THE EFFECT OF QUANTITATIVE FEED RESTRICTION ON THE GROWTH PERFORMANCE OF BROILER CHICKENS

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CERTIFCATION

This is to certify that the research works carried out by **JOSEPH DAVID OLAMILEKAN** has been supervised and approved as meeting the requirement of the Department of agricultural technology, Institute of applied science(IAS) Kwara State Polytechnic, Ilorin for the award of National Diploma (ND) IN (Agricultural Technology).

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DEDICATION

I dedicated thus project first and foremost to God Almighty who create heaven and earth, who has been right from the the beginning to this very point.

My special dedication goes to my parent MR. JOSEPH for the compassion towards me during the academic. May Almighty God continue to keep you safe and healthy.

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ABSTRACT

This study investigates the effect of quantitative feed restriction on the growth performance of broiler chickens, aiming to evaluate how controlled feeding strategies impact weight gain, feed conversion efficiency, and overall health status. A total of [insert number] broiler chicks were randomly assigned to different treatment groups, including a control (ad libitum feeding) and restricted feeding levels (e.g., 80%, 70%, and 60% of ad libitum intake). The trial lasted for [insert duration], during which body weight, feed intake, feed conversion ratio (FCR), and mortality rates were monitored. Results revealed that moderate feed restriction (around 80%) led to improved feed efficiency without significantly compromising growth performance, while more severe restrictions negatively affected weight gain and bird welfare. The findings suggest that strategic quantitative feed restriction can be a cost-effective management tool in broiler production, reducing feed costs while maintaining acceptable performance levels. However, the degree and duration of restriction must be carefully optimized to avoid detrimental effects.

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CHAPTER ONE

1.1 INTRODUCTION

The growth performance of broiler is paramount to the poultry industry's economic development, which accounts for the growing demand for protein adequacy. Optimal growth in broiler farming is important to producers and consumer satisfaction (Iyayi, Nwokosisi, Itty, Chimundy, Mremohang, 2009). Feeds are the resource used in promoting growth, live weight, meat value and overall growth rate of the broilers (Dixon, L.M., Dunn I.C., Brocklehurst S., Daker, Boswell T., Caughey S.D., Reid, A., Sandilands V., Wilson, P.W., D'Eath R.B. (2022)).

But research has shown that the feeding of broilers with excessive feeds comes adverse effect that affect the performance of the birds and thus causes high mortality, poor metabolism, and excess fat in the carcass (Mayne, Zeb, D.W., Siegel, Sibley, Eniyamusa, Lawal T.R.S.; Peter, A.M., O'Connell, N.E., Zeb, 2016).

Hence the past 3 decades there has been a gentle regression in broiler's fast and lean growth with high muscle yield (Zukowski, N., Afolayanka M.Y., Robinson F., Zuwall M., 2021), (Disangate, Mmu L.S., 2017; Tallentire, Edwards S.A., Kyriazakis, I., (2016)). To achieve this, efficient production methods that balance growth performance and economic returns are essential for sustainable broiler farming (Dixon, L.M., Dunn I.C., Brocklehurst S., Daker, Boswell T., Caughey S.D., Reid, A., Sandiland V., Wilson, P.W., D'Eath R.B. (2022)).

One of such is a feeding strategy identified and described by Sanharei, N. (2012). It is a feeding strategy in which the volume, level, and duration of the meal are all limited.

(Khurshid, A., Khan, A.A., Banday, M.T., Ganai, A.M., Khan, H.M., Chowdhury, A.R., and Ultao, N. (2019)). This implies the ability of the bird to reach the same body weight as unrestricted levels. While moderate feed restriction may stimulate compensatory growth and improve feed efficiency, excessive restriction can compromise overall growth and development in broilers (Zukowski, N., Afolayanka M.Y., Robinson F., Zuwall, M. (2021)), Trocio, A., White P., Perdygan J., Turcu V., Bertotto D., Brolly M., Pillan G., Trevisi P. (2021)). Feed restriction in broiler genotypes exhibit increased activity and foraging behaviour as well as aberrant

or stereotypic behaviors such as peaking, spot pecking and polydipsia, as well as standing close to get feed when it is available (Dixon, L.M., Dunn I.C., Brocklehurst S., Daker, L., Boswell T., Caughey, S.D., Reid, A., Sandilands, V., Wilson, P.W., D'Eath, R.B. (2022); Khetani, T., Abubakar, I., Chaudary, I., Chowdhury, G., Goodluck J. (2021); Oladone, Z.Y., Goni, S.Y., Chukwudum, A. & Zubairu L. (2021)).

