The Effect of Feeding Different Levels of Brewer's Dried Grain Yeast Mixture on the Performance of White Leghorn Chicks

[1]Zewdu Wondifraw, [2]Berhan Tamir

[*] Department of Animal Science, College of Agriculture and Natural resources, Debre Markos University, Debre Markos, Addis Ababa, Ethiopia.
[**] College of Veterinary Medicine and Agriculture, Debre Zeit, Addis Ababa, Ethiopia.

Abstract- This experiment was conducted to evaluate the effect of feeding different levels of Brewer's Dried Grain Yeast mixture (BDGY) on the performance of white leghorn chicks. A total of three hundred twenty four day-old white leghorn chicks were grouped in to 18 pens of 18 chicks each, and randomly assigned to six treatments (control; 6% BDGY; 12% BDGY; 18% BDGY; 24% BDGY; 30% BDGY) according to a completely randomized design (RCD). Brewer's Dried Grain Yeast mixture was composed of 80% brewer's dried grain (BDG) and 20% brewer's dried yeast (BDY). The mean dry matter intake and cost of feed per kg live weight gain did not vary ($P > 0.05$) among the dietary treatments. However, significantly ($P < 0.01$) lower daily gain and dry matter conversion ratio ($P < 0.05$) were obtained in chicks fed 24% BDGY and 30% BDGY than the rest of dietary treatments. Similarity in growth performance between chicks fed the control and 18% BDGY was observed. Based on this, it could be concluded that Brewer's Dried Grain Yeast mixture could be incorporated in chick's rations at the level of 18% without any adverse effect on growth performance so as to increase the economic efficiency

Index Terms- brewer's dried grain yeast, dry matter conversion ratio, dry matter intake, weight gain, economic efficiency.

I. Introduction

The use of cereal grains as the basis of poultry rations seems irrational under present conditions for the developing country where population growth places an increasing pressure on food supplies [1]. Ever-rising prices of ingredient remain to be the greatest single item determining the profit margins in poultry farming especially in developing countries. The most appropriate strategy for these countries is likely to be the development of dietary formulations, which allow locally available new ingredients to be used. Such an approach would reduce food costs as well as the dependency to import new materials [2]. Ethiopia is not self sufficient in cereal grains and could not provide the bulk of concentrate feeds for poultry. There are shortages of protein supplements and micronutrients which are needed for the preparation of balanced rations. Scarcity of poultry feed in the country is the major problem and the expected output from chicken is very low. Utilization of alternative feed ingredients in poultry ration is a key determinant of successful poultry production. The use of industrial by-products in animal nutrition represents a valuable means of the indirect production of food from industrial by-product [3]. Therefore, the search for alternative protein source has become urgent. Among the non-conventional feedstuffs, which could be used in the compounding of poultry rations are brewer's dried grain and brewer's dried yeast. Brewer's dried grain (BDG) and brewer's dried yeast (BDY) are valuable source of CP, ME and many of the B-vitamins and rich in P, but relatively low in Ca. These materials are also considered to be good sources of un-degradable protein and water soluble vitamins [4]. [5] described that 35 to 45 kg of DM can be obtained in the residues from the production of 1000 liters of beer.

The presence of a number of brewing industries in Ethiopia suggests that large volume of brewer's dried grains and yeast is produced every year. Currently small proportion of this by product is used as dairy cattle feed and large quantities accumulate at production sites causing disposal and public health problems. This huge by product has not yet been extensively utilized as a feed source for poultry. Therefore, the objective of this study was intended to evaluate the potential use of brewer's dried grains and yeast which could be used in poultry feeding on the performance of white leghorn chicks under intensive management condition.

II. MATERIALS AND METHODS

2.1. Study Area

This study was carried out in Ethiopia at Alemaya Agricultural University which is located at 42^0 3'E longitude, $9^{\,0}$ 26' N latitude at an altitude of 1980 m.a.s.l and 515 km east of Addis Ababa. The mean annual rainfall of the area amounts to 780 mm and the average minimum and maximum temperatures are 8.5 and 23.4^0 C, respectively.

