

BROILER FINISHERS TO DEEP LITTERS

The Effect of the Four Response of Broiler Finishers to Deep Litters (Intensive and Semi-Intensive Management System) in Anambra State Polytechnic, Mgbakwu

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Abstract

A study was conducted to investigate the performance of broiler chickens under the intensive and semi-intensive systems of poultry production in Anambra State Polytechnic, Mgbakwu. Results of the study revealed significant ($P < 0.05$) differences in all the parameters investigated between the broilers produced in the two management systems. Birds managed under the intensive systems showed superior performances in average final weight (1,372.25g/bird) as compared to those managed in the semi-intensive system (1,161.25g/bird). The daily weight gains of the birds were also significantly ($P < 0.05$) different, with the birds in the intensive group showing better performance. The superiority in final weight observed in the intensively managed broilers further reflected in their dressing percentage and primal cuts. In contrast, broilers managed under the semi-intensive system possessed superior internal organs on account of the exposure of the birds to varying environmental condition and feeds they utilized as they scavenge. Hence with the current trend in super market revolution, where the availability of primal cuts of broilers and internal organs are a major means of sales of the chicken in Nigeria, better management of the birds to bring about better production of primal parts and internal organs is advocated.

Keywords: intensive; semi-intensive; deep litter; birds; feeds; weight

1 Introduction

For the past decade, poultry (domestic fowl) keeping has advanced from total extensive (free range) to more complex and prolific methods which takes care of all necessary conditions needed by birds for efficient feed conversion (Okujagu and Kalio, 2006).

The domestic fowls commonly raised by poultry farmers in Nigeria are the broilers, cockerels and layers. The main reasons of managing these classes of fowls are to produce animal products that can increase the protein supplies with a high biological value to enhance the protein requirement of its consumers.

Three management systems: the intensive, semi-intensive and extensive systems can be distinguished in poultry production (Oluyemi and Roberts, 2000). Reports reveal that chickens managed under the extensive and semiintensive systems account for more than 75% of all poultry in rural villages (van Eekeren et al., 2006). Interestingly poultry farmers raise chickens all around the world

under widely varying circumstances of housing and management and their main objectives may be generally the same, usually to maximize production via minimum costs and with minimum risks. Reports through personal interviews and observations reveal that in Anambra State Polytechnic Mgbakwu two main systems of keeping domestic fowls predominate: the small-scale subsistence farming using semi-intensive management systems and the commercial poultry management system, where chickens are housed intensively and produced in large scale.

There is paucity of information as regards the performance of chickens especially the broilers in this area by farmers adopting these management systems. Therefore the objectives of this study were to investigate the response of broiler chickens via animal performance, carcass and organ characteristics under the intensive and semi intensive systems of managing broilers.

1.1 Statement of the problem

Commercial intensive poultry farming provides optimum conditions for the concentration of pathogens and transmission, due to the crowding of thousands of birds in enclosed warm and dusty environments conducive for disease transmission (Chima et al., 2012). Furthermore, selection of birds for faster growth rate and higher meat yield leaves the bird's immune system less able to cope with infections, while the higher degree of genetic uniformity in the population makes disease spread easier (Delany, 2003). Thus, commercial poultry production systems are influenced by endemic factors such as type of birds, housing, socio-economic background of practitioners, disease incidence, financial sources and feeding as well as products disposal methods and channels (Adedeji et al., 2013).

1.2 Objective of the study

The main objective of the study is to find out the four response of broiler finishers to deep litters (intensive and semi intensive management system).

Specific Objectives are as follows:

1. To determine the growth of the birds in intensive and semi-intensive management.
2. To determine weight gain of the birds in both intensive and semi-intensive management.
3. To determine the reaction of the birds to weather changes in both intensive and semi-intensive management.
4. To determine their faeces of the birds in both intensive and semi-intensive management.

2 Literature review

2.1 Poultry genetic resources

Breeds of poultry today are better in egg numbers, egg weight, fertility, hatchability, growth rate, body conformation, meat yield, egg and meat quality and other variabilities that maximize the efficiency of production and increase profitability than they were one hundred years ago (Anindo et al., 2018). Much of this progress in poultry efficiency is the result of the use of good breeding programmes based on application of the principles of genetics that has allowed breeders to select birds for desirable characteristics (Brown et al., 2019). A breed is a group of related individuals that possess the same ancestry and are true for a number of characteristics that identify the breed. Breed recognition is conferred by a recognized breeders' association that registers the breed. Thus, all

breeds and varieties of chicken farmed today are due to natural selection to produce those that are now commercially exploited (Devendra, 2013).

