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A Review on Poultry Energy Consumption and Broiler Nutrient Utilization with Diet Management

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Abstract – Poultry is a rapidly growing industry in India. Poultry meat & eggs are a great source of vitamins & micro nutrients that add to human diet as a valuable portion. The Indian Poultry Industry is estimated to be five thousand years old but has gained traction over the last four decades. Broilers are able to survive on many forms of diets, but perform well in diets made up of low-fiber grains & easily digestible sources of protein. The broilers' growth rate is known as the most significant economic feature in the broiler industry. Poultry feeds have been found adulterated with hormones, antibiotics, dioxine and other chemicals either deliberately, or from malpractice, or from sloppy manufacturing practices. Deficiency of a particular nutrient in the ration which is generally unnoticed by the farm owners causes major effects on production.

Key Words – Poultry, Broiler Feed Strategy, Enzymes, Efficiency and Nutrient Utilization, Diet Management, Energy Consumption

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INTRODUCTION

Over the last four decades, development of poultry has gained momentum in the region. This has now taken on a full-fledged company form. Currently, this industry has emerged with the most dynamic & quickest growing section on the animal husbandry market, with an average growth rate of 6% in the 1980s, 11% in the 1990s, & 19% in broiler chickens in 1997-2002 and 5% in egg production. India ranks 4th & 5th in the world with an annual production of around 43.67 billion eggs & 1440 thousand metric tons of broiler meat respectively (Mandal et al., 2005). In India the poultry sector is leading to GNP 100 billion rupees. The estimated accessibility of 1 kg of meat per household in India is less than 10.8 kg of meat recommend by the National Committee for Human Nutrition (Evans, 2002). In the meat market, however, the business has the capacity to expand by around 10 times. Broiler meat has a greater market relative to other foods, mainly due to the disadvantages of beef and pork, and religious uses. This also holds the highest acceptability of all customer pieces.

The excess feeding is transformed into food; encouraging broiler chickens to provide an infinite supply of feed would contribute to the need to consume excess poultry. In recent decades the excess body fat deposition has been of concern to both producers & consumers.

POULTRY PRODUCTION IN INDIA

The Indian poultry industry has developed as the most competitive & steadily growing segment of our livestock market, as evidenced by the rates of output of about 35 billion eggs &791 million broilers with an annual compound growth rate of 8% and 15% simultaneously. As a consequence, India today finds a prominent place on the international poultry map by arising as the world's 5th & 19lh largest producer of egg and poultry meat. India sells poultry goods worth Rs. 50 crore annually under the Agreements on Tariffs &Trade (GATT), Intellectual Property Rights (IRIPR) & World Trade Treaty Organization (WTO).

BROILER FEED STRETEGY

In broiler industry, feed constitutes 60-70% of the total cost. The exorbitant feed cost of conventional feed ingradients has necessitated to formulate efficient and cost effective broiler ration. Now the attention of the scientistis is towards the utilization of agricultural by-products like rice bran, wheat bran and sunflower cake. These feed-stuffs are of low nutritive value and are available at cheaper cost. The annual production of rice bran, wheat bran and sunflower seeds is 6.8 million tonnes in 1991-92 (Bhanja, 1992), 4-5-6- million tonnes in 1984-85 (Gazula, 1984) and 0.55 million tonnes in 1988-89

(Saxena, 1990), respectively. Since these ingradients contain high fibre the use of these in poultry ration is not a common practice because chicken being monogastrics can not utilize the fibrous ingradients as efficiently as ruminants. The inhibitory effect of dietary fibre on growth of chicks has been demonstrated repeatedly.

Now-a-days many biotechnological innovations and physicochemical treatments have made the utilization of fibrous ingradients easier. The physical methods include autoclaving, pelleting, grinding and steam pelleting, while chemical treatments include treatment of high fibre feed-stuffs with alkalis like sodium hydroxide and ammonium hydroxide and acids i.e. hydrochloric acid and sulfuric acid. Biotechnological aspect to improve feed value is the use of enzyme in poultry feeds. Many crude and commercial celluloytic and proteolytic enzyme preparations have been tried for use in poultry ration. The improvements due to physical treatments have been attributed to destruction of growth inhibitors, bacteria and mould growth, increase in soluble dietary fibre, digestitibility of protein and release of bound phosphorus. Chemical treatments improve the digestibility of organic matter and energy value and reduce hemicellulose contents.