2.2. Management of Experimental Birds

A total of three hundred twenty four day-old white leghorn unsexed chicks with an average body weight of 33.88 ± 1.8 g were purchased from the university poultry farm. All the chicks were randomly divided into 18 pens with 18 chicks/pen. The 18 pens were randomly assigned to six treatment groups. Replicates were housed in the partitioned house with all the necessary facilities for 8 weeks experimental period. Standard vaccination schedule was done and strict sanitary measures were followed during the experimental period. The chicks were vaccinated with live vaccine against Newcastle Disease on day eight, through drinking water. Chloramphenicol and OTC™ Plus was given in the drinking water against salmonellosis and for the treatment as well as control of a wide range of bacterial infections.

2.3. Experimental Diets

The feed ingredients, which were used in the formulation of the different experimental ration of this study were mixture of brewer's dried grain and yeast, noug seed (*Guizotia abyssinica*) cake (mechanically extracted), corn grain, wheat short, soybean grain, vitamin premix and salt. The wet brewer's grain and dried brewer's yeast were obtained from Harar brewery. The wet brewer's grains were sun-dried for four consecutive days by sparsely spreading on canvas. All the ingredients, except the wheat short, brewer's dried yeast and vitamin premix were hummer milled to 5 mm sieve size. The six treatment rations used in this study were formulated on an isocaloric and isonitrogenous basis having 12.28 MJ/kg DM of metabolizable energy and 20% crude protein. Feed and water were provided on *ad libitum* basis. Feed intake and refusals were weighed and recorded every day to estimate the feed consumption for each replicate and treatment. The chicks were also weighed individually at the beginning and subsequently every 7 days during the experimental period and at the end of 8 weeks by sensitive balance.

2.4. Laboratory Analysis

Representative samples were taken from each of the feed ingredients used in the experiment and analysed before formulating the actual dietary treatments at Debre Zeit National Veterinary Institute in the nutrition and biochemistry laboratory. Feed samples were analyzed for dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF) and ash [6]. The metabolizable energy (ME) levels of feed ingredients was calculated using the formula ME (kcal/kg DM) = 3951 + 54.4 EE - 88.7 CF - 40.8 Ash [7].

2.5. Measurements and Observations

Feed intake of each replicate was recorded daily throughout the experimental period. Individual weight of each replicates was taken once per week. The body weight measurements were used to determine pen averages and to calculate the feed conversion ratio. The average feed intake was recorded (g/day). Feed conversion ratio was calculated as gram feed intake /per gram body weight gain. Body weight gain was calculated by subtraction of the live body weight at the beginning of the week from that of the second measuring date (BWG, g/d). Feed cost per live weight gain was computed by the cost of feed consumed to attain a kilogram (kg) live weight gain.

Table 1. Ingredients of experimental diets fed to white leghorn chicks

Ingredients (%)	T1 (%)	T2 (%)	T3 (%)	T4 (%)	T5 (%)	T6 (%)
1. BDGY mixture (BDG: BDY)(80:20)	__	6 ($_{4.8:1.2}$)	12 ($_{9.6:2.4}$)	18 ($_{14.4:3.6}$)	24 ($_{19.2:4.8}$)	30 ($_{24:6}$)
2. Noug seed cake	30.00	24.00	18.00	12.00	6.00	_
3. Corn crushed	50.00	50.00	48.00	47.00	46.00	52.00
4. Wheat short	9.30	9.30	11.30	12.30	13.30	11.30
5. Soybean whole crushed	10.00	10.00	10.00	10.00	10.00	10.00
6. Vitamin premix	0.20	0.20	0.20	0.20	0.20	0.20
7. Salt	0.50	0.50	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated nutrient content						
ME (Kcal/kg DM)	2905.51	2915.41	2919.13	2925.94	2932.75	3016.49
CP (%)	20.71	20.35	20.11	19.82	19.52	19.45
ME: CP ratio	140.31:1	143.24:1	145.13:1	147.65:1	150.24:1	155.08:1
CF (%)	8.15	8.24	8.28	8.32	8.56	8.79

2.6. Experimental Design and Statistical Analysis

The data collected were analyzed as completely randomized designs following the procedures suggested by [8] and adopting one way ANOVA using SPSS [14]. When the analysis of variance indicated the existence of significant difference among treatment means, Duncan's Multiple Range Test (DMRT) were employed to test and locate the treatment means that are significantly differed from the rest.

