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SHORT NOTE [NOTA CORTA]

EFFECTS OF DIETARY GRIT INCLUSION ON THE UTILIZATION OF RICE HUSK BY PULLET CHICKS

[EFECTO DE LA INCLUSIÓN DE GRIT Y CASCARILLA DE ARROZ SOBRE EL DESEMPEÑO PRODUCTIVO DE POLLITAS]

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SUMMARY

Two hundred and forty, one day old pullet chicks were used to investigate the effects of grit inclusion on the utilization of rice husk by pullet chicks. There were eight experimental diets such that 4 levels of rice husk (0, 7.5, 15, and 22.5%) and 2 levels of grit (0 and 5%) were fed. Increasing the levels of grit in the diets of the chicks had no effect ($P > 0.05$) on the feed intake, weight gained, feed to gain ratio and protein retention. There was an effect ($P < 0.05$) in fat retention due to rice husk and grit inclusion. No effect was found ($P>0.05$) in protein retention on increasing the dietary level of rice husk in the diets. Feed cost decreased with the increase in the level of risk husk in the diet. The results obtained from this study showed that up to 5% saving on feed cost can be accomplished, without any adverse effect on the performance of pullet chicks through the use of grit.

Key words: Rice husk; grit; pullet chicks; utilization.

RESUMEN

Se emplearon 240 pollitas de un día de edad para evaluar el efecto de la inclusión de grit en la utilización de la cascarilla de trigo. Se emplearon ocho dietas experimentales considerando 4 niveles de cascarilla de arroz (0, 7.5, 15 y 22.5) y dos niveles de grit (0 y 5%) en un diseño factorial (4 x 2). El consumo de alimento, ganancia de peso, conversión alimenticia y retención de proteína no se afectaron por el nivel de grit ($P>0.05$). Se encontró un efecto ($P < 0.05$) sobre la retención de grasa por efecto de la cascarilla de arroz y el grit. No se encontró efecto de las cascarilla sobre la retención de proteína ($P >0.05$). El costo de la dieta fue menor al incluir cascarilla de arroz. Se concluye que es posible reducir el costo de la dieta sin afectar el desempeño productivo mediante la inclusión de cascarilla de arroz y grit en la dieta de pollitas.

Palabras clave: Cascarilla de arroz, grit, pollitas, costos.

INTRODUCTION

Importance of feeding in poultry production cannot be over emphasized, especially when it is realized that 55-70% of the cost of production is due to cost of feed (North, 1978). Feed and feeding in poultry production is as important as genetic factor (North, 1978). In addition to the genetic component of the bird, the quality of feed is the primary factor that determines the rate of growth of bird (Oluyemi and Roberts, 1985). There is evidence to suggest that birds raised under temperate condition perform better than those raised under tropical condition (Oluyemi and Roberts, 1985, Summer and Leeson, 1981). It has been established that environment is one of the factors accounting for these discrepancies (Norris and Stell, 1975).

Monogastric animals (birds inclusive) are known not to utilize fibrous feedstuffs efficiently. The reason being that there is no meaningful symbiotic relationship between the animal with simple stomach and microbial population anywhere in the gut (Moran, 1982). This leads to decrease in digestive efficiency especially with diets that have low energy content i.e. high fibre content. The fact that poultry is a monogastric animal indicates that it has limited ability to digest fibre. (Moran, 1982)

One of the unique aspects of the avian digestive system is the presence of the gizzard, where a combination of muscular and grinding action and enzymes help to reduce food material into absorbable portion. To aid the effect of the gizzard, the average local chicken picks up a few stones while scavaging for food. It is thought that these stones aid the digestion of materials which the local chicken picks up (Fritz, 1937 and Salverson, 1996). Birds reared under intensive management have no access to such stones

and hence ability to digest high fibre content of their regular diets is very low (Adeniji and Oyeleke, 2008). There is possibility that incorporation of grits (stones) into the diet of the intensively reared birds may increase the amount of nutrients extractable from these high fibre diets (Adeniji, 2009).

