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PROTEIN-ENERGY RELATIONSHIPS IN POULTRY NUTRITION: A REVIEW

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ABSTRACT
Animal protein shortage is endemic in developing countries today. The poultry industry supplies meat and eggs and thus have been reported to have a very high potential for increasing the per capita animal protein intake of Nigerians. The production of meat and egg requires large quantities of protein and energy. These two nutrients are the most expensive in rations. It is believed that 70 to 75% of total cost of broilers and layers production is incurred as feed cost. Thus a good understanding of the relationships between protein and energy in poultry nutrition and the influence of animal related environmental factors is an important prerequisite for improving efficiency of production. Consequently, protein and energy requirement as well as various relationships or interaction between protein and energy as reported by various researchers were assembled,and reviewed. Further research in the tropics especially those that are very practicable and result could be applied easily by farmers was suggested.
Keywords: Energy, Feed, Intake, Protein, Poultry, Relationships

INTRODUCTION
The cost of conventional feed stuffs which are the major sources of energy and protein are constantly on the rise (Eko *et al* ,2020**).** ,this has given rise to high price of animal protein food sources, therefore efforts are being made towards exploring available options to meet recommended nutrient requirements of chickens at a reasonable cost. The use of agro industrial-by-products was suggested by Apeh *et al*,(2021;) the authors opined that the utilization of agro industrial by-products in poultry nutrition could help to lower feed cost ,thus poultry production could be more affordable .

Poultry have been suggested as one of the means of massively producing animal protein food sources (meat and egg) because of the relatively short generation interval, high growth rate and the fact that its production capacity is quite profitable.(Eko *et al,* 2020(

The production of meat and eggs require large quantities of protein and energy. The net protein synthesis (protein deposition, protein in meat, protein in eggs etc.) is a process which requires much energy. 70-75% of the total cost of poultry production is incurred as feed costt (Ukah and Onwujariri,2011) Given the above scenario, a good understanding of the relationships between the energy requirements for protein production and certain animal related environmental factors in poultry nutrition is an important requirement for improving efficiency. Besides, a more empirical assessment of such interaction in the study at cellular and at organic level which is becoming important.

A concise and systematic study of the interactions and relationships between protein and energy (carbohydrates, lipids and other energy yielding metabolites) is expedient.

The objective of the review is to appriase available literature on the present state of knowledge of the relationships between protein and energy in poultry nutrition. It is believed that a proper application of this knowledge will lead to a more profitable and efficient poultry production

MATERIALS AND METHODS

Literature on the relationships between energy and protein were assembled from journals, conference proceedings, books and from the internet, and consequently discussed and reviewed.

RESULTS AND DISCUSSION.

Protein Requirement of Poultry

The synthesis of protein in the body tissues requires an adequate supply of about twenty (20) different amino acids. Ten (10) of these cannot be synthesized by the bird and must therefore be provided in the diet. These ten amino acids are termed essential,. of the remaining ten,while three can be readily synthesized by the body. These are termed non-essential. The remaining seven are less easily classified because either they can be formed only from other amino acids or the rate at which they are formed is not always sufficient to meet the demand of the productive processes. The protein requirement of a bird is defined as a requirement for a supply of each essential amino acid together with a sufficient supply of suitable nitrogenous compounds from which non- essential amino acids can be synthesized (Smith, 2001). It is unsatisfactory to specify a protein requirement as a single figure, since the amount of protein which must be supplied depends on the yield of amino acids obtained by the bird which is digested. Two different protein sources may have low biological values when fed separately, but when fed together, they may act synergistically and have a much higher biological value. Biological value is defined as the single numerical value ascribed to a protein which gives estimate of relationship between the essential amino acid balance of the diet protein and amino acid needs of the birds. For instance ,if a diet has a biological value of 80, it implies that for each 100g of protein absorbed, 20g are judged not to be useful due to certain imbalances. (Smith, 2001)

Boekhott et al (1994) postulated that live weight gain is mainly deposition of fat, protein and water. The birds ability to digest fiber is very limited, hence fiber as a nutrient contributes almost nothing to growth in the birds except for assisting the gizzard in the grinding process.

Energy Requirements of Poultry

Energy is the fuel that keeps many different body functions operating. It is a vital and costly feed component and the most wasted of the feed components. Diet with high levels of energy are referred to as having higher nutrient density. Dietary energy level is the main factor influencing feed intake, as birds will under normal circumstances eat to satisfy their energy need.

Experimental reports have shown that ME requirement are approximately 18% higher than the NE requirement. This is due to the specific dynamic action of nutrients. Consumption of protein causes about 10% increase in heat production while consumption of carbohydrate and fat yield 15 and 30% heat increment respectively.(Boekhott *et al* 1994)

2.2 Protein-Energy Relationship in Poultry Nutrition

Blaxter (1989) reported that manipulating protein and amino acid level may be a lot more critical than manipulating fat and carbohydrate energy because the heat increase of protein is lower than that of either fat or carbohydrate

Ukah and Onwujiariri (2011) observed that protein feed resources, though not required in large quantity as that of energy, are higher in cost/unit than the latter. Any effort towards reducing the cost of protein feed resources will highly reduce feed cost. Energy is one of the critical needs of birds between 9-20 weeks. unlike in chicks, the energy in the diet is largely in form of carbohydrate but some are fat and some are amino acids. Fats yield about 2.25 times more energy than carbohydrate. Feed containing high level of protein are expensive to purchase and so a diet which is too high in protein is unnecessarily expensive. The excess protein is broken down and used as an energy source and the excess is excreted as uric acid. (Smith, 2001)

(Smith, 2001) observed that a marginal deficiency of an amino acid such as, methionine, may cause hens and chicks to sometimes consume extra feed to restore their intake of the limiting amino acids to an adequate level. In this case an appetite for amino acid overrides the appetite for energy. The effect is a small one and occurs only when the concentration of the amino acid in the diet is just below the level needed for maximum performance.

Hidalgo (2004) reported that weight gain and feed conversion ratio were adversely affected when broilers were fed diet formulated to contain sub optimal concentration of crude protein and metabolizable energy. He further stated that Providing a diet containing a sub optimum concentration of ME may have more pronounced effect on performance with broilers marketed at higher weight because the duration of the production does not allow for compensating the growth as with heavy broilers marketed at older ages.

Hidalgo *et al* (2004) reported the differences in carcass yield, breast meat yield, constant ME:CP ratio. However, Dozier and Moran (2002) reported that feeding broilers diets formulated to certain sub optimum concentration of CP and ME impaired the amount and yield of carcass parts..

The dietary energy and crude protein may individually be adequate but be poorly digested to the extent that this reduces the performance of the birds or causes the deposition of fat in their carcasses. The concept of calories to protein ratio emanates from the ability of the fowl mediated through the nervous system in the hypothalamus to regulate its energy intake. It is therefore assumed that the fowl eats primarily to meet its energy requirement.

CONCLUSION AND RECOMMENDATION

The relationships between energy and protein is an important consideration in ration formulation for poultry. Protein and energy , appropriately combined in poultry diets may lead to more efficient poultry production

It is recommended that more studies should be carried out in the tropics , particularly under Nigerian conditions to obtain best results for the protein and energy combinations in poultry rations.

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