III. RESULTS AND DISCUSSION

[1] 3.1. Dry matter (DM) intake

The mean daily dry matter intakes of the six groups of chicks fed the six treatment rations for 8 consecutive weeks are shown in Table 2. The statistical analysis showed that there is no significant difference in dry matter intake (P > 0.05) between the dietary treatments. This result agrees with previous result of [9] who reported insignificant differences (P > 0.05) in mean dry matter intake between starter chicks containing 25% BDG and their counterpart fed the control diet. This might be due to the fact that all diets contain similar level of nutritive value mainly energy, protein and crude fiber. Thus, BDGY did not affect the DM intake of chicks and it improved the mean daily and cumulative feed consumption of chicks. This is an advantage for producers, as brewer's dried grain (BDG) and brewer's dried yeast (BDY) is regarded as a waste material that can be bought cheaply, and reduce the production cost without affecting the feed consumption. In contrast to this finding, [10] reported significant difference in dry matter intake (P < 0.05) between the dietary treatments with different level inclusion of BDG in chick's diet.

[2] 3.2. Mean Body Weight Gain

The effect of including different levels of BDGY in chicks ration on body weight gain is presented in Table 2. The mean daily body weight gain of chicks during this study was 3.29, 3.04, 3.08, 2.91, 2.73, and 2.60 g fed on T1, T2, T3, T4, T5 and T6, respectively. The control diet had significantly higher body weight gain than T5 and T6. There were non-significant difference among T2, T3, T4, T5 and T6. This result is in agreement with the findings of [11] who reported significant variation in the average body weight and daily weight gain with diets with 0, 25, 50 %, 75% and 100% inclusion level of urea-treated and fermented BDG. They have also showed that Broiler chicks can tolerate inclusions of urea-treated and fermented BDG up to 50%, which is about 16.70 % of the diets. Additionally, [10] reported significant difference in daily body weight gain ($P < 0.05$) between the dietary treatments with *Atell*a (residue of home brewed beer), Brewers grains and Noug seed cake as the sole source of protein in feeding of baby chicks indicating that Brewers grains is superior to *Atell*a in nutritive value as measured by chick growth performance.

In case of the group fed with the diet containing 24 and 30% BDGY, body weight gain was significantly lower than the group fed with control diet due to increased level of crude fiber. Accordingly, incorporation of BDGY in chicks ration above 18% in TMR, resulted in progressive declining of mean daily body weight gain. In monogastric animal, fiber represents the insoluble matter of plant cell walls that is indigestible by animal enzymes, but can be partially degraded by gastrointestinal microflora [12]. According to [13], inclusions of high fiber ingredients are usually limited because of the poor metabolizable energy contents and it affects performance and nutrient utilization of chicken. High amount of crude fiber in poultry rations reduce feed efficiency, growth, egg production and time of food passage throughout the digestive system.

Table 2. Means of chick's dry matter intake, weight gain and dry matter conversion ratio of treatment diets

Treatments	Dry matter intake (g/chick)		Body weights (g/chick)		Weight gain (g/chick)		DMCR (g DMI/g BWG)
	Total	Daily	Initial	Final	Total	Daily	
T1	910	16.18^{a}	34.71^{a}	218.9^{a}	184.27	3.29^{a}	4.92^{a}
T2	950	17.10^{a}	33.50^{a}	203.77^{ab}	170.27	3.04^{ab}	5.62^{ab}
T3	890	16.57^{a}	33.37^{a}	205.95^{ab}	172.58	3.08^{ab}	5.38^{ab}
T4	940	16.56^{a}	34.62^{a}	197.62^{ab}	163.00	2.91^{ab}	5.69^{ab}
T5	900	16.29^{a}	33.66^{a}	186.54^{b}	152.88	2.73^{b}	5.97^{c}
T6	840	15.22^{a}	34.30^{a}	180.03^{b}	145.73	2.60^{b}	5.85^{c}
F-Test		NS	NS	**		**	*
SEM		0.51	0.57	5.86		0.10	0.22
C.V. (%)		7.97	2.9	5.10		6.15	6.84