Crude fibre consists of cellulose, hemi-cellulose and lignin (McDonald *et al*., 1982) which although are carbohydrates, are not well utilized by monogostric animal including chicken (Moran, 1982). Fibre is known to increase the rate of feed passage in the gastro-intestinal tract, reducing digestibility.

Rice husk as fibrous feed is available in many parts of the world in large quantity as a by-product of rice milling. It consists primarily of outer covering of rice (Oyawoye and Nelson, 1998). It is an inexpensive source of fibre, obtained almost free and is considered as filler ingredient. It is high in fibre (28% crude fibre) but low in protein and fat. Because of its little or no cost, it is used as feed ingredient and thereby reduces the cost of production. Monogastric animal, including poultry are assumed to be able to utilize rice husk as a feed ingredient better when additives like grits or enzymes are added to it. Hence, the study was carried out to determine the level of rice husk pullet chicks can tolerate in their diet and to assess the effect of grit inclusion on the performance of pullet chicks fed rice husk.

MATERIAL AND METHODS

Two hundred and forty, one day old Harco pullet chicks were used for this study which lasted for a period 8 weeks. The chicks were randomly allocated to eight dietary treatments. Each treatment had three replicates and ten chicks were allocated per replicate. Rice husk which is the test feed stuff on analysis contained 6.56% crude protein, 3% ether extract, 28% crude fibre, 6.5% ash and 1900 kcal/kg of metabolizable energy. The eight experimental diets had 4 levels of rice husk at 0, 7.5, 15 and 22.5% and 2 levels of grit at 0 and 5% (Table 1) i.e. 4 x 2 factorial experimental design.

Table 1. Experimental diet (kg/100kg).

Ingredients	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	Diet 6	Diet 7	Diet 8
Rice husk	0.00	0.00	7.50	7.50	15.00	15.00	22.50	22.50
Grit (sand)	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
Maize	45.00	45.00	45.00	45.00	45.00	40.15	37.65	32.65
Corn Bran	19.15	12.15	10.65	3.65	1.15	0.00	0.00	0.00
SBM	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
GNC	20.00	22.00	21.00	23.00	23.00	24.00	24.00	24.00
Fish meal	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Lime stone	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Bone meal	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Premix*	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Lysine	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Analyzed proximate composition								
% Crude protein	21.87	20.56	20.78	19.90	22.09	20.78	21.20	19.69
Crude fibre (%)	8.50	14.50	22.50	17.50	12.50	15.00	22.50	22.50
Ether Extract (%)	8.00	2.50	2.50	8.50	2.00	7.50	8.00	2.00
Dry Matter (%)	99.40	96.20	96.50	94.80	95.80	99.30	98.70	96.30
Ash (%)	7.50	8.50	15.00	14.00	9.00	4.50	5.00	5.50
Metabolizable Energy (kcal/kg)	3021.15	2842.95	2824.55	2593.55	2663.55	2538.55	2608.25	2437.55

*BIOMIX premix used contained:- Vitamin A = 12500 IU; Vitamin D = 1500 IU; Vitamin E = 15mg; Vitamin K_3=2mg ;vitamin B_1 =250mg ; Vitamin B_2 = 3.7mg ; Niacin = 30mg ; pantothetic acid = 10mg Vitamin B_{12} = 0.02mg ; Folic acid = 0.75mg ; Biotin = 0.025mg ; Chloride = 37.5mg ; Manganese = 150mg ; Iron = 25mg ; Zinc = 37.5mg ; copper = 2mg ; Iodine = 1mg ; Cobalt = 0.20mg and Selenium = 0.10mg

The sand (grit) used was sterilized by heating for 3 hours to eliminate the presence of micro-organism. Grits fed was sieved to the 3 mm size milled with other ingredients.

Feed and water were provided *ad libitum* for the chicks throughout the experimental period. Also, necessary medications were given during the experimental period. The day old vaccination was administered at the hatchery against Marek and Newcastle disease.

