrition, employment and income generation. Poultry constitute 30% of animal protein and will increase to 40% before 2015 (IFPRI, 2000). Poultry production has witnessed a revolutionary growth during the past three decades, but still there is a long way to go. Against Indian Council of Medical Research (ICMR) recommendations of 180 eggs and 10.32 kg of poultry meat per head per year, current availability is just 44 eggs and 1.8 kg of poultry meat per person per year. In order to achieve such a fast growth rate, it requires adequate supply of various inputs and one major input is feed. The production level and availability of conventional feed ingredients is not increasing proportionately to meet the growing demand. Moreover, high ambient temperatures adversely affect the productivity of poultry because poultry can regulate their body temperature within a very narrow range of environmental temperatures (Sturkie, 1976). The poor performance of poultry under high ambient temperatures is mainly as a result of decreased feed intake which consequently reduces growth and meat quality, egg production and egg quality and efficiency of feed utilization. Under these circumstances the poultry nutritionists all over the world are working with a two pronged strategy, firstly to replace conventional feed ingredients by locally available and cheap non conventional ingredients and secondly by nutritional manipulation like incorporation of enzymes, probiotics, acidifiers in poultry diets to increase nutrient availability and uptake, thereby, improving the feed conversion efficiency (Awojobi and Meshioye 2001; Scott, 2002). Feeding of wet food is one of the latest managemental interventions to increase nutrient retention, improvement in feed conversion efficiency and to accelerate growth rate. Wet feeding has resulted in an improvement in egg production, egg weight and food efficiency (Thorne *et al.* 1989). Laying hens are found to lay more eggs when reared on combination of wet and dry feeding system as compared to exclusive dry feeding (El Kaseh and Forbes, 1995). The better feed conversion ratio is not surprising since it was discovered that the birds spent less time feeding on the wet feed and so expended less energy than those fed dry feed. Previous results by many researchers indicated that birds receiving wet feed showed significantly superior feed conversion ratio over the control group (Adams and Naber, 1969). Although much information is available regarding the wet feeding in broilers during heat stress conditions, not much attention has been given towards layer pullets in Kashmir region characterized with an ambient temperature above 31 ˚C during summer months. Therefore; the present study was conducted with the main aim of studying the effect of wet feeding on the feed conversion efficiency in laying hens during summer season in Kashmir.

MATERIALS AND METHODS

Mineral mixture composition

Orcal-p (calcium-165 mg, phosphorous-75 mg, vitamin-D 500 IU) was procured from TTK Healthcare Limited.

Location of study and climatic conditions

The experiment was carried out in the research station of Shuhama, Alusteng Veterinary College (Sher-e-Kashmir University of Agricultural Sciences and Technology) during summer season. The altitude of this area is 1578 m above the sea level, mean annual temperature was 13.5 ˚C and annual precipitation was 710 mm. However, during summer, temperature reached up to 31.5 ˚C and humidity was 56%. The area was characterized by a diurnal temperature in the range of 23-25 ˚C in the morning and 28-31 ˚C in the afternoon.

Treatment of experimental animals

One hundred ninety two commercial layer chicks were purchased for the purpose of the study from Venkateshwar Hatcheries Pune, India and were maintained under standard environmental conditions with adlib feed and water. The animals were provided similar managemental care and monitored closely over this period of study.

The birds were distributed into four treatment groups: Group I (T1) serving as control received dry feed, Group II (T2) received 700 mL water/kg feed, Group III (T3) received 800 mL water/kg feed and Group IV (T4) received 900 mL water/kg feed water (Table 1). During laying period the feed utilization in terms of kg of feed/kg egg mass and kg of feed/dozen of eggs was calculated at biweekly intervals up to the end of the experiment.

