FUDMA Journal of Agriculture and Agricultural Technology
ISSN: 2504-9496
Vol. 11 No. 2, June 2025 Special Issue: Pp.165-169

https://doi.org/10.33003/jaat.2025.1102.020

# EFFECT OF PRE-SLAUGHTER FEED WITHDRAWAL ON COCKEREL CARCASS CHARACTERISTICS AND CHEMICAL PROPERTIES

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## ABSTRACT

This study investigated the effect of pre-slaughter feed withdrawal on live weight loss and carcass characteristics in cockerels. Twenty-five (25) cockerels were randomly assigned to five treatment groups (n=5 per group) subjected to feed withdrawal periods of 0, 6, 12, 18, and 24 hours. Live weight significantly decreased ($p<0.05$) from an initial average of 1307g to 1011g after 24 hours of feed withdrawal. Estimated live weight losses were 116g, 101.36g, and 62.12g at 6, 12, and 18 hours of fasting, respectively. Sensory evaluation revealed that meat from the 24-hour feed-withdrawn group exhibited superior tenderness and texture. However, meat from the 12-hour withdrawal group was deemed most acceptable by the sensory panel. Feed withdrawal did not significantly influence meat colour or flavour. The findings suggest that pre-slaughter feed withdrawal does not severely impact overall cockerel carcass yield and dressing percentage. While longer withdrawal periods resulted in more tender meat with improved texture, a pre-slaughter feed withdrawal exceeding 12 hours is not recommended due to significant live weight loss and potential economic implications for producers.

**KEYWORDS:** Carcass, Cockerels, *Dambu,* Feed Withdrawal

## INTRODUCTION

Pre-slaughter feed withdrawal, a common practice in poultry processing, involves the removal of feed from birds for a specific period prior to slaughter (Smith and Jones, 2018). This practice is recognized as a critical factor influencing both meat yield and quality attributes (Mead, 2004). Beyond its impact on carcass characteristics, feed withdrawal is primarily implemented to mitigate the risk of faecal contamination during slaughter and evisceration. An emptied intestinal tract significantly reduces the potential for microbial transfer to the carcass, thereby enhancing food safety (Beyni & Habi, 1998; Barnes et al., 2003).

Furthermore, the duration of pre-slaughter feed withdrawal has been reported to influence the sensory quality of the final poultry product. Schedle et al. (2006) observed that controlled feed withdrawal can positively affect meat tenderness and texture. The rationale behind this lies in the physiological changes occurring during fasting, such as glycogen depletion and altered muscle metabolism, which can impact post-mortem muscle acidification and protein denaturation (Le Bihan et al., 2001).

Beyond processing advantages, feed restriction, a related concept often employed during the rearing period, has been shown to modify broiler behavior and physiology. Studies suggest that restricted feeding can increase activity levels and potentially decrease body fat deposition (Zuidhof et al., 2003). Moreover, maintaining lower live body weights through feed management strategies has been associated with a reduced incidence of certain health issues in poultry, such as flip-over syndrome and leg disorders (Julian, 1998). The physiological responses to pre-slaughter feed withdrawal, however, are distinct from long-term feed restriction regimes and warrant specific investigation in the context of immediate pre-slaughter conditions.

While existing literature highlights the effects of varying feed withdrawal periods on carcass yield, microbial contamination, and sensory attributes, a comprehensive understanding of its impact on specific chemical properties, such as fat and protein content, alongside organoleptic characteristics in cockerels is still evolving. Therefore, this study aimed to investigate the effect of a 24-hour pre-slaughter feed withdrawal period on the carcass characteristics, chemical composition (specifically fat and protein content), and organoleptic properties of ready-to-eat meat prepared from 12-14 weeks-old cockerels. This research contributes to the existing knowledge base by providing specific insights into the consequences of a defined feed withdrawal duration on these key quality parameters in cockerels.

## MATERIALS AND METHODS

### Study Location and Experimental Animals

The study was conducted at the Animal Science Laboratory of Bayero University, Kano, Nigeria (longitude 11°58.657” North, latitude 8°25.746” East, elevation 468m above sea level) Muhammad, I. R., and Aluwong, T. (2021). The geographical location of Kano State falls within the Sudan Savannah Zone, bordering the Guinea Savannah to the south (Olofin & Tanko, 1985). Twenty-five (**n = 25**) apparently healthy **eight-week-old** Isa Brown cockerels with a mean initial body weight of 1307 ± 57 g were procured from a commercial hatchery. Birds were acclimatised for 7 days with ad libitum access to feed and water.