The initial weight of the chicks were taken and recorded on their arrival. Records of daily feed intake and weight gained by birds were kept. Records of feed to gain ratio and other activities such as cost of feeding, medication, labour were calculated.

Nutrient retention study was conducted when the chicks were 7 weeks old. Weighed quantity of feed was supplied and excreta collected over 72 hours using total collection method. Faecal samples were first sun-dried and then over-dried at 70^0C for 48hours, weighed and ground prior to analysis.

All proximate analysis was conducted using methods of AOAC (1980). All data were subjected to analysis of variance using a 4 x 2 factorial design and where significant, treatment means were compared by the Duncan's multiple range tests (Steel and Torrie, 1980).

RESULTS

Growth performance of pullet chicks fed rice husk with or without grit is shown in table 2. the chicks in all the diets had comparable (P>0.05) feed intake values, except for the chicks fed on 7.5 % rice husk diet which had significantly lower (P<0.05) feed intake value of 29g the chicks fed the 5% grit diet had lower (P<0.05) feed intake value of 31.50g as against 34.80g consumed by the chicks not fed grits.

The weight gain values decreased (P>0.05) as the level of rice husk increased in the diet. The chicks on the 0% rice husk diets had the highest (P>0.05) weight gained value of 6.00g. Chicks on the 7.5 and 15% rice husk diets had comparable (P>0.05) weight gain values of 5.80 and 5.90 respectively which is significantly higher (P<0.05) than 5.70g gained by the chicks fed the 22.5% rice husk diets. There was no significant effect of grit levels on the weight gained obtained.

The chicks fed the 7.5% rice husk diets had the best (P>0.05) feed to gain ratio of 5.00 which is comparable to 5.85 obtained on the chicks fed 15% rice husk diets. The chicks fed on both the control (0% rice husk) and 22.5% rice husk diets had the poorest (P>0.05) feed to gain ratios. The chicks fed on the 5% grit had a better (P<0.05) feed to gain ratio of 5.34 as against 5.90 from the 0% grit fed chicks.

The financial implication of feeding pullet chicks on rice husk with or without the inclusion of grit is shown in (Table 3). There seems to be gradual in the cost of feed with the increase in inclusion level of rice husk in the experimental diets. Also the cost of producing a kilogram of feed with grit is lesser than producing a kilogram of feed without grit, though the reduction in price was marginal. Also, the cost of rearing the chicks gradually reduced with the increase in the inclusion levels of rice husk in the experimental diets. Similarly, gross profit and profitability increased as the level of rice husk increased in the chick's diet. Inclusion of grit tended to further increase the profits.

The results of nutrient retention are presented in table 4. The treatment had no significant effect (P>0.05) on protein retention by fed broilers. The chicks on the 0% rice husk had the highest (P>0.05) fat retention value which was comparable with the retention value for bird fed 7.5 and 15% rice husk . While birds fed 22.5% rice husk had the lowest fat retention of 69.07%. The chicks fed 5% grit had a better (P>0.05) fat retention as against the chicks fed 0% grit.

Table 2. Growth performance of pullet chicks fed rice husk with or without grit.

Treatment	Feed intake (g/day)	Weight gain (g/day)	Feed : gain ratio
Rice husk (%)			
0%	35.90^a	6.00^a	5.98^c
7.5	29.00^b	5.80^b	5.00^a
15	34.50^a	5.90^b	5.85^b
22.5	34.70^a	5.70^c	6.09^c
SEM	1.34	1.28	0.03
Grit (%)			
0	34.80^a	5.90a	5.90^a
5	31.50^b	5.90a	5.34^b
SEM	0.95	0.90	0.19
Husk x Grit	N.S	N.S	N.S

SEM:-Standard error of mean N.S:- No significant (P >0.05). a,b,c, Means in the same column followed by different superscript letters differ significantly (P>0.05).

Table 3. Financial implication on feeding pullet grits to birds.

