INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

www.scienceandnature.org

AN EXPERIMENTAL EVALUATION OF THE ECONOMIC EFFICIENCY OF VITAMIN SUPPLEMENTS IN POULTRY FEEDS IN KOGI STATE, NIGERIA

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ABSTRACT
The study evaluated the economic performance of broiler birds fed on different treatments of vitamins and minerals supplementation, with a view to determining the profitability and economic efficiency of broiler chicks fed feeds fortified with vitamins A, C, E and selenium mineral. One hundred birds were used for the study in split experimental design. Data were obtained from broiler birds split into five treatment groups of ten birds each in replicate; including: feed fortified with vitamin A only (hroup1), vitamin C only (group2), vitamin E with selenium (group3), vitamins A, C, E. and selenium (group4), and the control without vitamin and mineral supplementation (group5). Results showed that fortification of broiler feeds with vitamins A + C + E + Selenium yielded highest weight increase, profitability and rate of return to money invested, and that vitamin E + Selenium supplementation showed beneficial effect on the profitability of broilers in the study area. Results also showed that the control group performed better than the groups that received dietary vitamin A only and vitamin C only supplementation. It was concluded that the profitability and economic efficiency of broiler enterprise could be enhanced by supplementation of feed with vitamins A + C + E + selenium; while poultry enterprise would be worse off if the feed is supplemented with vitamin A only or vitamin C only. Livestock extension service should promote broiler feed fortification with vitamins A + C + E + selenium mineral.

KEY WORDS: economic efficiency, profitability, broilers, vitamin, mineral, supplementation

INTRODUCTION

Adequate quantity of animal protein is very crucial to food security. However, about 70 percent of Nigerians consume far below the Food and Agricultural Organization (FAO) recommended value of 35gram (gm) of animal protein per person per day and nearly 30 percent of world humanity suffers from one or more of the multiple forms of malnutrition (World Health Organization, WHO and National Human Development, NHD, 2006). Indeed, Akinyele (2005) inferred that Protein Energy Malnutrition (PEM) is the greatest single cause of child mortality in Nigeria; and United Nations International Children's Education Fund, UNICEF (2006) confirmed this by the report that one quarter of the world children under the age of five are undernourished and that 60 percent of child deaths in Nigeria are related to Protein Energy Malnutrition.

The annual production capacity of commercial poultry in Nigeria was estimated at 96, 981, 001 kg dressed broiler; 40, 738, 698 kg dressed culled layers and 8, 216, 208, 000 eggs (Adene and Oguntade, 2006). Although, increasing population of meat type chicken has been recorded or Nigeria in recent times (Adebambo et al., 2009), there is still serious shortage of animal products. FAO (2005) indicated that the poor performance of the livestock sector in the developing countries have been caused by low animal productivity, inappropriate technologies, inadequate research and extension support, poor infrastructure and unfavourable market conditions. Feed is a very important determinant of poultry bird performance; several reports have established the relationship between body weight and physical characteristics as indicative of feed efficiency and performance of broiler birds (Akano and Ibe, 2006; McDowell and Ward, 2009). McDowell and Ward (2009) further established that vitamin dietary intake and utilization by poultry birds can be influenced greatly by factors such as feed ingredients, bioavailability, harvesting, processing, storage, feed intake, antagonists and least – cost feed formulation. Poultry feed fortification with vitamins has therefore become a necessary tool for enhancing the performance broiler birds.

The use of vitamins supplementation in the poultry industry was described as being necessitated in the tropics by stress factors (Ogbamgba *et al*, 2007). Ahmed *et al* (1967) reported that the stress factors in the poultry industry could include among others high ambient temperature, high relative humidity, high air pollution from industries and the administration of drugs and vaccines. The intensive nature of modern poultry farming also imposes a big stress on chicken and this has led to deficiency in some vitamins (Bartov *et al*, 2001).

National Research Council (NRC) requirement for vitamin intake by broiler birds is usually the minimum levels needed to prevent deficiency signs and for conditions of health and adequate performance. However, McDowell and Ward (2009) observed that even when sufficient amounts of poultry feed are supplied, conditions of poultry in Nigeria are such that other nutrients are often not adequate. The opinion is that broiler production can be improved in both physical and economic terms if the

Broiler feeds are adequately fortification with vitamins.
Thus, the hypothetical question explored was whether vitamin supplementation would indeed improve the economic performance of broiler birds significantly. Therefore, the study aimed at evaluating the economic efficiency of vitamin supplements in broiler birds; with specific objectives of determining the efficiency of resource use in vitamin supplementation in broiler birds, and compare the profitability of broiler birds' production at different levels of vitamin supplementation.