Food production in the Nation's indeed the world's largest business and more than two third of the people of developing countries are directly involved in food production. The world wide per capita food situation is worsening because death rates are decreasing, birth rates remain high and crop yields continue to be constant. If the world food population crisis is to be resolved out the protein gap closed, efforts and resources be brought to commensurate with the importance and urgency of the situation. Efforts to meat world food deficits should not overlook the need for development of a balance agriculture economy in the country. Animal production is important to maximal effective use of available natural resources and broiler production is one of them, which requires less land, labour and capital to start with.

The increase poultry production is also due to the intensive agriculture system and the increased grain production. Poultry is the most efficient converter of grain and by-products into meat with added advantage of high productive rate, short generation interval and quick turnover of the input costs leading to a relatively lower cost of meat per unit weight compared to other species under limited resources of land and input costs. Hence, the prospects of poultry is brighter than the other species for supply of meat.

Incorporation of Enzymes in Broiler Diet:

Some major enzymes are used in the diet of monogastric animals (poultry and pigs) as feed additive. Enzymes commonly used as feed additives in poultry and their substracts are listed in Table.

Enzymes used as dietary feed additives in poultry.

S.N.	Enzyme	Substrate
1.	Amylase	Starch
2.	Phytase	Phytic acid esters
3.	Pectinase	Pectins
4.	Cellulase	Cellulose, Hemicellulose
5.	Hemicellulase	Hemicellulose
6.	b-glucanase	b- glucoans
7.	Arabinoxylanse	Arabinoxylans
8.	Lipase	Fats, esters
9.	Protease	Proteins

Exogenous enzymes added to the poultry feed have potential to improve nutrient utilization, feed intake, feed efficiency, reduce pollution associated with manure and increase lower nutritional quality feed ingredients.

It is well established that high crude fiber level poultry diet has detrimental effect on growth, feed efficiency and survivability of the birds, particularly during early part of the life ISI (1997) has recommended maximum crude fiber content in the diet of broiler up to 6%. Season is also known to influence the performance of broiler. The fast growth of broiler industry has created a wide gap between the demand and supply of conventional feed ingredients for formulation of broiler feed. The exorbitant expense of traditional feed ingredients demands that broilers devise cost-effective feed. While thinking of cost effective feed, the use of low cost unconventional feed ingredients comes into picture. Chickens being monogastrics have limited capacity to utilize fiber. Hence, ways and means should be find out to improve the utilization of fibre before planning to incorporate high fibre unconventional feed-stuffs in the diet of broilers. Benefit in holding poultry largely relies on a beneficial partnership between the costs required for processing poultry products & revenue generated from them. Therefore, poultry producer should concentrate his attention on those items that will reduce the cost per unit of the product for increasing margin of profit. Studies on the economics of poultry production will throw light on various factors affecting the total cost of producing chicks some of which are stable and some are variable. The stable ones that do not vary much from year to year include buildings, use of land, equipment, the amount of labour in caring for the flock and iterest on fixed capital. These factors usually amount to the same in the case of a poor flock as in the case of a good flock. Other factors of a miscellaneous nature include such items as electric consumption, disinfectants, chicks brooder. The most important factors that vary from year to year include the price of feed, flock mortality and rate or level of broiler production.

IMPACT OF DIETARY SUPPLEMENTARY ENZYMES ON THE EFFICIENCY AND NUTRIENT UTILIZATION OF BROILERS:-

Fungal enzyme supplements enhanced growth & feed efficiency of birds fed high fiber diets but had no effect whenever added to low fiber diets. This was reported by Hastings, as early as 1946.