There are many methods of classifying chicken depending on different principles. These include biological classification, economical classification and geographical classification (Evans, 2012). Under economical classification, chickens could be regarded as egg, meat or dual purpose types. The egg type breeds have small body size and slower growth rate. Examples are Harco, Ancona, Rhode Island Red, Black Leghorn, White Leghorn etc (Gow, 2011). The meat type breeds are raised for meat production. They have large body size and also heavy breeds that grow faster than the egg type breeds. Examples are Light Sussex, White Sussex, White Wyandotte, Plymouth Rock and Anak (Gow 2011). The dual purpose birds are raised for both meat and egg production and include the Light Sussex, Rhode Island Red, and Plymouth Rock, New Hampshire etc. In today's economic reality, in developed countries, dual-purpose breeds are regarded as inefficient, producing neither meat nor eggs very efficiently. However, in Nigeria dual-purpose birds can be very useful, especially in less intensive systems of production. For example, the cocks are used for meat production and the hens for the production of both eggs and meat. Both are considerably older when slaughtered than are broilers and therefore, have more flavor (Fugile, 2011).

Geographical classification from the Nigerian perspective is based on the whether the bird is exotic, local or hybrid. The exotic breeds include the Rhodes Island Red, Leghorns, Light Sussex, Barred Plymouth Rock and Harco among others (Smith, 2001). The local breeds are the birds' peculiar to the West African sub-region. They are generally small with tough flesh, are poor layers but good brooders. Their feather varies in color from white to black including multi-color mixtures. The hybrids are commonly seen and use in commercial farms. They are generally high yielding in both meat and egg production and are fast replacing most standard birds (Devendra, 2013).

2.2 Poultry production systems

There are many husbandry systems employed in the poultry industry with each representing a particular economic method of poultry production under a given situation. The type or class of chicken and farm location plays a major role with respect to the rearing system adopted (Foidl et al., 2011). The systems which are most suited to small-scale poultry husbandry are free range, in which the birds can roam at will over an extensive area; intensive, in which the birds are wholly confined, such as the deep-litter system; and semi-intensive, in which the birds are partially confined, but have at least occasional access to an outside run or scratching shed or straw yard (Horton and Flynn, 2017). Among these, the extensive or the traditional systems are not only favored by small of farmers, but already have a place in many developing countries (Khajarem et al., 2019).

Nigeria is now the sixth most populated nation in the world after China, India, USA, Indonesia and Brazil with more than 180 million persons (NPC, 2014). Poultry outnumbers all other forms of livestock in Nigeria, and, not surprisingly, is found throughout the country wherever there is human settlement. Typically, they are maintained under traditional, low input, free-range management systems, but substantial numbers are also reared intensively on commercial basis, particularly in the southern states of Nigeria. Commercial holdings account for some 10 million chickens, or 11 % of the total estimated population of 82.4 million (Randal et al., 2017).

Poultry production in Nigeria applies to a wide variety of birds of several species including chicken, guinea fowl, pigeons, ducks, geese, turkey etc (Okafor, 2014). These different types are found in the small - holder poultry system of Africa, defined as family poultry. These birds in their natural habitat

scavenge for their food and seek shelter in natural surroundings in trees and bushes. Over the years, human has intervened on their natural habitat through domestication and research which have resulted into different management systems (Richardson et al., 2018). Thus, there are two distinct production systems in Nigeria; namely commercial and rural poultry production system as found in most developing countries of Africa and Asia (Younas and Yaqoob, 2015). Each of these two systems is associated with characteristics of stock, scale, husbandry and productivity that define it as a distinct production system. However, the industry is essentially a twoway production system in which the traditional or rural production system exists side by side with the commercial system (Work, 2017).

2.2.1 Intensive poultry production system

In Nigeria the intensive poultry production system is practiced by medium to large-scale commercial enterprises, and also at the household level. Birds are fully confined either in houses or cages. Capital outlay is higher and the birds are totally dependent on their owners for all their requirements; production however is higher (FAO, 2004). This system of management is not easily affordable or practiced by peasant farmers. In addition, it is not practiced using native chickens in Nigeria due to high cost of housing, feeding, medication and other veterinary services and facilities. The intensive system of managing native chickens can only be found on the research farms whose results have not been properly documented (Tillman, 2019). There was a boom in intensive chicken production in Nigeria in the early 1980s, when the government of Nigeria subsidized the prices of day old chicks and feed ingredients (Farayola et al., 2013). There are three types of intensive systems; deep litter, slatted floor and battery cage system.

- **Deep litter system:** Under this system, birds are fully confined (with floor space allowance of 3 to 4 birds/m²) within a house, but can move around freely. The floor is covered with a deep litter (a 5 to 10 cm deep layer) of grain husks (maize or rice), straw, wood shavings or a similarly absorbent (but non-toxic) material. The fully enclosed system protects the birds from thieves and predators and is suitable for specially selected commercial breeds of egg or meat-producing poultry (layers, breeder flocks and broilers) (FAO, 2004).
- **Slatted floor system:** Wire or wooden slatted floors are used instead of deep litter, which allow stocking rates to be increased to five birds/m² of floor space. Birds have reduced contact with faeces and are allowed some freedom of movement.
- **Battery cage system:** This is usually used for laying birds, which are kept throughout their productive life in cages. There is a high initial capital investment, and the system is mostly confined to large-scale commercial egg layer operations

2.3 Poultry production environment

The environment in the poultry pen is a combination of physical and biological factors which exist as a complex dynamic system of social interaction, husbandry system, light, temperature and the aerial environment (Roxas, 2019).