MATERIALS AND METHODS

One hundred day old broiler chicks were obtained for this study. The chicks were divided into 5 groups of 20 each. The birds were fed with commercial broiler feeds called 'Hybrid Feeds' obtained from the Feedtech Farms, Kaduna, Kaduna State of Nigeria. Analysis of the feed showed that the broiler starter mash had crude protein of 25 percent, while the broiler finisher mash had 21 percent.
Ward (1993) discovered that over 90 percent of broiler turkeys and laying hens require most vitamins at levels much higher than NRC recommendation. In view of the above, higher than the NRC recommended levels of Vitamins A, C, and E and Selenium were used in this study to determine their effects on live weights of broiler chickens. The feed of Group 1 was supplemented with Vitamin A (375miligram, mg) only. Group 2 received Vitamin C (10gm). Group 3 had supplementation of Vitamin E (7.5gm) and Selenium (12.5mg) only while Group 4 had Vitamins A (375mg) + C (10gm) + E (7.5gm) and Selenium (12.5mg). Group 5 serving as the control group received no additional vitamin / mineral supplementation.
Average weights of chicks per replicate were measured and recorded on arrival. Birds were then allowed to acclimatize for 1 week post arrival. Their feed intake and average body weight measurements per week per replicate were taken till they were 8 weeks old. The average live weight per treatment group was taken for the period of 8 weeks recorded per group.
Data obtained were used to estimate the profitability of the different poultry groups with the application of gross margin analysis; and the economic efficiency of vitamin supplementation in each group using the Shepherd-Futre model. The estimates for the different groups of broiler birds were subjected to Analysis of Variance (ANOVA) using SPSS 15.0 to determine the degree of variability in profitability at different levels of vitamins supplementation. The gross margin analysis was applied to indicate the excess of total revenue from each group of birds undergoing vitamin supplementation over the total variable cost of keeping the birds to eight weeks (Arene, 2003); as follows:
GM = TR – TVC; where:
GM = gross margin (₦),
TR = total revenue (₦), measured by the product of live weight of broiler bird at 8 weeks and the market price of live-broiler birds in the study area, which was ₦700.00/kg;
TVC = total variable cost (₦), measured by the sum of the costs of feed, vaccination and vitamin supplements. Labor cost was not included because the labor requirement for mineral supplementation of poultry feed was negligible.
The Shepherd-Futre model (Shepherd, 1962) expressed the economic efficiency of vitamin supplementation of broiler birds, as follows:
S.F. = (value-added by vitamin supplementation, VA ÷ cost of vitamins supplementation) x 100; where:S.F. = Shepherd-Futre coefficient of economic efficiency Value-added by vitamin supplementation (VA) was measured by the difference between the market value of live weight of birds at 8weeks and the value at day-old (in Naira). The cost of vitamin supplementation was measured by the cost of feed fortified with vitamins taken per bird for 8 weeks (in Naira, ₦). The higher the coefficient, the higher the level of efficiency of vitamin supplementation. Analysis of variance F = estimated variance from between means/estimated variance from within samples

RESULTS AND DISCUSSION

Table1 presents the estimates of average gross margin value of live broilers at eight weeks of life on fortified feeds at different levels of vitamin supplementation; and the analysis of variance (ANOVA) indicating the degree of variability in the average margin due to vitamin supplementation. The highest average live weight of 3,450g was obtained in the group that had the combination of Vitamins A, C, E and Selenium (Mineral) added to their feed; translating into highest average revenue of ₦2, 415.00 per bird at the market price of ₦700.00 per kg of live broiler. The control group without vitamin supplements second in rank, followed by the groups with Vitamin E+Selenium, vitaminA only and finally, vitamin C only, in descending order. The average variable cost of maintenance including cost of feed, vitamins and vaccination followed the same order as for the average revenue, indicating that feed intake was highest for the group of broilers supplemented with Vitamins A+C+E+Selenium, followed by the control group without vitamin supplementation and VitE+Selenium, but lowest for the group with vitamin C only. This implies that vitamins and mineral supplementation may be having implication for the rate of feed intake and utilization. Balanced supplementation with Vitamins A+C+E+Selenium results in highest feed intake, while isolated supplementation (vitamin A or C or E) will reduce feed intake beyond the normal rate for the control group; thereby resulting in lower cost than the control group without supplementation. These results corroborate the findings of McDowell and Ward (2009), and Akano and Ibe (2006). The average margin was highest for the group of broilers with Vitamins A+C+E+Selenium, second for Vitamin E+Selenium and third for the control group. The analysis of variance (ANOVA) showed significantly highest variance from the mean margin for the group of broilers with Vitamins A+C+E+Selenium at $P < 0.05$; indicating that the profitability of broiler birds enterprise could be most significantly enhanced by supplemention of feeds with Vitamins A+C+E+Selenium, followed by Vitamin E+Selenium. Although the birds in the control group without supplementation showed higher weight gain and consequently higher revenue, the average variable cost is higher for the control group and consequently less profitable than the group with Vitamin E+Selenium. However, supplementation with either Vtamin A only or