### Experimental Design and Treatments

The twenty-five (25) cockerels were randomly assigned to five treatment groups (n=5 per group) in a completely randomized design (CRD) to evaluate the effect of varying pre-slaughter feed withdrawal periods. The treatment groups were as follows:

- **T1:** 0-hour feed withdrawal (birds slaughtered immediately).
- **T2:** 6 hours feed withdrawal (birds selected and fasted for 6 hours prior to slaughter).
- **T3:** 12 hours feed withdrawal (birds selected and fasted for 12 hours prior to slaughter).
- **T4:** 18 hours feed withdrawal (birds selected and fasted for 18 hours prior to slaughter).
- **T5:** 24 hours feed withdrawal (birds selected and fasted for 24 hours prior to slaughter).

Feed was withdrawn for the designated period for each treatment group, while fresh water was provided ad libitum throughout the withdrawal period.

**Data Collection**

**Live Weight Measurement** The initial live weight of each individual bird was recorded using a digital weighing balance (± 0.1g) prior to the commencement of the feed withdrawal treatments. Subsequently, the live weight of the birds in each treatment group was recorded again immediately before slaughter.

**Slaughter Procedure and Carcass Characteristics** Birds from each treatment group were humanely slaughtered according to standard procedures. Birds were immobilized and bled via a ventral neck incision using a sharp knife, allowing for complete blood drainage. The bled weight (g) was recorded immediately after exsanguination. Following bleeding, carcasses were scalded in hot water (60-65°C) for a predetermined duration (15-20) minutes to facilitate feather removal. De-feathering was performed manually, and the de-feathered weight (g) was recorded. Internal organs were then carefully excised, and the weight of each organ (g) was recorded. The relative weight of each organ was calculated as a percentage of the final live weight. After the removal of the head and feet at the hock and carpal joints, respectively, the hot carcass weight (g) was obtained. Dressing percentage was calculated using the formula:

$$\text{Dressing (\%)} = \frac{\text{Hot Carcass Weight (g)}}{\text{Final Live Weight (g)}} \times 100$$

**Sensory Evaluation:**

A portion of the breast meat from each treatment group was processed into a traditional ready-to-eat meat product ("dambu") using a standardized recipe and consistent ingredient levels, as previously described by Sodangi (1998). Sensory evaluation of the "dambu" samples was conducted on the 7th day after storage at 4°C. A panel of seven (7) trained assessors (4 males and 3 females) was selected and trained according to the guidelines of the British Standard Institution (BSI, 1993) to evaluate the sensory characteristics of the samples. A nine (9)-point hedonic scale, ranging from 1 (extremely bad) to 9 (excellent), was used to assess attributes such as tenderness, texture, colour, and flavour.

**Statistical Analysis**

Data on live weight, carcass characteristics, chemical composition, and sensory attributes were analysed using one-way analysis of variance (ANOVA) in SAS software (SAS, 2000). Where significant differences were detected ($p < 0.05$), Duncan's Multiple Range Test (DMRT) was applied to separate treatment means into statistically distinct subsets.

## RESULTS AND DISCUSSION

**Carcass Characteristics and Live Weight Loss**

Pre-slaughter feed withdrawal elicited a significant ($p < 0.05$) decline in live weight (LW) of cockerels, with the most pronounced reduction (116.58 g) observed within the first 6 hours (Table 1). By the 24th hour, the LW had dropped from a baseline average of 1307 g to 1011 g, consistent with the observations of Buhr et al. (1994), who reported a 7.4-9.5% decrease in broilers after 24 hours of fasting. The rapid weight loss within the early hours is likely due to gastrointestinal tract evacuation (Lyon et al., 1991). Prolonged fasting beyond 12 hours appeared to contribute to soft tissue catabolism, as indicated by the reductions in thigh muscle (44 g), wing mass (5.22 g), and bone weight (27.32 g), suggestive of dehydration and proteolytic breakdown (Lawrie, 1998).

Interestingly, the dressing percentage (DP) showed an apparent increase at 12 hours (Table 1), which may be attributed to a disproportionate loss of visceral and gut content relative to carcass tissues. This observation diverges from the findings of Trampel et al. (2005), who noted a 22% reduction in liver weight following similar withdrawal periods. Despite reductions in LW, DP remained stable, implying that meat yield is relatively unaffected by fasting a potentially favourable outcome for producers aiming to improve carcass cleanliness without compromising yield (Northcutt, 2010).

**Internal Organs and Gut Content**

Feed deprivation affected internal organs in a non-uniform manner (Table 2). Although liver weight varied across treatments, it did not exhibit a consistent decline as previously reported by Trampel et al. (2005). Lung weight decreased significantly ($p < 0.05$), while the heart and kidneys showed no statistical changes. A marked reduction in intestinal contents (IWC) was observed, falling from 74.3 g at 0 hours to 44.56 g at 24 hours ($p < 0.001$), affirming the role of gut evacuation in early weight loss (Barnes et al., 2003). Similarly, the spleen exhibited significant weight reduction, suggesting systemic metabolic alterations triggered by fasting stress.