2.3.1 Nutritional environment of intensive poultry

There is no other factor that is directly or indirectly related to proper nutrition and high performance of poultry that is more critical than feed quality evaluation, control and ration consistency (Obi, 2012). According to Nefzaoui (2019), under commercial production, the overall mission of feed formulation and manufacturing is to provide farmers with efficiently manufactured feeds that are

correctly delivered to their facilities and consistently contain the available materials required by animals for body maintenance, growth and reproduction having considered the nutrient and physical characteristics of the feed raw materials.

The nutrition of animals involves various activities that result in the conversion of feed into animal tissues or animal products such as, egg, meat and milk (Richard and Church, 1998). Mellish et al. (2013) defined nutrition as a series of processes by which an organism takes and assimilates food for promoting growth and replacing worn out tissues. Also, Jensen (2012) defined nutrition as a process which provides nourishment to a living organism and thus the food which a living organism takes in is used primarily for two major purposes; maintenance and productive function. Oguniyi & Omoteso (2012) emphasized that in modern poultry, nutrition is more critical than in other farm animals because poultry birds are usually reared in confinement. Poultry are also more active and more sensitive to environmental influences than other farm animals. Again, poultry have high growth rate, intensive metabolic rates and rapidly developed reproductive organs. Therefore, during the first ten weeks of post embryonic growth, the weight of broilers may increase about thirty to forty times and such rate of growth has not been encountered in other farm animal (Obi (2012). The ultimate aim of poultry nutrition is to increase the productive efficiency of the poultry. The economic importance of intensive poultry feeding becomes apparent, when it is realized that feed is the highest single cost factor, about two third of the total production cost (White, 2015). Thus, many cases of poultry business failures can be traced to poor or improper feeding of the birds (Scerra et al., 2016). Therefore, it is pertinent that the right nutrients in adequate quantities must be supplied to the birds after proper evaluation (Younas and Yaqoob, 2015).

2.3.2 Poultry feeding in Nigeria

Feed types: Different kinds of chicken feeds are available as commercially or home manufactured feeds in Nigeria. Commercial feeds in most cases will come in the form of dry mixtures called mash and sometimes pellets or crumbles. Whether commercial or home mixed, feeds must match the different protein needs of chicks, broiler and layers. It is the protein content which distinguishes what feed should be given to different ages and types of chicken (Obi, 2012). Among the methods of feeding chickens are all mash, pellet or crumbles, whole grain and cafeteria system (Jensen, 2012).

- **The all mash system:** This is the use of a complete ground feed, which is adapted to use in the mechanical feeding system.
 - **Wet Mash:** Chicken usually eat more wet mash than dry because they enjoy its consistency. However, wet mashes, particularly in hot weather, go bad very quickly, hence only an amount which will be consumed within two hours should be feed.
 - **Dry Mash:** When it is well balanced and sorted properly, dry mash usually is the best way of feeding confined chickens. According to Okafor (2014), it is commercially sold with designations; Chick mash (contains 20 % protein); Grower mash (contains 16 - 17 % protein); Broiler mash (contain 20 - 23 % protein); Layer mash (contains 15 - 17 % protein).
- **Pellets or crumbles:** Commercial mixtures in pellet or crumble forms are excellent but usually cost more than mash. Chickens may produce slightly better with the pellet/crumble forms. Pellet and crumble feeds reduce feed waste and the chickens may eat them a little better.
- **Whole grain:** Feed is often used as whole grain, either by itself or mixed with other nutrients. Sometimes whole grain is scattered in the litter. The whole grain method of feeding is however

not recommended for commercial farming systems. When fed with other ingredients, the grain is eaten first, resulting in improper diets, when scattered, much is contaminated or lost.

- **The cafeteria system:** This allows the birds to balance their own rations. Grain is fed in one feeder and high (26%) protein supplement is fed in another feeder. Feed is kept in feeders at all times. Older birds may tend to eat too much grain and not enough protein supplements when this system is used (Esonu, 2006; Tuleun, 2008).

Feeding practice: The success of raising poultry depends very much on adequate feeding of the birds. Feed is offered to poultry at all times (ad libitum) or controlled (restricted) (Nefzaoui, 2019).