Means with different superscripts in a column differ significantly, *$P<0.05$, ** $P<0.01$ & NS = Non significant

[3] 3.3. Dry Matter Conversion Ratio

Dry matter conversion ratio of the experimental chicks expressed as grams of dry matter consumption per unit body weight gain were shown in Table 2. The mean dry matter conversion ratio expressed as gram of dry matter intake per unit of weight gained showed significant difference ($P< 0.05$) among the dietary treatments. A group fed with a diet containing 24% and 30% BDGY had significantly lower dry matter conversion ratio compared with a group that fed a diet containing 0, 6, 12, and 18% BDGY. This is perhaps related to the higher efficiency of feed utilization by chicks fed diets T1, T2, T3 and T4 as compare to T5 and T6 indicating their ability to digest and retain better dietary nutrients. Thus, more feed was needed to attain a unit gain in T5 and T6; this may be also due to the higher crude fiber content in the experimental diet that led to reduced body weight gain. This result is in agreement with the findings of [11] Isikwenu *et al*. (2005) who revealed significant difference in feed: gain ratio with diets 0, 25, 50 %, 75% and 100% inclusion level of urea-treated and fermented BDG. They have also showed that Broiler chicks can tolerate inclusions of urea-treated and fermented BDG up to 50%, which is about 16.70 % of the diets. Treatment diets with 75% and 100% inclusion level of urea-treated and fermented BDG, which is about 25 % and 33.5% of the diets showed lower feed: gain ratio.

[4] 3.4. Economic Analysis

The cost effectiveness of this experimental diet is shown in Table 3. Feed cost/live weight gain was 8.41, 8.67, 8.62, 8.59, 7.74 and 7.63 Birr for the groups fed on the control diet, 6% BDGY, 12% BDGY, 18% BDGY, 24% BDGY and 30% BDGY, respectively. The inclusion of BDGY in chicks ration and feed cost per kg were inversely proportional. The feed cost per kg was decreased with increasing BDGY in diets as compared with control group. The cost/kg feed of treatment containing 30% BDGY was lowest, due to the low price of BDGY and it had the positive effect on economic value of production. However, the daily gains of chicks in T6 were relatively lower. For this reason, treatment rations relatively with better daily gain and economic return could be recommended as the biological and economical optimum for raising chicks.

Table 3. Partial budget analysis of white leghorn chicks expressed as chick sale to feed cost ratio, feed cost/kg live weight gain and feed cost/chicken reared

Treatment	Total feed cost (Birr)	Total chick sales (Birr)	Chick sale to feed cost ratio	Feed cost/chicken reared	Feed cost/kg live weight gain
T1	74.65[a]	530.00	7.127[b]	1.407[a]	8.41[a]
T2	74.59[a]	510.00	6.850[b]	1.460[a]	8.67[a]
T3	69.37[b]	520.00	7.497[b]	1.373[a]	8.62[a]
T4	70.36[b]	500.00	7.130[b]	1.403[a]	8.59[a]
T5	67.14[c]	510.00	7.610[ab]	1.313[b]	7.74[b]
T6	63.56[c]	520.00	8.247[a]	1.220[b]	7.63[b]
C.V (%)			5.36	5.50	6.75
SEM	7.12		0.23	0.04	0.32
F-test	*		*	*	*

Means with different superscripts in a column differ significantly, *P<0.05

* Birr is Ethiopian currency which is equal to exchange rate 8.65 USD at the time of the research work.