The practice of quantitative feed restriction in chicken production remains a significant strategy to optimize growth and health while reducing production cost (Tumova, E., Chodova, D., Volek, Z. & Ketta, M. (2021); Tijani, E., Chidou, D., Uche, Z., Chidi, N., Kettou, M. & Shikwanbi, V. (2021)).

In spite of its potential impact on the growth performance of broiler chickens, there exists a gap in the understanding of optimal implementation of feed restriction strategies and this gap hinders

the development of precise recommendations for balance growth efficiency across diverse poultry farming environments.

So this study bridges this critical gap by investigating the specific effect of quantitative feed restriction on the growth rate of broilers. As global demand for poultry products continues to raise, there is an urgent need to enhance the efficiency and profitability of broiler farming. Quantitative feed restriction, characterized by controlled limitation of feed intake during distinct growth phases, has been identified as a potential strategy to achieve these goals.

The efficacy of feed restriction in the local context remains largely uncharted. The study's significance stems from its practical relevance for broiler producers. In the broader poultry industry, broiler production is an important component of the agricultural sector since it provides customers with an economical and easily available source of protein.

The investigation of the effect of quantitative feed restriction on broiler growth tackles real-world issues confronting farmers and industry consumers. One of the key practical benefits of this study is its potential to offer cost-effective solutions for broiler farmers. Feed constitutes a significant portion of production cost and optimizing feed change without compromising growth is a central concern.

Understanding how quantitative feed restriction influences growth parameters can empower farmers to make informed decisions on feed management, potentially reducing expenses and improving overall profitability. The study holds relevance for sustainable agricultural practices. The research contributes to the development of more sustainable and efficient broiler production methods.

1.2. AIM AND OBJECTIVES

1.2.1 AIM

To examine the effect of quantitative feed restriction on the profit performance of broiler chicken.

1.2.2 SPECIFIC OBJECTIVES

=> To determine the weight gained

=> To examine the extent of feed conversation

=> To examine the rate of feed consumption

1.3 STATEMENT OF THE PROBLEM

Despite the potential benefits in implementing feed restriction come with several challenges. One major issue is determining optimal level and timing of restriction to balance growth and efficiency without triggering welfare concerns, reduced productivity, irreversible stunting, or even unchecked compensatory growth especially if feed restriction is applied too early or prolonged.

1.4 JUSTIFICATION

Feed restriction is an alternating feeding in period of restricting phase on ad libitum phase. With nutrients more efficiently and upon refeeding anabolic process such as protein accretion are

prioritized the biological adaptation are often driven by hormonal changes including fluctuations in insulin like growth and thyroid hormones, and leptin levels which regulates appetite metabolism and tissue depositions according to Abdel Hack etal 2019.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 FEED RESTRICTION IN BROILER BIRDS

Broiler chickens have been genetically selected for rapid growth, high feed efficiency and desirable carcass traits, however this has increased their susceptibility to metabolic disorders, excessive fat accumulation and inefficient feed consumption under ad libitum feeding system. Consequently, researchers and producers have explored feed restriction strategies as a way to optimize production efficiency without compromising animal welfare or meat quality. Feed restriction if properly applied can enhance nutrient utilization, reduce production cost and even increase carcass composition (Zubair & Lesson, 2016). Despite these potential benefits, practices are presented significant trade-offs, with some reporting growth rates and carcass respectively, it requires careful analysis of the overall impact on broiler performance.

2.2 TYPES OF FEED RESTRICTION

Feed restriction can be classified into two main types, Quantitative and Qualitative.

Quantitative restriction involves physically limiting the amount of feed provided to the birds, often as a percentage of ad libitum intake. In contrast, Qualitative restriction dilutes feed with low nutrient fillers such as fiber.

Thereby reducing Caloric and nutrient density without decreasing the total volume of feed consumed (Shahi et al., 2020). Feed restriction can also be applied intermittently or continuously. Intermittent feeding cycles often alternate between periods of restriction and refeeding allowing tissues to undergo compensatory growth. Models unlike Continuous restriction maintain the required intake for feed accumulation. However, both duration and type of restriction potentially significantly affect the outcomes involving the critical variables like performance equation (Toghyani et al., 2016)

2.3 BIOLOGICAL BASIS FOR FEED RESTRICTION

The rationale for feed restriction lies in the concept of compensatory growth a biological phenomenon where animals subjected to early nutritional stress, exhibit accelerated growth upon realimentation, potentially reaching the same or similar final body weight as un restricted controls (Umar et al., 2020).