Investigations under taken by **Jensen *etaf* (1957) revealed a signi (leant** growth & feed efficiency response to an enzyme preparation in chicks fed diets containing barley. **Leong *et al* (1961)** study the influence of fiber content on chick growth response to enzyme supplements. These workers observed that a high level of fiber was not required in diet for fungal enzyme to give a growth response in chicks. Addition of fungal enzymes did not improve growth of chicks fed high fiber diet that did not contain barley. Substitution of pearled barley for maize depressed chick growth. The depression was counter acted by enzyme supplementation. Results of study conducted by the same workers indicated that addition of enzyme supplement increased the metabolizable energy of pearled barley and regular barley by 23.8 and 14.5 percent, respectively. Water treatment of the same samples resulted in increase of 26.1 and 24.6 percent in metabolizable energy. In experiments with poultry-relatively low digestibility coefficients for the nutrients of barley and sticky droppings due to barley feeding have been reported **(Burnet, 1996; Paterson, 1972; Vohra, 1972).**

NUTRITIONAL VALUE OF ENERGY SOURCES IN THE FORMULATION OF POULTRY

Feed involves diligent usage different (available) feed ingredients to get the poultry with sufficient quantities & proportions of some nutrients needed. Poultry feed is made up of several ingredients so these ingredients are graded as calories (fats , oils, & carbohydrates), protein (amino acids), vitamins, & minerals. Dietary energy is among the most essential among feed nutrients, because it influences the use of other nutrients by its capability to regulate a high degree of feed intake. Formulating poultry diets must be accomplished with the objective of achieving maximum energy level based on the composition of feed components to reduce feed costs per unit of poultry production and to achieve higher end products. The supply of energy in animal feeds constitutes a big part of the cost of the drug. Because feed ingredients this included nutrition in a standard broiler diet are at the maximum level of integration (40–70 percent). it's really important to formulate an understanding of the animal's energy use and energy demand in order to best meet its energy requirements. The development of processes for assessing the energy content of raw materials and feeds is also a key factor in the production of the least expensive products. The minimum energy requirements for broilers are 3000 kcal ME / kg or 12.55 MJ / kg (starter), 3100 kcal ME / kg or 12.97 MJ / kg (growers), & 3200 kcal ME / kg or 13.39 MJ / kg (finisher).

Since dietary energy management will affect costs & product quality based on the inclusion of specific feed ingredients, a summary table showing different feed ingredients which offer high to reasonable energy to show farmers & feed manufacturers interested in manipulating costs and improving broiler products through the utilize of dietary energy will not only provide the nutrition indications - energy supply has a specific composition due to factors like geographic location, industrial processes, and climatic conditions. Adequate understanding of broiler nutritional requirements depending on the type, the energy content of a feed component, the consistency and price of such ingredients is critical when formulating the least cost and achieving enhanced broiler efficiency. Controlling dietary energy has reported to influence feed intake with consequent impact on quality and durability of the carcasses.

Poultry adjust their feed intake to meet a wide variety of diets with varying nutritional content at different ages, and in response to specific factors such as dietary nutrition. A properly assessed awareness of several nutrition-rich feedstuffs on different compositions of dietary resources is therefore important. Nevertheless, the high cost of feed analysis often makes it difficult for farmers (especially small-scale farmers) and feed producers to analyze each batch of feed for its nutrient content as well. Invariably, they usually depend on data obtained based on different laboratory analyzes regarding the composition of feedstuffs. Consequently, it becomes critical for farmers, investigators & feed manufacturers to get a realistic, reliable & outlined approximation of the energy content of feed product to allow them to minimize the expense and time needed to test and obtain more accurate laboratory tests. The calories that a bird requires for feeding, and productive behaviors are mainly obtained from starches (carbohydrates), lipids , and proteins. Energy feed products may be separated into cereal grains, root & tubers, plant protein sources, animal protein sources, fats & oil as described in Section 2 of this article. Such foods have the nutritional value high to moderate. The use of such ingredients therefore needs sufficient expertise and skills to produce the best available solution at the lowest possible cost and to ensure an increased quality of the drug.

LATEST DEVELOPMENTS IN RECOGNIZING POULTRY ENERGY CONSUMPTION

Meremikwu declared that one of the specific imperatives for the production of productive tropical poultry is to claim obedience to wholesome norms. For eg, NRC , as suggested by Meremikwu, nutritional standards that over-determine eating less carbs in some resource-poor low-salary nations (especially those in muggy tropics) due to natural limitations. The generally accepted theory for such a long time was that feathered creatures consume to constant vitality intake, regardless of the feed 's vitality amount. Throughout either event, with genetic

dedication evolving over the years, the perception has certainly advanced.