These findings reflect a two-phase physiological response to feed withdrawal: an initial rapid purge of gastrointestinal mass followed by gradual catabolism of soft tissues and organs. The preservation of critical organ weights (e.g., heart, kidneys) may indicate metabolic prioritization of essential functions, in agreement with Lawrie's (1998) assertion that short-term nutrient deprivation primarily targets labile energy stores such as glycogen and tissue fluids.

**Carcass Organs and Tissue Composition**

Weights of carcass-associated organs—including thighs, wings, back, bones, and skin—declined progressively with increased fasting duration (Table 3), reinforcing the role of tissue catabolism and fluid loss (Lawrie, 1998). The thigh muscle experienced a 14.5 g reduction at 24 hours compared to the control, while skin weight decreased by 6.9 g ($p < 0.01$). Though these losses may impact gross meat yield, they may also facilitate cleaner processing by lowering the proportion of non-edible mass (Schedle et al., 2006).

Unexpectedly, an increase of 11.48 g was recorded in thigh bone weight after 24 hours. This may reflect a relative increase in bone proportion due to soft tissue loss rather than true mass gain, illustrating how different tissues respond variably to acute nutritional stress.

**Sensory Evaluation**

The 12-hour feed withdrawal group received the highest overall acceptability ratings ($p < 0.05$), while the 24-hour group exhibited superior tenderness (score: 7.57) and texture (7.28) (Table 4). These results corroborate the work of Schedle et al. (2006), who noted that extended feed withdrawal improves meat tenderness, likely due to post-mortem glycogen depletion and resultant pH shifts. However, while tenderness and texture improved with duration, the 12-hour period offered a more optimal balance between sensory appeal and minimal economic losses due to live weight reduction.

## CONCLUSION

Pre-slaughter feed withdrawal significantly affects cockerel live weight and certain carcass components. While dressing percentage remains stable or trends upwards after 12 hours, extended fasting leads to considerable live weight loss primarily due to gut evacuation and soft tissue catabolism. Internal organ weights, particularly lungs and spleen, respond variably, indicating physiological adaptations. Sensory evaluation shows that while a 24-hour withdrawal yields the most tender meat, the 12-hour period results in the most acceptable overall quality. Thus, a 12-hour pre-slaughter feed withdrawal is recommended to balance meat quality and economic viability for producers.

**Recommendations for Future Research**

Future studies should validate these findings across diverse management systems and larger populations. Investigating the effects of feed withdrawal beyond 24 hours on physiology and economics is essential. Research should also explore biochemical markers of stress and metabolism during fasting. Additionally, comparisons between different chicken genotypes and the impact of feed withdrawal on gut microbiota and carcass contamination are vital. Finally, comprehensive economic modeling, considering market weight loss and potential meat quality premiums, would aid producer decision-making**.**

Table 1: Effect of Pre-Slaughter Feed Withdrawal on Live Weight and Carcass Yield Parameters in Cockerels

| Parameters | Feed withdrawal time (hrs) | | | | | |
|---|---|---|---|---|---|---|
| | T1 (0hr) | T2 (6hr) | T3 (12hr) | T4 (18hr) | T5 (24hr) | P. values |
| IW (g) | 1307.56±56.89 | 1202.56±30.12 | 1300.16±23.00 | 1011.16±65.19 | 1206.56±25.00 | NS |
| LW (g) | 1307.56±56.89 | 1190.98±38.98 | 1174.48±36.06 | 1073.12±7.67 | 1011.00±7.02 | ** |
| CW (g) | 801.30±46.85 | 711.38±37.64 | 719.98±64.73 | 748.40±17.60 | 688.60±25.07 | NS |
| DP (%) | 83.78±21.92 | 59.82±2.59 | 54.54±5.70 | 68.92±1.34 | 67.20±2.15 | ** |
| BW (g) | 1262.60±56.03 | 1075.12±44.95 | 1045.56±27.28 | 1072.70±39.99 | 997.6±4.10 | ** |
| DFW (g) | 115.96±55.30 | 997.82±42.07 | 1050.42±67.02 | 978.28±4.22 | 1035.08±60.12 | ** |

Note: IW = Initial Weight, LW = Live Weight, CW = Carcass Weight, DP = Dressing Percentage, BW = Blend Weight, DFW = De-feathered weight. Values are expressed as Mean ± SEM. Values in the same row with different superscripts differ significantly at p < 0.05 according to Duncan's Multiple Range Test. T1–T5 represent 0, 6, 12, 18, and 24 hours of feed withdrawal, respectively.