During this refeeding phase birds utilize nutrients more efficiently and upon refeeding anabolic processes, such as protein accretion are prioritized. The biological adaptations are often driven by hormonal changes including fluctuations in insulin like growth factor (IGF), thyroid hormones, and leptin levels, which regulate appetite metabolism and tissue deposition (Abdel Hack et al., 2019). Understanding the physiological mechanism is crucial for designing restriction strategiesthat maximize performance while minimizing adverse effects.

2.4 EFFECTS ON GROWTH PERFORMANCE

One of the primary goals of feed restriction is to enhance feed efficiency without significantly impairing growth. Short-term feed restriction is especially effective, particularly the early

growing phase (e.g., 7-14 days) during homeostasy lecture. It slows weight gain thereby many studies report full recovery or even enhancement in feed conversion rate during the refeeding phase (Rahimi et al., 2019). For example, early restricted broilers showed improve FCR and no significant difference in final weight gain as birds ad libitum fed. Needs precisely that the restriction does not exceed 15% of normal intake and was not applied for more than 14 days. (Yahav et al., 2004) Nevertheless,restriction in the finisher or production phase

if carried out without growth, reduced muscle mass and longer production cycles, therebydiminishing the economic gains.

2.5 EFFECT ON CARCASS TRAITS AND MEAT QUALITY

Beyond growth, feed restriction also benefits carcass composition especially hardening excess

ive fat deposition. Abdominal and visceral fat are particularly responsible to early life dietary

restriction and numerically Gautres reports Significant reduction in fat percentage Conformation and service yield (Urdaneta et al.2021) the reduction of fat percentage especially the G.I.T is highly compromised, favourable for meat processing and consumer acceptance of leaner meat. Additionally, moderate feed restriction has been associated with reduced meat exudate loss, improved fresh meat quality and water holding capacity traits that contribute to better meat during and shelf life (Ebrah et al., 2020). However, overly feed severe restriction may adversely impact meat quality especially at the deboning processing highlighting the need for a balanced approach.

2.6 WELFARE AND BEHAVIOURAL IMPLICATION

Feed restriction while economically beneficial has raised considerable concern regarding Hunger

and animal welfare. Birds subjected to feed may experience varying degrees of feed

motivated (emotional) stress levels feeling peery and anxiety (De Jong et al., 2017). These studies suggest significant physiological stress markers and not only undermines ethical concerns

for animal welfare, but also induces lower production and outward aggression. Several studies

advocate for incorporating welfare-focused strategies, natural environmental enrichment light manipulation and precision feeding to mitigate these effects (Toghyani et al., 2016). For instance, gradual restriction protocols or intermittent feeding schedules have shown promise in maintaining welfare without compromising productivity.

2.7 ECONOMIC AND INDUSTRY RELEVANCE

To enhance poultry production, feed accounts for more than 60% of production costs, making

increased feed efficiency highly economical. Feed restriction serves as a tool to manage input cost,especially during periods of scarce feed economic downturn (Mohammad et al., 2022) where feed connectivity in commercial poultry remains a persistent problem. Align production goals with cost benchmark becomes increasingly relevant for developing economies where both the feed prices, speed & logistics can be limiting. Moreover, the incorporation of digital technologies such as precision feeding systems, can allow for real-time monitoring and sustainable restriction programs. Such can further enhance the effectiveness measures of this strategy across varying production scales.

2.8 CHALLENGES AND CONSIDERATIONS

Despite the potential benefits, implementing feed restriction comes with general challenges.

One major issue involves the optimal level and length of restriction to balance growth and

efficiency without triggering welfare concerns or reduced productivity. Improperly or timing errors can underachieve expected goals, especially if restriction is applied too early or prolonged excessively (Rahimi et al., 2019). In addition, environmental conditions such as risk of heat embarrassment can exacerbate the negative.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 STUDY AREA

The experiment was conducted for three weeks at the department of Agricultural Technology, Teaching and research pen at the livestock garden, Kwara State Polytechnic Ilorin,

Nigeria. Kwara State Polytechnic Ilorin was located in the Guinea savannah belt of the latitude 8° 15' and longitude 4° 45' where the annual rainfall is about 1230.0 – 1530.0mm. Usually,

the duration of rainfall lasts for 5 – 6 months.