Vitamin C only would result in significant decrease in profitability of broiler enterprise; indicating that the birds are better off without vitamin supplementation than with only VitaminA or VitaminC.

Also, Table2 shows the highest Shepherd-Futre coefficient for the broiler group with Vitamins A+C+E+Selenium; indicating that it is most economically efficient to supplement broiler feeds with Vitamins A+C+E+Selenium. These results are contrary to the findings of Ogbamgba *et al* (2007), that vitamins A, C and E supplementation did not show beneficial effect on the growth of broilers in the study area as the control group exhibited slightly better performance than most of the groups that received dietary vitamins A, C and E supplementation. Udoh and Ushanga (2010) observed that 68 percent of poultry farmers in Akwa Ibom State raised 350-500 birds; while about 44 percent realized annual income of ₦5, 000-20,000, 35 percent obtained ₦21, 000-35,000, 12 percent obtained ₦36, 000-50,000, and 9 percent obtained more than ₦50,000 . The amount of income realized in a farming business depends on the level of capital investment. It therefore means that if farmers could supplement their broiler feeds with Vitamins A+C+E+Selenium, they could increase or even triple their profit or income from poultry enterprise. With about 316 percent rate of return on capital investment, it is feasible that farmers will want to sustain their poultry business by adopting the technique of Vitamins A+C+E+Selenium supplementation, so as to enhance productivity of broiler bird enterprise.

TABLE 1:Gross Margin from 8 Weeks old Broiler Chicks fed feeds fortified with Vitamins A, C, and E and Selenium

Treatments	Live weights (gram)	Average Revenue(₦)	Average Variable Cost (₦)	Average Margin (₦)	ANOVA
Grp1:vitA only	2120	1484	660.9	823.1	62.384^{b}
Grp2:VitC only	1950	1365	644.31	720.69	113.589^{b}
Grp3:VitE+Sel	2310	1617	724.95	892.05	27.909^{a}
Grp4:VitA+VitC+VitE+Sel	3450	2415	940.9	1474.1	263.116^{a}
Grp5:Contro	2460	1722	892.6	829.4	59.234^{b}
Average	2458	1720.6	772.732	947.868	

Source: field experiment, 2010

Note: Different superscripts indicate significant difference along the columns ($P < 0.05$).

TABLE 2: Economic Efficiency of 8 Weeks old Broiler Chicks fed feeds fortified with Vitamins A, C, and E and Selenium

Treatments	Average Revenue(₦)	Cost of vitamin supplementation (₦)	Value-added (₦)	Efficiency coefficient (%)
Grp1:vitA only	1484	410.9	1254	305.1837
Grp2:VitC only	1365	394.31	1135	287.8446
Grp3:VitE+Sel	1617	474.95	1387	292.0307
Grp4:VitA+VitC+VitE+Sel	2415	690.9	2185	316.2542
Grp5:Contro	1722	642.6	1492	232.1818

Source: field experiment, 2010

Note: Different superscripts indicate significant difference along the columns ($P < 0.05$).

CONCLUSION

The study compared the performance of broiler birds fed on different treatments of vitamins and minerals supplementation, with a view to determining the influence on profitability and economic efficiency of the enterprise. Findings revealed that fortification of broiler feeds with vitamins A + C + E + Selenium yielded highest weight increase, profitability and efficiency, and that vitamin E + Selenium supplementation showed beneficial effect on the profitability of broilers in the study area. Findings also showed that the control group without vitamin and mineral supplementation had slightly better performance than most of the groups that received dietary vitamins A, C and E supplementation. While the profitability and economic efficiency of broiler enterprise could be enhanced by supplementation of feed with vitamins A + C + E + selenium, as well as with vitamin E + selenium; the poultry enterprise would be worse off if the feed is supplemented with vitamin A only or vitamin C only. Livestock extension service should promote broiler feed fortification with vitamins A + C + E + selenium mineral.

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