- **The unrestricted/ad libitum feeding programme:** Feed must be available to birds at all times. This practice is commonly referred to as ad libitum feeding. This method of feeding allows the poultry to consume feed to appetite or want. Birds raised for meat (broilers) are preferable fed ad libitum. Advantages include more uniform weight attainment at maturity, feed management technique is less complicated as compared to feeding regime in feed restriction program, since birds that feed themselves at will are less stressed up (Gow, 2011). Disadvantages include facts that birds may overeat and increase feed cost during rearing period, while meat type (broiler) breeders tend to overeat and grow excessively, thus compromising production efficiency and profitability, since overweight broiler breeders are prone to prolapses, reduced fertility, hatchability and reproductive failures (Ekpa, 2013).
- **The restricted/controlled feeding programme:** Feed is supplied to the birds in limited quantity and/quality. The strains of birds must be grown on the controlled feeding programme to limit weight, particularly with broiler breeder strains. The female feed intake may be adjusted to delay egg at sexual maturity to maintain desired body weight and reduce prolapses (Obi, 2012). If the birds are overweight, some form of feed restriction may be imposed. It is advisable to start the restricted feeding programme from 6 weeks of age, although some breeders recommend earlier ages (2–3 weeks of age). Advantages include reduction in the cost of feeding the birds during the growing period. Feed restriction may also result in later maturing birds that lay larger eggs at the initial period, the birds may have less fat, thus protecting the birds from breeding problems due to excess fat. The practice may also lead to the production of more hatchable eggs during the laying year. Disadvantages include the facts that management of restricted feeding programme is more complicated than ad libitum feeding. Birds may be more uneven in body size mainly because of the differential feed intake of “boss” vs. “timid” birds. It is more troublesome to feed the birds because they fight among themselves in a bid to get at the feed thus increasing cannibalism and mortality problems (Gow, 2011).

Feed quality: Given the increasing number of people venturing into poultry business in Nigeria and the consequent high demand for commercial feeds, there is increasing tendency for feed manufacturers to produce substandard feeds, especially as the quality control agencies in Nigeria are less concerned or nonfunctional (Hochstrasser, et al., 2017). It appears the farmer, consumer and the public at large are left at the mercy of commercial feed millers and feed raw materials suppliers and processors. This is not an exaggeration considering the fact that feeding poultry alone accounts for not less than 70% of cost of production (Adebowale et al., 1998; Oyediji, 2001), depending on the region and season of production (Amir et al., 2001). It appears the manufacturers are aiming at high profit margins instead of focusing on quality of their feeds (Jones, 2005).

Factors that determine the nutritive quality of feeds and feedstuffs are numerous. The fact that a feedstuff is eaten by animals is only an indication of acceptability. Usually feedstuffs have physical,

nutritional and toxicological characteristics (Omede, 2008; Okoli et al., 2012). The nutritional characteristics could be divided into the biophysical and biochemical components that determine nutrient uptake and availability respectively (Okoli et al., 2009). Information on the proximate composition and sometimes toxicology of novel feedstuffs has been used routinely in determining the suitability of such feedstuffs in poultry feeding, especially during animal feeding trials (Esonu, 2009). Also, too much emphasis is usually laid on the analyses of crude protein and fibre as indicators of the nutritive quality of feeds and feedstuffs (Soetan and Oyewole, 2009). Limited information however exists on the biophysical characteristics of such novel feedstuffs (Okoli et al., 2009). Biophysical characteristics such as Bulk Density (BD), Water Holding Capacity (WHC), Particle Size (PS) and Specific Gravity (SG) play important roles in controlling feeding (Nir et al., 1994; Kyriazakis and Emmans, 1995; Makinde and Sonaiya, 2007), and thus productivity of birds. All available information, both qualitative and quantitative must be used in making judgments about the quality of feed (Soetan and Oyewole, 2009).

Feed quality among other things therefore, includes appropriate particle size and moisture content of the diet fed to highly productive lines of animals (Omede, 2010). Feed quality maintenance usually includes appropriate milling of the feed ingredients, proper storage and packaging as well as proper handling during marketing of the bagged feeds at the various sales outlets from where the farmers collect to feed their animals (Okoli et al., 2013). Particle size and water holding capacity together with bulk density also play important role in feed quality since they influence feed intake (Okoli et al., 2009; Omede, 2008) and thus the productivity of animals, especially poultry.

2.3.3 Litter environment and management

Birds pass out concentrated waste (uric acid) making it possible to house a lot of birds on litter with the major problem of only moisture buildup (Jesse, 2004; Asaniyan et al., 2007). A good poultry litter is started using adequate materials applied to a depth of at least 2 cm (Cool sand), 5-10 cm (wood shavings), 10 cm (chopped straw) and 8 cm for any other litter material on a dry damp-free floor (Moore et al., 2004; Asaniyan et al., 2007). For a litter to be well managed, considerations must be given to such factors as type of litter material used at the time of the year, depth of the litter, floor space per bird, feeding and watering devices, kind of floor, ventilation system, routine litter management practices, litter amendment procedure and incidences of disease that can have effects on litter value (Asaniyan et al., 2007). Environmental and indoor conditions of poultry houses (temperatures, flock density and air movements) have significant influences on litter quality and NH₃ emissions (Terzich et al., 1998; Meda et al., 2011). Deep litter management despite its importance seems to be neglected in poultry industry in Nigeria (Ezeokoli et al., 1984).