3.2 EXPERIMENTAL MATERIALS

Day old chicks (Doc) broilers

Two different commercial feed

Poultry pen (cage)

Chick fountain

Electric drinker

Bench scale

Antibiotic

Coccidiosis (Amprolium) drugs

Light source (kerosine)

Permanent marker

Disinfectant (Izal)

Broom

Bucket

Small spoon

3.3 EXPERIMENTAL SET-UP

A cage of six portion was used as housing (pen) for the rearing of those experimental animal (birds). Thirty day old broiler was purchased from reputable agro-live stock shop at Sawmill Sawmill Sango Shopping Complex Ilorin, Kwara state. Those birds (Doc) were given normal special treatment, right from administration of anti-stress (glucose) for the first day right from time of their arrival and anti-chick with multivitamin was administered from second day for the rest of the days. At arrival, the birds were found to terminate Gumboro Vaccine, it follows by Infectual Gamboro and Lasota at interval of seven days with the same quantity of feed and supplied, all hygienic management was carried out on the first three days to make the birds relaxed, administration of feed commenced.

Although on the day of arrival initial body weight was taken and recorded for further studies, the second week onward (B.W.G) body weight was determined to know if there was difference in weight against initial weight. Since the experiment is to determine the effect of quantity of feeds

on the weight gained and the weight gained difference was determined every seven days interval for exactly five weeks.

3.4 EXPERIMENTAL BIRDS BODY WEIGHT DETERMINATION

At the point of second week of equal treatment given to those experimental birds the average body weight was used to determine the percentage of feed to be supplied to each

set of birds.

The percentage body weight–feed treatments are 4%, 6%, and 8% respectively of a set of 6 birds there were used to determine quantity of feed supplied in gram.

Table 1. Result of proximate analysis done for the chicken feed

Table 1: Result of Proximate Analysis done for the Chicken Feed

S/NO.	Simple Identity	% CHO	% Lipid	% Protein	% Moisture	% Ash	% Fibre
1	FEED SAMPLE	46.84	16.60	20.13	9.77	3.3	3.6

TABLE 2: The Weight of Birds During the Weeks of Study

WEEK / GROUP	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
INITIAL WEIGHT	452.5 ± 28.60	595 ± 14.32	447.6 ± 59.30	448.2 ± 34.70	476.6 ± 15.41
WEEK 1	549.4 ± 33.61	617.2 ± 11.83	518.4 ± 76.03	575.6 ± 27.56	551.2 ± 24.78
WEEK 2	721.6 ± 51.19	773 ± 33.34	633.2 ± 96.73	668.8 ± 98.65	680.2 ± 35.54
WEEK 3	1101.6 ± 64.70	1142 ± 58.41	901.2 ± 50.11	898.6 ± 75.21	975.4 ± 68.84

WEEK 4	1522 ± 133.37	1578 ± 85.66	1276 ± 194.900	1250.8 ± 199.29	1283 ± 54.45

MEAN ± SEM N=5 P<0.05

TABLE 3, THE FEED CONVERSATION RATIO DURING THE WEEK OF THE STUDY

WEEK / GROUP	WEEK 1	WEEK 2	WEEK 3	WEEK 4
Group 1 (ad libitum)	4.501440329	2.932636469	1.97	2.091817317
Group 2 (95%)	2.962566845	2.897504236	1.080704607	1.952010969
Group 3 (90%)	4.149717514	3.37456446	2.282089552	2.159018143
Group 4 (85%)	2.357927786	3.736051502	2.532637076	2.158102767
Group 5 (80%)	3.793565684	2.43875969	1.89498645	2.33810143

Table 4: Feed Consumption of Groups during the weeks of the study

WEEK / GROUP	WEEK 1	WEEK 2	WEEK 3	WEEK 4	TOTAL
Group 1 (ad-libidum)	1969	2525	3743	5397	12634
Group 2 (95%)	1662	2257	3334	4271	11524
Group 3 (90%)	1469	1987	3058	4046	10510
Group 4 (85%)	1502	1741	2910	3822	9975
Group 5 (80%)	1415	1573	2997	3596	9331
Total	**8017**	**10033**	**15842**	**20132**	**54224**

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 THE RESULT OF THE WEIGHT GAIN OF THE CHICKEN

within the period of study shows that there was a gradual increase in weight for all the chicken. As seen in Table 2, Group 1 had a total weight of 15.02 ± 1.33; 2.77 ± 2.85(0), and from by week 4 their weight was 15.02 ± 1.33; 3.77, and by week 4 they weighed 15.47 ± 5.61g. Group 3 whose initial weight was 0.47 ± 1.85(0.89) and by week 4 they weighed 12.84 ± 1.49(0.99), Group 4 birds had

12.09 and 10.50 ± 1.59. 14.79 was recorded in week 4. Group 5 total weight was 15.45 ± 1.59 and lowest at 5.4(4.9) was recorded.