Table 1 Random distribution of birds

Replications	T_1 control (dry feed)	T_2 700 mL water/ kg feed	T_3 800 mL water/ kg feed	T_4 900 mL water/ kg feed
1	12	12	12	12
2	12	12	12	12
3	12	12	12	12
4	12	12	12	12
Total	48	48	48	48

Ethical permission

All the animals were closely monitored and were provided similar managemental inputs during experimental period. The animals were treated following the compliance of the institute's norms for ethical treatment. The experiment was approved by the Institutional Animal Ethics Committee (IAEC) constituted as per the order no. /FVSc and A.H/C-10/1456-48. Norms regarding the ethical treatment of animals during the whole operation were strictly followed.

Housing and feeding

Each treatment group had four replicates, and each replicate consisted of twelve birds. Chicks of each replicate were reared on deep litter system for a period of 180 days. Group feeding and watering were practiced throughout the experimental period. The chicks were brooded in battery brooder until 8 weeks of age. All chicks were vaccinated against Ranikhet disease on 6^{th} day with F_1 strain and against Infectious Bursal Disease at 16^{th} day of the age. These were again vaccinated against Ranikhet disease (R2B) at the age of 8 and 16 weeks. Debeaking was performed at 10^{th} day and 14 weeks of age. The chicks were reared under standard managemental conditions. The feed offered to chicks consisted of starter diet (crude protein (CP) 18% and metabolizable energy (ME) 2750 kcal/kg) up to 8 weeks of age and grower diet (CP 16% and ME 2600 kcal/kg) up to 20 weeks of age. From 20 weeks onwards, birds were provided with layer diet (CP 18% and ME 2700) up to the end of the experiment. The ingredient composition of grower and layer ration 12 are listed below (Table 2).

Mortality

There was no mortality during the whole experimental period in all treatment groups.

Table 2 Ingredient composition of grower and layer ration

Ingredients	Grower ration	Layer ration
Maize	45	47
Soyabean meal	20	24
Fish meal	5	5
Rice polish	15	15
Molases	5	-
Mineral mixture	2.5	3
Lime stone	1	2.5
Dicalcium phosphate	1	2
Sand	5.5	1.5
Total	100	100
Calculated composition		
Crude protein (%)	16	18
Crude fibre (%)	4.38	4.73
Metabolizable energy	2600	2750

Statistical analysis

The study plan was complete randomized block design. Birds were grouped in different blocks by age and within each block, treatments were randomly assigned. The linear additive model includes effect of treatments and feed utilization on group I (control group), group II and group III and interaction between treatments. Experimental results were presented as mean ± standard error of means (SEM). The data obtained from the experiment was analysed statistically by means of SPSS software (SPSS, 2011). Data were subjected to analysis of variance (ANOVA) and the Tukey test was used to separate the means (P<0.05) that were considered statistically significant and from 0.05 < P < 0.10 were designated as non significant.

RESULTS AND DISCUSSION

Effect of feeding wet food on feed conversion ratio (kg of feed/kg egg mass)

Results of the present study indicate that effect of wet feeding improved the feed conversion efficiency when birds were offered wet food.

The effect was evaluated in terms of kg of feed/kg egg mass and kg of feed/dozen of eggs. The effect of wet feeding on the feed conversion ratio (kg of feed/kg egg mass) is represented in Table 3. Results revealed the significant improvement in feed conversion efficiency in T1, T2 and T3 groups as compared to control but the improvement was remarkably significant (P<0.05) in T_3 group in which water supplementation was made at a level of 800 mL/kg feed. The feed conversion efficiency (kg of feed/kg egg mass) was significantly lower (3.60 and 3.77) in T3 and T4 as compared to T1 in which it was 4.35. The overall feed conversion efficiency in T2 group was 3.88 which differed significantly (P<0.05) with T1 but differed non-significantly between the treatment groups.