Depth of the litter varies with the type of litter material in use and will influence performance particularly if it prevents dust bathing (Moore et al., 2004; Asaniyan et al., 2007). High stocking density leads to decreased water and gas exchanges between air and litter (Meda et al., 2011), high chances of feed and water spillage due to space competition, high secretions and excretions in the litter, and high temperature and ammonia build up in the poultry house. (Okoli, 2004). This will subsequently lead to high chances of bad litter occurrence, while naturally well ventilated poultry houses with relatively light stocking densities maintain a good litter. Litters, if well managed can be changed between crops or commonly changed when they appear bad or following diseases outbreaks in most places. Poor litters are dusty, wet and cake easily, while a good litter should adhere slightly and easily breaks up when dropped from the hand (Oluyemi and Roberts, 2000). When litter is too wet, it normally balls up if squeezed in the hand, while too dry litter does not normally adhere

(Anonymous, 1990). Litter materials on earthen floors have been reported to hold as much as 30% moisture making it almost impossible to effectively manage than litters on damp-proofed concrete floors (Terzich et al., 1998). If the back of the hand feels damp when applied onto a litter, then it possibly contains at least 30% moisture which encourages breast blisters, rapidly converts uric acid to toxic ammonia and supports the growth of fly larvae and coccidian organisms (Anne, 2007).

Litter management has few rules but most decisions are subject to operator's judgment. Litter materials should be checked for bacterial and fungal contaminations, while fine particle litter materials should be covered with paper to avoid litter eating. New litter material should be treated with approved antifungal agents, while litter intended to be reused should also be treated with lime (Anne, 2007). Special attention should be paid to drinker points, since such areas are liable to caking and should be rotated to activate litter or removed and fresh litter material added (Sanjay et al., 2006; Anne, 2007). However, tilling of litters is frequently associated with rapid increase in ammonia levels in poultry houses and therefore usually done with windows open or fans on to rapidly dissipate the ammonia (Anne, 2007). A working litter warms the poultry house, while a wet litter cools the house by taking away heat in the process of drying out (Ruszler and Carson, 1968).

Ammonia levels of 15 - 20 ppm in the poultry pen is acceptable and can be estimated fairly accurately by using the operators sense of smell or litmus paper or more accurately using a dragger gas detector which is commercially available (Xin et al., 2002). Ammonia build up beyond 40 ppm is potentially dangerous to the birds and the operator (Ritz et al., 2004; Okoli et al., 2004, 2006). The consequences in birds include decrease feed intake and productivity, as well as respiratory tract infections and blindness (Wheeler et al., 2004). The concept of litter amendments has shown drastic reduction of ammonia levels in poultry houses thereby improving birds health and performance (Sanjay et al., 2006).

Poultry litter amendments to effectively control ammonia levels involves application of acidifiers, alkaline materials, absorbers, inhibitors, microbial and enzymatic treatments, superabsorbent polymers and even dietary manipulations (Blake, 2001; Sanjay et al., 2006; Meda et al., 2011; Timmons and HarterDennis, 2011). Acidifiers such as alum, sodium bisulphate, ferrous sulphate and phosphoric acid are the most effective and widely used poultry litter amendment and work by creating acidic conditions in litter so that ammonium rather than ammonia is retained and this helps facilitate bacteria and enzyme inactivity so that ammonia is not produced in the litter (Sanjay et al., 2006; Moore et al., 1996). Alum reduces NH_3 by 71 - 92%, while phosphoric acids reduce it by 56 - 92% (Moore et al., 1996). They suppress ammonia levels below 25 ppm for 3 - 4 weeks post application and improve in-house air quality in poultry houses (Sanjay et al., 2006).

According to Sanjay et al. (2006) alkaline materials like agricultural lime (CaCO_3), hydrated or slaked lime ($\text{Ca}(\text{OH})_2$), or burnt lime (CaO) work by increasing litter alkalinity ($\text{pH} > 7$) which help to convert more of the ammonium within litter to gaseous ammonia that can be readily lost through venting so that lower ammonia level is achieved when next batch of chicks are brought. However, this practice is associated with loss of soluble phosphorus level in litter with low fertilizer value and may have negative impact on the environment as ammonia levels may later increase significantly when fresh manure is added to the litter. Absorbers like certain natural clay types (zeolite) and peat are good in adsorbing ammonia and lowering ammonia levels if used in poultry houses. Inhibitors in poultry litter slowly convert uric acid and urea to ammonia by the process of inhibiting enzymes and microbial activities. For example, phenyl phosphorodiamidate was reported to inhibit urease activity and reducing conversion of urea in to ammonia (Sanjay et al., 2006).

Microbial and enzymatic treatment of litter uses beneficial microbes and enzymes which can convert uric acid and urea fairly rapidly into ammonia which can then be vented out thereby reducing the ammonia levels before chicks are placed in the house later. Such microbial products like USM-98 or Yucca schidigera extract as a natural feed additive were reported to significantly lower ammonia levels, improve bird weights and reduced mortality (Sanjay et al., 2006). Other dietary manipulations involve reducing the nitrogen intake per bird by reducing the crude protein in poultry diet, because ammonia is formed by the breakdown of undigested protein and uric acid in the manure. A 1% reduction of CP resulted to 10 - 22% reduction in NH₃ emission (Meda et al., 2011). Increased age and weight at slaughter will influence NH₃ emissions because nitrogen excretion per day per bird increases with increasing daily feed intake (Amanullah et al., 2010).