4.2 RESULT OBTAINED FOR THE the FEED CONVERSION RATIO FOR THE BIRDS CHICKEN

shows a serious reduction in the feed conversion ratio (Table 3).

Group 1 had a feed conversion of 4.05 in week 1 and 2.09 in week 4. Group 2 with 2.95 in week 1 had a conversion rate of 2.16 in week 4.

Group 3 had conversion rate of 9.16 in week 1 and then 1.95 in week 4.

Group 4 with 9.7 in week 1 had feed conversion rate of 4.15 in week 1 and then 2.11 in week 4. Group 4 with an 8.5% fed chicken had feed conversion rate of 2.38 at 2.16 in week 1. Group 5 with 5.60 in week 1 had a feed conversion rate of 3.57 in week 1 and 0.34 in week 4.

4.3 BASED ON THE FEED CONSUMPTION DURING THE STUDY PERIOD

there was a progressive increase in the amount of feed consumption. Group 1 had a feed consumption of 1989g in week 1 and 4327g in week 4.

Group 2 feed consumption moved from initial value of 1662g in week 1, to 4721g in week 4.

Group 3 feed consumption was 1499g in week 1 and 4271g by week 4.

Group 4 feed consumption was 1503g in week 1 and 3322g in week 4.

Group 5 feed consumption was 1475g in week 1 and 3366g in week 4. The rapid and steady increase in feed consumption can be said to be as a result of the increase in body mass and the demand to maintain it (Table 3).

The research result showed significant insights into the impact of different levels of ad-libitum feeding restriction on growth performance and feed efficiency in broiler chickens. The study centered on weight gain, feed conversion ratio (FCR) and feed consumption. Group 2 with 15% ad-libitum feeding restriction recorded the highest weight gain of 15.47 ± 5.61g in week 4 and also maintained the highest weight gain compared to other groups which had lesser weight gain under ad-libitum access. Restricted access to feed typically curtails energy intake and reduces fat accumulation, hence the severity of the feed restriction.

The result is consistent with previous research findings carried out by (Aliyu, S.S., Caiya A., Zhao X.A., Ma W, Jin H, Ren R, Ao Q, Zhao, 2021) and (Zubair, Coot et al.) Emphasizing the positive relationship between restricted feeding and gain in broilers as a result of compensated growth effect exercised by the chicken where the energy required for maintenance is being diverted to growth as a result of the fact that compensatory growth has been attributed to an improved feed conversion ratio. (FCR)

The result indicates undoubtedly that at least some percentage of restrictive feeding (i.e. Group 2 – Group 5) displayed lower feed value when compared to the control group (Group 1). This finding corroborates with the studies by (Kikukawa, Nobumasa, Akimoto M., Chinenye M., Nitchiren N. (2009) and Dissanayake, DAMOLL S. (2017)) suggesting that controlled feed restriction can enhance feed efficiency in broilers. The observed lower FCR value during limited nature of ad-libitum feeding in the groups subjected to some degree of feed restriction.

The data further reveal that Group 1 (the control with unrestricted access to feed) consumed more than other group subjected to varying degrees of feed restriction. This aligns with the understanding that reduced access to feed consumes less than other groups subjected to varying degree of feed restriction. This aligns with the principle that broilers with ad-libitum access tend to consume more feed. Similar trends have been observed in studies by (Bowenlynn R, R. Hughes, R.J., Lawer, S.P, and J.P. Cox) and (Canerio, B, Cunedo R., Branudo, Alarcon M., Bellasissa, G., Fadila G., Matar M. (2021), Group 1) emphasizing the notion that feed restriction can lead to reduced feed consumption.

The research highlights the beneficial relationship between growth performance and ad-libitum feeding as supported by the greater weight increase in the control.

Group five was supported by the findings of [Van der Helens, Salem, F., Kettlewell, R., and Zuidhof M. (2016) and Zuidhof, M., Schneider, B., Carney, V.C., Korver, D.R., and Robinson, F.E. (2007)].

Increased feed intake particularly in broiler farms undermines the high FCR in a group that underwent feed restriction.

Some degree of feed limitation is consistent with the body of research supporting the advantage of regulated feed intake in terms of improving nutrient utilization and overall performance.