Effect of feeding wet food on feed conversion ratio (kg of feed/dozen eggs)

Present results also suggest a significant decrease (P<0.05) in the kg of feed/dozen eggs in T2, T3 and T4 as compared to T1. But the feed conversion efficiency was significantly (P<0.05) higher in T3 and T2 groups as compared to T1. The feed conversion efficiency (kg of feed/dozen eggs) was significantly lower (2.42 and 2.68) in T3 and T2 as compared to T1 in which it was 3.03. The overall feed conversion efficiency in T4 group was 2.75 which is lower as compared to T1 but differs non-significantly between the treatment groups. These results suggested that overall feed conversion efficiency (kg of feed/kg egg mass and kg of feed/dozen eggs) was significantly (P<0.05) higher in T3 group as compared to T1 groups. It was observed to be 3.60 and 2.42 as compared to 4.35 and 3.03 in T1 respectively. The values during first period (21-22 weeks) varied from 4.10 to 5.25 in different treatment groups and the corresponding values during the last period (33-34 weeks) varied from 1.87 to 2.67 (Table 4).

Heat stress is a major concern for poultry production in tropical as well as temperate climatic conditions. The variation in climatic variables like temperature and humidity are recognized as the potential hazards in the growth and production of all domestic livestock species including poultry. High ambient temperature accompanied by high air humidity causes an additional discomfort and enhances the stress level. In temperate conditions, ambient temperature above 30 ˚C is considered as unfavorable for poultry production because it results in depression of the physiological and metabolic activities.

The increasing concern for heat stress for poultry production is not only debatable for countries of tropical zones, but also for nations of temperate zones in which ambient temperature is increasing due to climate change (Nardone *et al.* 2010). Previous studies have reported that poultry can only regulate their body temperature within a narrow range of environmental temperatures between 16-26 SPSS ˚C (Sturkie, 1976; Diarra and Tabuaciri, 2014; Deng *et al.* 2012).

The present study was conducted to ascertain the effect of heat stress on the feed conversion efficiency in layer chicks. The present study is relevant because the ambient temperature for this study exceeded the thermoneutal conditions of 16-26 ˚C for laying hens.

Several studies in the past have shown that feed intake, gain in body weight, meat quality, egg quality is greatly reduced during high ambient temperature conditions (Kutlu and Forbes, 1993; Yahav, 2000). Moreover, increased feed conversion ratio and high mortality rate have also been reported (Niu *et al.* 2009; Imik *et al.* 2012; Yahav, 2000).

Table 3 Effect of feeding wet food on feed conversion ratio (kg of feed/kg egg mass)

Age (weeks)	T1	T2	T3	T4
21-22	7.80^{b}±0.27	6.27^{a}±0.25	6.10^{a}±0.15	6.12^{a}±0.19
23-24	3.60^{a}±0.12	3.37^{a}±0.18	3.26^{b}±0.13	3.62^{a}±0.16
25-26	3.60^{b}±0.12	3.37^{ab}±0.10	3.10^{a}±0.11	3.32^{a}±0.13
27-28	4.52^{b}±0.13	4.50^{b}±0.17	3.85^{a}±0.11	4.02^{a}±0.14
29-30	3.22^{b}±0.12	3.00^{a}±0.00	2.85^{a}±0.10	2.87^{a}±0.11
31-32	4.15^{b}±0.10	3.72^{a}±0.12	3.67^{a}±0.11	3.72^{a}±0.12
33-34	3.10^{c}±0.08	2.80^{b}±0.04	2.72^{a}±0.07	2.77^{b}±0.06
Overall mean	4.35^{b}±0.55 (28)*	3.88^{ab}±0.43 (28)	3.60^{a}±0.41 (28)	3.77^{ab}±0.36 (28)

The means within the same row with at least one common letter, do not have significant difference (P>0.05).
* Figures within parenthesis are number of observations.

Table 4 Effect of wet feed on feed conversion ratio (kg of feed/dozen of eggs)