Treatment	Feed cost (N / kg)	Cost of rearing (N)	Selling price (N)	Gross profit (N)	Profitability (%)
Husk (%)					
0	40.61	321.11	430.00	108.89	33.90
7.5	40.27	320.77	430.00	109.23	34.05
15	39.14	319.64	430.00	110.88	34.70
22.5	38.62	319.12	430.00	110.88	34.70
Grit (%)					
0	39.89	320.39	430.00	109.61	34.20
5	39.42	319.92	430.00	110.08	34.40

*Data not statiscally analyzed. It was determined based on market price at the time the experiment was conducted, N128 = $1 USD

There was significant effect (P<0.05) of the level of rice husk fed on crude fibre retention. The chicks fed 22.5% rice husk had the best (P<0.05) fibre retention (46.05%) which is significantly higher (P>0.05) to values retained by chicks fed 0% rice husk (37.63%). The chicks fed 7.5 and 15% rice husk had comparable (P>0.05) fibre retention values. The chicks fed 0% grit had decreased (P<0.05) fibre retention (32.38%) compared to chicks fed 5% grit (43.99%)

Table 4. Effects of dietary grit inclusion on nutrient retention (%) by pullets fed rice husk.

Treatment	Protein	Fat	Crude Fibre
Rice husk (%)			
0%	78.04	83.36^{b}	37.63^{ab}
7.5	76.32	77.27^{b}	44.74^{c}
15	79.91	78.11^{b}	34.74^{bc}
22.5	77.67	69.07^{a}	46.05^{c}
SEM	1.27	3.21	4.44
Grit (%)			
0	77.92	75.23^{a}	32.38^{a}
5	78.05	78.64^{b}	43.99^{b}
SEM	0.90	2.27	3.14
Husk x Grit	N.S	N.S	N.S

SEM:-Standard error of mean
N.S:- No significant (P >0.05).
a,b,c, Means in the same column followed by different superscript letters differ significantly (P>0.05).

DISCUSSION

Monogastric animals (birds inclusive) are known not to utilize fibrous material efficiently, because there is no meaningful symbiotic relationship between the animal with simple stomach and microbial population anywhere in the gut (Moran, 1982). This is responsible for the decrease in digestive efficiency especially with diets where the energy content of the diet is low. As a result of this problem being faced, there is the need for birds reared intensively to improve feed utilization and performance when such birds are fed on high fibre diet. The use of grit is conceived because it is readily available and accessible to livestock farmer at no extra cost.

The reduced feed intake on grit fed diets and comparable feed intake values on the experimental diets with the control diet is supported previous reports of Rowland et al (1980) and Adeniji and Oyeleke, (2008) who reported that dietary grit improved utilization of nutrients resulting in good feed conversion and increase in growth of pullet chicks.

Grit was also observed to be useful in poultry diet where energy content of the feed is low. There was numerical but no significant increase in metabolizable energy of diet with grit as compared to those on control diet.

Observation of commercial feed indicates that most of the fibre act as nutrient diluent, as opposed to the fact that the nutrients are encapsulated within the fibre. Thus, even when there was an improvement in crude fibre digestion, the amount of the nutrient gained from such improvement was not substantial enough to significantly improve performance of birds. Smith and Macintyre (1959) reported that significantly improvement with performance with dietary grit apparent only when whole or cracked grain were fed. Hinners and Elliot (1972) observed no effect of dietary grit on the growth and feed efficiency of pullet chicks.

The results of this study indicate that the birds fed with 5% dietary grits had a lower feed intake than the birds fed with 0% grit which implies that less feed was

consumed to meet the nutrient needs of the chicks. The daily weight gain shows no significant difference. The birds fed the control diet had the highest feed intake which is significantly different from others which probably implies that grit inclusion in diet is more efficient in improving feed utilization when the level of fibre is higher. In cases where the fibre level in low as in the rice husk diets, inclusion of grit is not needed.