2.3.4 The nature of poultry waste

The major components of poultry waste include the bedding material, feather, the split feed and manure (Kelley et al., 1996; Tasistro et al., 2004). The manure contains considerable amounts of nutrients such as nitrogen, phosphorus, and other excreted substances such as hormones, antibiotics, pathogens and heavy metals which are introduced through feed (Steinfeld et al., in FAO, 2006b; Bolan et al., 2010). As with other organic wastes, the moisture content, pH, soluble salt level and elemental composition of poultry manure and litter have been shown to vary widely as a function of types of poultry, diet and dietary supplements, litter type and handling and storage operations (Bolan et al., 2010).

Nutrients: Birds reared in intensive production systems consume considerable amounts of protein and other nitrogen-containing substances in their diets. The conversion of dietary nitrogen to animal products is relatively inefficient; 50 to 80% of the nitrogen is excreted (Arogo et al., 2001). Nitrogen is excreted in both organic and inorganic forms. Nitrogen emissions from manure take four main forms: ammonia (NH₃), dinitrogen (N₂), nitrous oxide (N₂O) and nitrate (NO₃⁻).

Phosphorus is an essential element for animal growth but unlike nitrogen, phosphorus is relatively stable once attached to soil particles and does not leach through the soil into groundwater. It does not pose any environmental risks except as a nutrient; it limits biological activity in water resources and builds up in soil when applied in excess (Okoli et al., 2005). Phosphorus emissions from manure occur in one main form: phosphate (P₂O₅).

Heavy metals: Manure contains appreciable quantities of potentially toxic metals such as arsenic, copper and zinc (Bolan et al., 2004). In excess, these elements can become toxic to plants, can adversely affect organisms that feed on these plants, and can enter water systems through surface run-off and leaching (Gupta and Charles, 1999). Trace elements are introduced into poultry diets either involuntarily through contaminated feedstuffs or voluntarily, as feed additives used to supply the birds requirements or, in much greater proportions, as veterinary medicines or growth promoters.

Drug residues: Antimicrobial agents are administered to poultry for therapeutic reasons or to prevent illness. At much lower doses, antimicrobial agents are used as feed additives to increase the rate of growth and to improve feed efficiency (Campagnolo et al., 2002; Steinfeld et al., in FAO, 2006). Irrespective of dosage, an estimated 75% of antimicrobial agents administered to confined poultry may be excreted back into the environment. Some studies suggest that the interaction between bacterial organisms and antimicrobials in the environment has contributed to the development of antimicrobial-resistant bacterial strains (Chee-Stanford et al., 2001). Campagnolo et al. (2002), in a study that evaluated the presence of antimicrobial compounds in surface water and groundwater resources

proximal to intensive poultry operations, found antimicrobial residues to be prevalent or present in 12 water samples collected proximal to poultry farms.

Pathogens: Manure also contains pathogens which may potentially affect soil and water resources, particularly if poorly managed. Parasites such as cryptosporidium and giardia spp. can easily spread from manure to water supplies and can remain viable in the environment for long periods of time (Bowman et al., 2000).

2.3.5 Aerial or gaseous environment and management

Air hygiene is an important factor to be considered in intensive poultry production as it has considerable impacts on the health and wellbeing of farm animals and staff as well as the outdoor environment of the farming enterprise (Nwagwu et al., 2012). An adequate environment within the poultry house is a very important requirement for success in the industry.

Over 100 gaseous compounds are found in the air of poultry buildings (Hartung, 1988), and include aerial ammonia, carbon monoxide, sulphur oxide, hydrogen sulphide, nitrous oxide and flammable gas (methane), among others. Most are simple odorants, which may give rise to complaints among neighbors, while some are greenhouse gases (Wathes, 2001). In Nigeria, concentrations of most of the gases are usually in the range of parts per million or lower with the exception of carbon dioxide which may record concentration levels 5 to 10 times higher than the ambient (Okoli et al., 2004; Nwagwu et al., 2011). These gases have economic and public health importance in poultry production. For example, their concentration levels and emission rates in poultry buildings when high, eventually result in health problems among birds and workers (Okoli et al., 2006). Their public health importance is predicted on the disease they may cause in workers, when their levels become high in the pens (Okoli et al., 2004).

Most studies of noxious gases in livestock pens have focused upon ammonia probably because of its toxicity and role in acid rain formation (Nwagwu et al., 2011). Ammonia concentration in poultry pens varies depending upon several factors, including temperature, humidity, animal density and ventilation rate of the facility. Chickens exposed to ammonia show reduction in feed consumption, feed efficiency, live weight gain, carcass quality and egg production (Reece and Lott, 1980).

Micro-organisms in the litter convert birds excreta and spilled feeds to ammonium (NH_4^+) which is soluble in water and is convertible to ammonia in the presence of high pH and temperature (Sanjay et al., 2006). On the other hand, a high ammonia level in litter is reported to increase fertilizer value but with a consequence of environmental pollution posing health hazards to neighbors. Ammonia in the presence of rainfall contributes to soil acidification and also facilitates algae growth in water bodies (Sanjay et al., 2006). There is a growing concern in regulating ammonia emissions from livestock worldwide. Ammonia emission could be reduced with regular litter change, use of appropriate litter material, decreased manure moisture and improved indoor conditions (Meda et al., 2011).