Age (weeks)	T1(control)	T2	T3	T4
21-22	5.25^{b}±0.05	4.22^{a}±0.01	4.10^{a}±0.03	4.17^{a}±0.01
23-24	2.47^{b}±0.05	2.42^{b}±0.04	2.15^{a}±0.08	2.35^{ab}±0.08
25-26	2.37^{b}±0.08	2.87^{c}±0.03	2.10^{a}±0.08	2.37^{b}±0.07
27-28	3.07^{c}±0.01	2.17^{a}±0.06	2.15^{a}±0.08	2.77^{b}±0.02
29-30	2.30^{a}±0.06	2.30^{a}±0.06	2.07^{a}±0.02	2.85^{b}±0.07
31-32	3.10^{c}±0.04	2.80^{b}±0.07	2.72^{a}±0.05	2.77^{b}±0.07
33-34	2.67^{b}±0.04	2.00^{a}±0.03	1.87^{a}±0.07	1.97^{a}±0.05
Overall mean	3.03^{a}±0.97 (28)*	2.68^{ab}±0.71 (28)	2.42^{b}±0.72 (28)	2.75^{ab}±0.67 (28)

The means within the same row with at least one common letter, do not have significant difference (P>0.05).
* Figures within parenthesis are number of observations.

Several management practices including feeding wet mash have proven beneficial in alleviating the effects of heat stress. The results obtained in the present study stand in accordance with the results obtained by Thorne *et al.* (1989) who reported improved feed conversion efficiency in hens fed with wet food.

Improved feed intake and efficiency of utilisation have been observed in heat-stressed broilers fed wet mash compared to dry mash fed birds (Moritz *et al.* 2001; Khoa, 2007; Awojobi *et al.* 2009).

Similarly, Tadtiyanant *et al.* (1991) reported that moistening the feed of laying hens at the ratio of 1:1 (feed:water) at high environmental temperature improved laying performance compared to dry feeding.

The results obtained in this study are also in accordance with the previous study conducted by Bhat and Khan (2008) in broilers who reported significant improvement in weight gain and feed conversion ratio and decrease in feed consumption when fed wet food (700 g/kg of feed) as compared to control the control group birds.

In this study, there was an improvement in feed conversion efficiency in all groups as compared to control but it was highly significant (P<0.05) in T3 group in which water supplementation was made at a level of 800 mL/kg feed. Lowest values (2.42) were observed in 800 mL water treated group which was significantly different (P<0.05) from control (3.03).

The most probable reason for the beneficial effects of wet feeding on broiler performance has been attributed to an improvement in feed digestibility (Forbes, 2003).

Another reason could be the increased DM intake on wet feed which increases micronutrients intake and in turn is responsible for the improved performance of poultry in high environmental temperatures.

However, present results are contrary to the results obtained by Caldwell *et al.* (1986) who reported a decrease in egg production when hens were fed diets over 300 mL water/kg of feed. But, this decrease in production can be attributed to fungal growth and the different conditions of study.

The trials with wet feeding conducted on layers at Cehave Landbouwbelangs Research Farm (2008) revealed that besides cutting the feed costs by several percents, certain feed rations also led to better technical results, better feed conversion efficiency and higher egg production, egg weight, an improved weight development of the hens and reduced mortality.

This study also stands in agreement with El Kaseh and Forbes (1995) who reported that with both conventional (11.0 MJ ME/kg) and low energy (10.0 MJ ME/kg) foods, hens given wet food (1.8 kg water/kg) laid many more eggs than dry fed controls. With a lower quality food, there was a significant increase in food intake and in feed conversion efficiency.

Collectively these findings along with previous results in broilers provide compelling evidence for a major effect of wet feeding on the feed conversion efficiency in pullets during summer season.

CONCLUSION

The major finding that emerged from this study reveal the significant effect of wet feeding on the feed conversion efficiency in layer pullets during summer season. The results obtained in the present study indicate that wet feeding during the time of heat stress significantly improved the feed conversion efficiency in laying hens and the effect was highly significant in the treatment group T3 fed with 800 mL/kg feed in both the parameters. In conclusion, the data presented in this paper clearly depicts that wet feeding in the summer season has the potential to enhance productivity in laying hens by improving the overall feed conversion efficiency in layer pullets.

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REFERENCES

Adams O.L. and Naber E.C. (1969). Effect of physical and chemical treatments of grains on growth of and feed utilisation by the chick. *J. Poult. Sci.* **48,** 853-858.