IV. CONCLUSION

The results obtained in this study indicate that feed intake was not affected by the levels of inclusion of BDGY. However, daily body weight gain, dry matter conversion ratio (DMCR), cost of feed per chicken reared and feed cost/live weight gain varied significantly among dietary treatments. Growth rate was generally depressed progressively with increasing levels of BDGY in the ration. For this reason, T4 would be recommended as the biological optimum for raising chicks from day old to 8 weeks of age. Thus, this result clearly indicated that the inclusion of BDGY at 18% inclusion level in chicks ration reduces production cost, economically feasible and brought high economic efficiency without affecting feed intake, weight gain and feed conversion efficiency of chicks as compared to the control diet. Thus, In view of the shortage and the high costs of protein feed stuffs, exploitation of industrial by-products may make a substantial contribution towards better and more economic feeding of poultry.

ACKNOWLEDGMENTS

The authors acknowledge with thanks the Agricultural, Technical, Vocational, Education and Training (ATVET) project office for financing the research work. Appreciation is also expressed to Dr. Berhan Tamir for his continuing guidance and valuable comment.

REFERENCES

[1] Balakrishnan, V., 2004. Developments in the Indian feed and poultry industry and formulation of ration based on local resources. Animal production and Health. FAO, Rome, 2004. Pub. No. p. 215.

[2] Amire, H.N. 2001. Nutrition affects immune responses in poultry. World poultry Journal, Vol. 17, No. 1-12, Pp. 42. University of Florida, USA.

[3] El Boushy, A.R.Y. and A.F.B. Van der Poel. 2000. Handbook of Poultry Feed From Waste Processing and Use. Kluwer Academic publisher 2nd ed. Netherlands.480p.

[4] Vasso Oreopoulou and Winfried Russ. 2007. Utilization of by-products and treatment of waste in the food industry, Springer science (2007).

[5] Parra, R. and A. Escobar. 1985. Use of fibrous agriculture residues in ruminant feeding in Latin America. FAO. Animal production and health paper. No. 50. Rome, Italy. pp.111.

[6] A.O.A.C. 1990. Official methods of analysis (13th ed). Association of Official Analytical Chemists. Washington D.C.

[7] Wiseman, J. 1987. Feeding of non-ruminant animals. In: Meeting nutritional requirement from available resources. Butter worth and C. Ltd. 370p.

[8] Gomez, K.A. and A.A. Gomez. 1984. Statistical Procedures for Agricultural Research. 2nd ed. John Willey and Sons, New York. 720p.

[9] Diriba Debor. 1991. The study of the nutritive and supplementary value of different levels of brewers dried grains in starter chick's rations. An M.Sc. Thesis Presented to the School of Graduate Studies of Alemaya University, Ethiopia. 62p.

[10] Solomon Demeke. 2007: Comparative nutritive value of *Atella* and industrial brewers grains in chicken starter ration in Ethiopia. Livestock Research for Rural Development. Volume 19, Article #8.

[11] Isikwenu, Jonathan Ogagoghene, Omeje, Simon Ikenna., Okagbare, Gregory and Akpodiete, Orieru Job. 2005. Effect of replacing groundnut cake with urea fermented brewer's dried grains in broiler chicks diets. Animal research international, 5(1): 795 – 800.

[12] Damron BL, and Sloan D.R. 2009. Poultry Diets for Small Flocks. University of Florida IFAS extension. p. 1.

[13] Johnston SN, Antonio R, Jerry S. 2005. Feeding by-products high in concentration of fiber to non-ruminants. West Central Research and Outreach Center University of Minnesota. p. 15.

[14] SPSS (2002). Statistical Package for Social Science, SPSS 13 for Windows. SPSS Inc. Chicago, Illinois.

AUTHORS

First Author – Zewdu Wondifraw, PhD in Livestock Production and Management, Department of Animal Science, College of Agriculture and Natural resources, Debre Markos University, Debre Markos, Addis Ababa, Ethiopia. Email: -zewduwondifraw@gmail.com
Second Author – Berhan Tamir, PhD in Animal Nutrition, College of Veterinary Medicine and Agriculture, Debre Zeit. Email: berehantamir@yahoo.com

Correspondence Author – Zewdu Wondifraw, PhD in Livestock Production and Management, Department of Animal Science, college of Agriculture and Natural resources, Debre Markos University, Debre Markos, Addis Ababa, Ethiopia, Mobile +251910172313, fax + 251587711764, Email: -zewduwondifraw@gmail.com