The body weight gained of the birds fed 0% and 5% grits showed no significant difference from each other which showed that grit inclusion had no effect on weight gain, but was effective in reducing the amount of feed consumed by chicks. It's also evident when the chicks fed the 0% rice husk diet with low level of fibre exhibiting the highest weight gained.

Economically, inclusion of grits in diets of pullets containing rice husk has been shown to reduce the cost and improved profitability even though the differences in the profit margins seems low. Rice husk is a waste product from rice milling and it is normally discarded. This waste is collected free except for the transportation cost to farm site. But, then some savings can still be made with grit inclusion in diet. The grit fed is sand, which is also gotten free except for sterilization cost.

In support of reports of Rowland *et al.*, (1980) Nutrient retention was improved with the incorporation of grit in diets of pullets containing rice husk. Adeniji (2009) made similar observation when pullet chicks were fed palm kernel cake with grit inclusion.

CONCLUSION

Based on these results the 15% rice husk with 5% grit is recommended for diets of pullet chicks. 15% rice husk gave a good feed to gain ratio and the best protein retention and fat retention in fed birds. Similarly, the 5% grit had the best feed to gain ratio and better retention of protein and fat. The use of rice husk can be improved by the inclusion of grit at 5% in the diets of chicks. This will help farmers in making more saving particularly in the third world countries where cost of food stuffs are high and many farmers have been put out of production.

REFERENCES

Adeniji, A. A. 2009. Effects of dietary grit inclusion on the utilization of palm kernel cake by pullet chicks. Animal Nutrition and Feed Technology, 9: 29-36

Adeniji, A.A. and Oyeleke, M.M. 2008. Effects of dietary grit fed on the utilization of rumen content by pullet chicks. Journal of Applied Sciences Research, 4: 1257-1260

AOAC, 1980. Association of Official Analytical Chemist; Official Methods of Analysis, 11th Edition. Association of Official Analytical Chemist, Washington DC.

Fritz, J.C. 1937. The effect of feeding grit on digestibility in the domestic fowl. Poultry science, 16: 75-79.

Hinner, W.W. and Elliot, B.L. 1972. Chicken response to grits. Poultry Science, 51: 1817 (abstract).

Mc Donald, P., Edwards, R.A. and Greenhalgh, J.D. 1982. Animal Nutrition. 3rd Edition, Longman-Harlow/New York. 479p.

Moran E.T. Jr 1982. Comparative Nutrition of Fowl and Swine. The Gastrointestinal Systems, Office of Educational Practice, University of Guelph, Guelph, Ontario. Canada. Pp: 79.

Norris E.C. and Stell, J.B. 1975. Ability of grit in the Regulation and grinding in gizzard of Norwegian Willow. Poultry Science, 54: 1839-1843.

North M. O. 1978. Commercial Chicken Production Manual, 2nd Edition Text book. Avi Publishing Company. West Port, CT, USA.

Oluyemi J.A. and Roberts F.A. 1985. Poultry production in warm-wet climate. MacMillan Press Ltd. New York. pp: 126-127.

Oyawoye,E.O. and Nelson, F.S. 1998. Utilization of graded levels of rice offal by rabbits. Proceedings of Nigerian Society of Animal Production; held at Abeokuta btw 21-26 March. Pp: 143-144.

Rowland, L.O., Hooze, D.M. and Hooze, J.R. 1980. Effect of dietary sand on the performance of young Broiler chicks. Poultry Science 59: 1907-1911.

Salverson, C.A. 1996.Grit feeding in caged layers. Poultry Science 75:112

Smith R.E. and Macintyre, T.M. 1959. The influence of Soluble and insoluble grit upon the digestibility of feed by the domestic fowl. Journal animal Science, 39; 164-169.

Steel, R.G.D. and Torrie, J.H. 1980. Principle and procedures of Statistics. A Biometrics Approach, 2nd Edition, McGraw-Hill, New York.

Summer J. D. and Leeson, S. 1981. Poultry Nutrition. Hand Book, University of Guelph, Canada.

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