Awojobi H.A. and Meshioye O.O. (2001). A comparison of wet mash and dry mash feeding for broiler finisher during wet season in the tropics. *Nigerian J. Anim. Prod.* **28,** 143-146.

Awojobi H.A., Oluwole B.O., Adekunmisi A.A. and Buraimo R.A. (2009). Performance of finisher broilers fed wet mash with or without drinking water during wet season in the tropics. *Int. J. Poult. Sci.* **8,** 592-594.

Bhat G.A. and Khan A.A. (2008). Effect of feeding wet mash on the performance of broilers. *Indian J. Anim. Sci.* **78,** 1168-1169.

Caldwell J.M., Lyons J.J. and Vandepopulier J.M. (1986). Methane digester effluent as feedstuff for layers. *World Poult. Sci.* **65,** 147-152.

Cehave Landbouwbelang Research Farm. (2008). Wet Feeds for Poultry Developed. Weda Bonda Holland.

Deng W., Dong X.F., Tong J.M. and Zhang Q. (2012). The probiotic *Bacillus licheniformis* ameliorates heat stress-induced impairment of egg production, gut morphology and intestinal mucosal immunity in laying hens. *Poult. Sci.* **91,** 575-582.

Diarra S.S. and Tabuaciri P. (2014). Feeding management of poultry in high environmental temperatures . *Int. J. Poult. Sci.* **13,** 657-661.

El Kaseh R. and Forbes J.M. (1995). Effect of wet food on the performance of laying hens. *J. Br. Poult. Sci*. **36,** 839-840.

Forbes J.M. (2003). Wet foods for poultry. *Avian. Poult. Biol. Rev*. **19,** 175-193.

IFPRI. (2000). International Food Policy Research Institute. Available at: www.cgiar.org.

Imik H., Ozlu H., Gumus R., Atasever M.A., Urgar S. and Atasever M. (2012). Effects of ascorbic and alphalipoic acid on performance and meat quality of broilers subjected to heat stress. *Br. Poult. Sci*. **53,** 800-808.

Khoa M.A. (2007). Wet and coarse diets in broiler nutrition. Development of the GI tract and performance. Ph D. Thesis. Wageningen University and Research Centre, Wageningen.

Kutlu H.R. and Forbes M.J. (1993). Alleviation of the effect of heat stress by dietary methods in broilers: a review. *World Rev. Anim. Prod.* **28,** 16-22.

Moritz J.S., Beyer R.S., Wilson K.J. and Cramer K.R. (2001). Effect of moisture addition at the mixer to a corn-soybean-based diet on broiler performance. *J. Appl. Poult. Res.* **10,** 347-353.

Nardone A., Ronchi B., Lacetera N., Ranieri M.S. and Bernabucci U. (2010). Effects of climate changes on animal production and sustainability of livestock systems. *Livest. Sci.* **130,** 57-69.

Niu Z.Y., Liu F.Z., Yan Q.L. and Li W.C. (2009). Effects of different levels of vitamin E on growth performance and immune response of broilers under heat stress. *Poult. Sci.* **88,** 2101-2107.

Scott T.A. (2002). Impact of wet feeding wheat-based diets with or without enzyme on broiler chick performance. *J. Canadian Anim. Sci*. **82,** 409-417.

SPSS Inc. (2011). Statistical Package for Social Sciences Study. SPSS for Windows, Version 20. Chicago SPSS Inc.

Sturkie P.D. (1976). Regulation of body temperature, Pp. 343-379 in Avian Physiology. G.C. Whittow, Ed. Springer-Verlag, New York.

Tadtiyanant C., Lyons J.J. and Vanderpopuliere J.M. (1991). Influence of wet and dry feed on laying hens under heat stress. *Poult. Sci.* **70,** 44-52.

Thorne D.H., Vanderpopuliere J.M. and Lyons J.J. (1989). Automated high moisture diet feeding system for laying hens. *J. World Poult. Sci.* **68,** 1114-1117.

Yahav S. (2000). Domestic fowl: Strategies to confront environmental conditions. *Avian. Poult. Biol. Rev*. **11,** 120-126.