Studies on the effects of dust in animal housing generally indicate potential for adverse effects on the health, growth and development of animals (Janni et al., 1985; Feddes et al., 1992). Respirable aerosol particles within poultry housing have been shown to decrease bird growth, increase disease transfer within flocks and condemnation of meat processing plants (Simensen and Olson, 1980). Optimal relative humidity of 60 – 70% has been recommended for laying houses, however, in case of low relative humidity, concentration of dust particles may increase and may be followed by a corresponding increase in respiratory diseases among chickens (Getachew et al., 2016).

2.3.6 Climatic environment and management

When ambient temperature is high, chickens have higher energy needs than when in thermoneutral environments (Ekpa, 2013). Poultry flocks are particularly vulnerable to climate change because there is a range of thermal conditions within which they are able to maintain a relatively stable body temperature in their behavioral and physiological activities (Gow, 2011). Hence, birds can only tolerate narrow temperature ranges to sustain the peak of their production for human consumption and any unpredictable climatic changes will therefore trigger a series of adjustment and readjustments by poultry birds in the struggle for survival which may have negative consequence on the viability of poultry production (Obi, 2012). The environmental conditions affecting the performance and optimal productivity of chicken include temperature, relative humidity, light, sunshine prevailing at a given time, housing system and ventilation (Obi, 2012). Ambient temperatures significantly influence the survivability and performance of the poultry production. Climate change alters global disease distribution, affects poultry feed intake, encourage outbreak of diseases which invariably affects poultry output and also cost of production (Hochstrasser et al., 2017).

Abdullahi and Abdullahi (2015) reported in their study that high rainfall and relative humidity provide conducive environment for breeding of parasites that causes outbreak of diseases, which invariably reduces egg production. They further reported that high temperature reduces the feed intake of poultry birds because more energy is needed to conserve the heat produced due to high temperature, hence, a decreased in the rate of feed intake. The environmental temperature within which poultry are able to keep a constant body temperature with minimum effort (thermos-neutral zone or comfort zone) ranges from 16 - 26o C (Adejumo and Ademosun, 2015). Environmental extremes have deleterious effects on the productive performance and wellbeing of all domestic animals. Hot ambient temperatures above zones of thermo-neutrality for domestic poultry affect performance and overall adaption to the climatic region (Devendra., 2019). For efficient poultry development Scott (1999) emphasized that the temperature of a chicken pen must not go beyond 35o C for any prolong period of time.

Humidity and temperature also have impacts on air quality. Therefore, ventilation is an important consideration for controlling heat, humidity and gas concentrations in poultry houses (Devendra, 2013). Sterling et al. (2003) correlated environmental temperature with many measures of performance including feed and water consumption, body weight, egg production, feed conversion and egg weight. Ellen et al. (2000) showed that reduction in egg production under heat stress may be related to altered respiratory pattern, while Ben Salem et al. (2013), showed that reduction in environmental temperature, leads to consumption of more feed in order to maintain body heat.

2.4 The health of intensive poultry

Poultry production systems in developing countries are increasingly characterized by rapid changes driven by factors such as human population growth, increased demand for poultry products as income rise with increasing urbanization (Bratte et al., 2011). Climate change effects are also adding to the considerable development challenges posed by these drivers of change (Chadhokar, 2014). Increasing intensity of environmental stressors and frequency of droughts and flooding events have translated into increased spread of vector borne diseases and macroparasites, along with the emergence of new diseases and transmissions models (IFAD, 2002). Poultry diseases contribute to important sets of problems within the production system. These include production losses, welfare issues, uncertain food security, loss of income and negative impacts on human health (Ben Salem et al., 2015).

Poultry diseases management is made up of two key components; preventive (biosecurity) measures in susceptible flocks and control measures taken in infected flocks (Al-Haboby et al., 2019). The probability of infection from a given disease depends on existing farm practices as well as the prevalence rate in host populations in the relevant area (Amata & Lebari, 2011). As the prevalence in an area increases, the probability of infection increases. According to Amata (2010), preventing the entry and spread of disease agents is the most effective way of managing disease. Many of the approaches to poultry diseases management are disease specific, however, improved regulation of flock movement affords better protection.

3 Materials and methods

The experiment was conducted at the poultry unit of Animal Health and Production Technology Department, Anambra State Polytechnic, Mgbakwu in Awka North Local Government Area of Anambra State. The institution is located about 2 km away from the heart of Mgbakwu town. Mgbakwu covers an area of about 10km² with a population of about 20,000 people according to 2006 population census, Nigeria (NPC, 2006).