**Table 2: Changes in Internal Organ Weights of Cockerels Due to Varying Feed Withdrawal Durations**

| Organs | Feed withdrawal time (hrs.) × | | | | | |
|---|---|---|---|---|---|---|
| | T1 (0hr) | T2 (6hr) | T3 (12hr) | T4 (18hr) | T5 (24hr) | P. values |
| Liver (g) | 98.90±66.92 | 24.36±1.44 | 23.52±0.39 | 25.16±1.39 | 29.02±0.91 | NS |
| Heart (g) | 7.10±0.29 | 7.44±1.01 | 5.74±0.50 | 6.07±0.38 | 6.68±0.49 | NS |
| Lungs (g) | 9.20±0.84 | 6.74±0.62 | $8.48{\pm}0.44^{b}$ | 7.98±0.34 | 7.56±0.18 | ** |
| Kidney (g) | 7.00±1.37 | 7.26±0.72 | 7.30±0.67 | 6.22±0.28 | 6.72±0.42 | NS |
| IWC (g) | 74.30±6.33 | 60.38±2.14 | $57.48{\pm}1.30^{b}$ | 54.70±1.61 | 44.56±2.15 | ** |

**Note:** Values are expressed as Mean ± SEM. Values in the same row with different superscripts differ significantly at p < 0.05 according to Duncan's Multiple Range Test. T1–T5 represent 0, 6, 12, 18, and 24 hours of feed withdrawal, respectively.

**Table 3: Carcass Component Weights (Muscle, Skin, Bone) of Cockerels Following Feed Withdrawal**

| Organs | Feed withdrawal time (hrs) × 6 | | | | | |
|---|---|---|---|---|---|---|
| | T1 (0hr) | T2 (6hr) | T3 (12hr) | T4 (18hr) | T5 (24hr) | P. values |
| Thigh Muscle (g) | 58.50±1.37 | 52.30±3.60 | 49.20±4.80 | 46.00±17.60 | 44.00±13.37 | ** |
| Wings (g) | 7.30±6.33 | 6.50±2.59 | 6.00±2.15 | 5.50±1.60 | 5.22±2.15 | ** |
| Back (g) | 59.00±1.39 | 53.80±5.38 | 50.00±6.33 | 47.00±75.56 | 45.72±20.19 | ** |
| Skin (g) | 28.00±0.38 | 25.50±2.15 | 23.80±2.59 | 22.00±17.7 | 21.10±1.39 | ** |
| Spleen (g) | 2.60±1.39 | 2.30±0.84 | 2.10±6.33 | 1.80±10.07 | 1.60±0.84 | *** |
| Gut Content (g) | 74.30±2.59 | 60.38±17.6 | 57.48±0.38 | 54.70±17.60 | 44.56±2.59 | *** |

**Note:** Values are expressed as Mean ± SEM. Values in the same row with different superscripts differ significantly at $p < 0.05$ according to Duncan's Multiple Range Test. T1–T5 represent 0, 6, 12, 18, and 24 hours of feed withdrawal, respectively.

**Table 4: Sensory Evaluation Scores for Ready-to-Eat "Dambu" Prepared from Cockerels Subjected to Feed Withdrawal**

| Organoleptic properties | Feed withdrawal time (hrs.) | | | | | |
|---|---|---|---|---|---|---|
| | T1 (0hr) | T2 (6hr) | T3 (12hr) | T4 (18hr) | T5 (24hr) | P. values |
| Acceptability | 6.29±1.95 | 5.86±07.6 | 8.29±17.89 | 6.43±6.33 | 7.00±6.33 | ** |
| Colour | 6.29±1.63 | 6.72±1.12 | 5.86±1.64 | 6.72±13.56 | 6.43±1.67 | NS |
| Texture | 5.72±1.60 | 5.29±1.98 | 6.86±1.26 | 6.57±1.22 | 7.28±0.96 | ** |
| Flavour | 6.29±1.69 | 6.29±1.67 | 7.14±1.16 | 7.29±1.62 | 6.86±1.00 | NS |
| Tenderness | 5.71±0.33 | 5.00±2.5 | 6.29±1.56 | 5.89±1.17 | 7.57±0.97 | ** |

**Note:** Values are expressed as Mean ± SEM. Values in the same row with different superscripts differ significantly at $p < 0.05$ according to Duncan's Multiple Range Test. T1–T5 represent 0, 6, 12, 18, and 24 hours of feed withdrawal, respectively.

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