The constant upgrading of poultry winged creatures, particularly grill chickens through hereditary determination, primarily created by focus on development & laying rate, at that point, by considering other physiological perspectives, strengthened the potential of the poultry feathered creature for better feeding productivity. From a nourishing point of view, such inherited dedication has spurred changes in the supplementary prerequisites of improved feathered creatures which gather that feed quality must be constantly modified by feed producers, perhaps to fulfill the need imposed by this turn of events. In a considerable degree, the appearance of poultry concerning the proportion of feed transition is subject in ME calculations of feed fixings. While Pymand Fairfull and Chambers once hypothesized that the consequence of genetic preference on ME is usually negligible, this hypothesis necessitate a second gander at late research shows something else, with the production of winged animals taking care of wheat-based feeding schemes indicating high heritage of ME esteems. The belief that winged beings have selected a accelerated pace of growth would entail a higher stamina. In either event, one possibility may be that inherited grill development would result in the consequent lack of affectability to regulate feed intake depending on the degree of dietary vitality.

DIET MANAGEMENT AND FEED CONSUMPTION IN POULTRY NUTRITION

The volume of feed eaten by an animal determines how much of the animal's diet works for upkeep and growth. Feed intake tends to affect gain in body weight, FCR, carcass cost and quality. Based on these facts, effective feed intake control utilizing multiple strategies becomes a critical activity directed at accomplishing a quality product and reducing the poultry production costs. Factors such as dietary factors (dietary nutrient composition, form of feed, feed inclusion ratios &consistency of pellets) and management factors (bird feed & water availability, environmental protection, density storage and regulation of diseases) influence feed intake in poultry production individually or collectively. Of the factors listed above, dietary factors (diatric nutritional composition) have been established as having a great / significant impact, with dietary intake having the most consistent effect when extended to poultry on feed intake. Feed consumption has been documented to increase or decrease, as dietary energy intake declines or rises, respectively. In relation to the food energy level, the rise or reduction of feed consumption is determined by the volume of feed in the intestine or by certain anatomical limits. Intake of dietary energy has also been documented to affect growth rate and efficiency of the carcass through its effect on feed intake.

In fact, a central feature of cells in all animal species is the capacity to feel the energy state and adjust the actions of the metabolic pathways. Energy-sensing receptors are found in the central nervous system (CNS) and bird peripheral tissues, and they serve another set of regulatory structures used to modulate peripheral metabolic tissue function and to control feed intake, energy expenditure to sustain energy balance and body weight. In order to regulate feed intake, the intake of dietary commodities has to balance the energy expenditure of the creature. It / is handled by the hypothalamus. The hypothalamus in the poultry brain plays a pivotal role in processing all inputs and producing the accurate approaches to feed consumption and dietary demands necessary to ensure homeostasis of nutritional origin.

Initiation of AMPK in the hypothalamus in reaction to lower energy status improves the output of NPY / AgRP-expressing (anabolic) neurons, resulting in increased feed consumption and reduced energy expenditure that works together to improve energy status. On the other side, mTOR stimulation induces increased POMC-expressing (catabolic) neuronal activity, that turn causes feed intake to decrease as a consequence of improved energy expenditure, thus facilitating energy usage for repair, development, and reproduction. Hence, equilibrium in the activity of the melanocortin network's hypothalamic neurons is what ultimately determines the intake of feed considering the absorption of dietary energy and the resulting improvement in the energy balance of the entire body and body mass. Nevertheless, the impact of dietary energy intake on feed intake in poultry has been documented conflictingly and examined. These incoherences may be due, inter alia, to genotype / strain differences, environmental impact, storage capacity, bird size usage. It is worth mentioning that, owing to their scale, low-mass birds such as laying hens appear to change their intake of feed more in response to the concentration of dietary energy than larger birds such as broilers, who sustain a steady intake of feed regardless of the concentration of dietary energy, but that this is constrained by the quality of the gut or other physiological factors.