The area of Mgbakwu lies between the latitude 6°16'58"N and longitude 7°3'46"E and is bordered in the North by Ebenebe, in the West by Isuaniocha, and in the South is Okpuno with rainfall amount of about 750 mm and the general rainfall is about 2000 mm with annual temperature range of 25 °C and 27 °C and relative humidity of 75% and 95%. The major occupation of people in Mgbakwu includes medium scale trading, crop and livestock farming (NPC, 2006; <https://www.mindat.org/feature-2330178.html>, 2023).

3.1 Experimental animals and management

Prior to the arrival of the chicks at the poultry section of the polytechnic on March 29, 2022, the cage was cleared very well and was littered with fresh wood shavings, the poultry house was disinfected with disinfectant such as (Dettol and Izal) before the experiment commenced fully. On the arrival of the day old chicks, some glucose was given to the chicks to serve as an anti stress. Gumboro and Lasota formula were dissolved in water and given to the chicks for vitamins and contributes as this will help to fight against some diseases.

Two (2) drinkers and feeder each were washed and kept the sum prior to the chicks arrival.

These materials were later placed at convenient places in each pen. There were three (3) treatments, a total number of twenty five (25). Unsexed day old chicks birds were used.

The three (3) commercial feeds used were New hope, Top and chukun as treatment A,B and C respectively. Fresh clean water and weighed quantity (ies) of feed (0.5Kg) were supplied to the birds in each pen, every day and later increased. Feeders and drinkers were cleaned before supplying new feed and water to the birds every morning.

Chicks were weighed on one (1) weekly bases while daily feed consumption were weighed and recorded. The quantity of feed consumed by the birds daily was obtained by the difference between the amount supplied and the left-over at the time of weighing.

3.2 Experimental design

Day - old broiler chicks which were unisex were randomly assigned to three (3) treatments over the experimental period. Each treatment had four replicates assigned into a completely randomized

design (CRD). (Weighing was done between 7:30 - 8:30 am before feeding them to get actual weight of the birds at the end of the week.

In the last week of the experiment, the final weight was taken before some of the birds in each treatment were sold. The readings taken were analyzed eight (8) weeks of experiment period, before putting it in a cumulative mean weight gain table that summarizes the weeks of experiment and the feed conversion ration of the birds.

3.3 Data collection

Different types of data were collected during the research project from many areas and are as follows.

Initial body weight of the experimental birds were taken just prior to the commencement of the experiment and thereafter, the birds were weighed for thinly one (1) weeks, to determine the live weight gain till the final weight was taken, determined at the end of experiment.

Mean body weight gain was taken as well as the mean daily feed intake in (Kg). The birds used for study were sourced from OBA poultry farm at Awka, in Anambra State and the birds of good quality could also be gotten from the hatchery farms, such as Obasanjo farm in Ogun State.

At the end of the experiment, the cumulative mean weight gain of the birds were subjected to statistical analysis to determine the level of significant of the means.

3.4 Experimental diets

Commercial feed were bought from some distributors in Mgbakwu and Isuanocha in Anambra State, also in Asaba Delta State. The proximate composition of the feeds is given in Table 1.

- Chukun Starter: Asaba Ogwushukwu.
- Vital Starter: Isuanocha
- Hybrid Finisher: Isuanocha & Mgbakwu.

Table 1. Proximate nutrient composition of the proprietary broiler starter and finisher feeds.

Nutrient	Starter (%)	Finisher (%)
Crude protein	21.0	18.0
Ether extract	6.0	6.0
Crude fibre	5.0	5.0
Calcium	1.0	1.0
Phosphorus	0.45	0.40
Metabolizable energy (kcal/kg)	2,800	2,900
Lysine	1.00	0.85
Methionine	0.50	0.35
Salt	0.30	0.30

4 Results and discussion

Table 2. Initial weight gain per bird (kg).

S/N	A	B
1	0.26	0.57
2	0.32	0.34
3	0.21	0.51
4	0.47	0.25
5	0.21	0.37
6	0.41	0.41
7	0.27	0.41
8	0.16	0.27
Total	2.31	3.13
Mean	0.28875	0.39125

In Table 2, the total initial weight of group A is 2.31 while that of Group B is 3.13. The mean initial weight gain of Group A is 0.28875 while that of Group B is 0.39125.

Table 3. Weight gain per bird at week VIII (kg).

S/N	A	B
1	3.94	3.59
2	3.69	3.58
3	2.84	2.94
4	2.34	3.44
5	3.29	3.26
6	3.94	3.44
7	2.59	2.84
8	3.34	3.44
Total	25.97	26.53
Mean	3.24625	3.31625

In Table 3, the weight gained in the week VIII for Group A is 25.97 while that of Group B is 26.53. The mean weight gained in the week VIII for Group A is 3.24625 while that of Group B is 3.31625.

5 Conclusion

The response of broiler finisher to deep litter (Semi-intensive and intensive) management system have been an interesting researchable topic in which the total of group A is 18.6025 with the average of 2.32551 while the total of group B is 19.24865 with average of 2.40608 . The grand mean of group

A is 21.05625 with the average of 2.632031 while group B is 19.24865 with the average of 2.40608. This shows that Group A (Semi-intensive) have the higher total gain weight than Group B (Intensive).

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