COMPENSATORY DEVELOPMENT IN THE BROILER CHICKEN

Compensatory growth is define as a comparable exceptionally quick development with age within a form of creature (Wilson 1960). Continuous creature creation assumes a preordained curve in growth. For starters, transitory circumstances troubling to growth under diet or illness cause the creature go amiss from its normal way of developing. The organism often demonstrates quickened growth at the stage where great conditions are reorganized. Many common experiments of compensatory growth have used sheep & steers of formation of creatures (O'Donovan, 1984). Two theories were

proposed in order to explain the structures which oversee compensatory development. The initial is the concept of 'focal control,' which implies, individual set point for body size suitable for exacting age, & regulation device remains in the focal sensory system (Wilson 1960). During a cycle of sustenance, the body seeks in the shortest possible time to reach height that is appropriate the age. The second is the speculations of 'fringe regulation,' which indicates the management of body size firm by tissues wherever cell number, specifically, DNA concludes the degree of development period of under-nutrition or disease (Pitts, 1986).

A schematic depiction of the dissimilar oven chickens creation bends as depicted by Leeson (1991) was known in Fig. 1. Lines A, B & C refer to 3 primary developmental bends in ovens that at 42 days old sufficiently hit about 2 kg body weight. When flying beings evolve at a identical rate, growth would delineated by line B & refers to a most certainly normal ideal, i.e., nonstop-consistent development with no significant time of mild or rapid development. Nevertheless, with such 'factual' consistency hardly any creatures create. Winged animals who grow along lines An and C all enter 42 days at a weight of 2 kg, yet the paths they follow are very divergent. Flying creature A has a more accelerated production at the beginning, and thus a slower progress of commercial weight. At first, Winged entity C has a sluggish rate of growth, trailing into commercial weight with a quickened production.

Flying creature C would most definitely display an unrivaled improvement in feed, because it would has lower prerequisite for help particularly at an early age. The reasoning for this compact help necessity is that for this reason, the winged animal would need fewer feed supplements at a given age before hitting point X. Littler winged animals have a comparatively greater demand for medication, so in the case that C is not exactly the same as A, there would be a reduction in the overall volume of nutrients that are meant for care. Adding to these decreased help requirements and at the same time maintaining the preferred body weight X (Fig . 1) will consequence in more organized feed for production & thereby increase feed performance. All things considering, it will embrace this theory that the fragment of the corpse is unaltered.

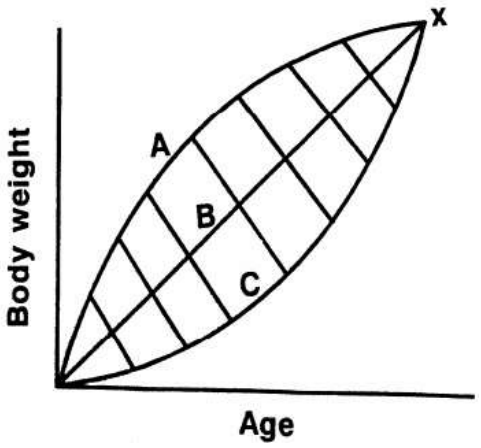

Fig. 1: Schematic depiction of growth curves of broiler chickens

A: faster initial development & then quicker development exceeding market weight

B: Constant stable growth, without sluggish or quick development

C: At first sluggish growth pace accompanied by faster rise to consumer weight

Earlier studies into feed reduction systems in ovens were mainly concerned with decreasing muscle to fat ratio & improving feed efficiency (Fisher, 1984), which was done most of the time to the disadvantage of other body weight. Osbourn (1960) & Auckland (1971) established the attainability of compensatory growth of chickens & turkeys subject to early life treatment such that last body weight was not cooperating. In either event, numerous experts failed to demonstrate complete growth remuneration in equivalent nutritional regimen (Jones 1992: Zubair, 1996b). The variance in the after-effects of the studies is perceptibly attributable to various factors causing the response of grill poultry to a current moment or pause in nutrition.

CONCLUSION

In India, even though many of the crop residues and agricultural byproducts are utilized in live stock and poultry feeds, a shortage of feeds and fodders continues to exist. Increasing feed resources for the live stock and poultry by sparing additional land and other resources is costly because of the increased need for cereal grains by the growing human population. Among agro-based enterprises, the farming of domestic fowl *(Gallus domesticus)* for large scale, occupies an important position for the improvement of socio-economic status of rural population particularly for weaker sections of the society. It needs low capital investment and ensures quick return. Moreover, poultry is universally accepted as an economic converter of agricultural by-products into a nutritionally balanced protein simulating human food in a shorter possible time.

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