International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

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Growth and gross margin of broiler starter chicks fed graded levels of watermelon peel meal as a substitute for wheat offal

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International Journal of Science and Research Archive, 2024, 11(01), 1172–1177

Publication history: Received on 21 December 2023; revised on 29 January 2024; accepted on 01 February 2024

Article DOI: https://doi.org/10.30574/ijsra.2024.11.1.0173

Abstract

The performance of broiler chicks fed graded levels of watermelon peel meals as a substitute for wheat offal was investigated using ninety-six 1-day old Amo broiler chicks. They were allotted to four dietary treatments with each having three replicates and 8 birds per replicate in a completely randomized design (CRD). The experiment diets contained 0.0, 1.25, 2.5 and 3.75% dried watermelon and coded as $DWMP_{0.0}$, $DWMP_{1.25}$, $DWMP_{2.5}$ and $DWMP_{3.75}$. Ninety-six (96) two-weeks old chicks were randomly assigned into four (4) dietary treatments, each having twenty-four (24) birds, and replicated three (3) times in a completely randomized design (CRD). The experimental diets contained 0.0, 1.25, 2.5 and 3.75% dried watermelon peels meal and coded as $DWMP_{0.0}$, $DWMP_{1.25}$, $DWMP_{2.5}$ and $DWMP_{3.75}$. Results obtained shows no significance ($P>0.05$) difference in all the growth and economic parameters evaluated. Feed intake and weight gain which are indicators of growth were better in birds fed diets containing 2.5 and 3.75% watermelon peels. Gross margin analysis reveals that it is more economical to feed starter broilers with up to 3.75% DWMP. In conclusion, starter broiler chicks can be conveniently fed DWMP up to 3.75% for better growth and cost effective broiler production.

Keywords: Watermelon; Growth; Gross margin; Broiler

1. Introduction

The search for alternative energy sources for poultry feeding is continuous due to increase in human population and the use of cereals especially maize as a source of energy. This has led to keen competition among human, animals and industry with animals at disadvantage. Fruit-wastes have been identified as alternative feedstuffs and can form a major source of energy in animal feed [1]. One of the fruit wastes are watermelon peels. Watermelon (*Citrullus lanatus*) consists of 12.25% crude protein and metabolizable energy of about 2800Kcal/Kg [2]. Information on the use of watermelon peel meal in broiler diet as a substitute for wheat offal is yet to be reported in the study area. This forms the basis of this study.

Watermelon (*Citrullus lanatus*) which belongs to the family Cucurbitaceae is widely grown in many parts of Nigeria. The plant which grows fast (80-120 days) is mainly cultivated for the fruit while the peels become waste after processing of juice or used to produce bioethanol fuel [3]. Thus, there is guarantee of watermelon peels' availability throughout the year. Watermelon peel meal has high fibre(30%) content with many vitamins and minerals [4]; [5]. It is also rich in *citrulline* and *lycopene* which improve the digestive tract, urinary tract infections and reduced rectal temperature of broilers [6]. Hence, the study aimed to evaluate the inclusion effects of watermelon peel meal levels as substitute to wheat offal in diets of starter birds.

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2. Material and methods

2.1. Experimental Location

This experiment was conducted at the poultry research unit of department of agricultural education, Adau Augie College of Education Argungu, Kebbi State, Nigeria. Argungu is geographically within latitude 12°43'59.99"N of the equator and longitude 4°30'59.99"E of the greenwich meridian. Argungu is a mid-size place in the region of Kebbi in Nigeria with a population of approximately 47.067 inhabitants [7].

2.2. Experimental Material Source

The fresh watermelon peels were collected free of charge from Argungu market. The fresh peels were scraped, cut, sliced and air-drying under shade within Laboratory complex of Faculty of Agriculture for 4 days and ground into powder using pestle and mortar prior to diet formulation.

2.3. Experimental Birds, Diets and Design

Ninety-six (96) 2-weeks old chicks were used for this research. The birds were randomly assigned into four (4) dietary treatments, each having twenty-four (24) birds, and replicated three (3) times in a completely randomized design (CRD). The experiment diets contained 0.0, 1.25, 2.5 and 3.75% dried watermelon and coded as $DWMP_{0.0}$, $DWMP_{1.25}$, $DWMP_{2.5}$ and $DWMP_{3.75}$. DWPM inclusion in the experimental diets is shown in the table 1.

Table 1 Experimental diet for broiler starter chickens

Ingredients	**Inclusion Levels (%)**			
	DWMP0.0	**DWMP1.25**	**DWMP2.5**	**DWMP3.75**
Maize	50.71	50.67	50.54	50.95
GNC	35.79	35.83	35.96	35.55
Wheat offal	5.00	3.75	2.50	1.25
WPM	0.00	1.25	2.50	3.75
Blood meal	3.50	3.50	3.50	3.50
Bone meal	1.00	1.00	1.00	1.00
Limestone	2.00	2.00	2.00	2.00
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated value				
CP (%)	24.25.	24.07	23.92	23.48
ME (Kcal/kg)	2808.24	2792.12	2274.92	2763.3
CF (%)	3.47	3.36	3.22	3.10
EE (%)	5.59	5.74	5.46	5.37
Calcium (%)	0.37	0.33	0.33	0.32
Phosphorus (%)	0.47	0.73	0.46	0.45

KEY: WPM=watermelon peels meal, CP=crude protein, ME=metabolizable energy, CF=crude fibre, EE=ether extract

2.4. Growth Performance

The daily feed intake was obtained by subtracting the left-over from total amount of feed supplied. Each bird was weigh at the beginning of the experiment and weekly thereafter to obtain the weekly and daily weight gain throughout the experimental period. The feed conversion ratio was calculated as the feed intake per unit weight gain.

2.5. Gross Margin Analysis

To determine the economic utilization of WPM, feed cost/Kg would be calculated as the total cost of feeds (N) divided by total weight of feed (Kg). Whereas feed cost/weight gain would be calculated using the below formula:

$$Feed\ cost\ = \frac{Total\ feed\ intake\ (Kg) \times feed\ cost/Kg}{Total\ weight\ gain\ (Kg)} \times 100$$

2.6. Statistical Analysis

Data collected on growth performance and carcass characteristics were subjected to analysis of variance (ANOVA) using SPSS. Means separation was carried out using Least Significant Difference (LSD) [8].

3. Results and discussion

3.1. Growth Performance of Broiler Starter Birds

Table 2 Growth performance of the starter broiler chickens fed varying inclusion levels of DWMP diets. The results obtained shows no significance (P>0.05) difference in all the growth parameters evaluated across treatments

Parameters	**Treatments**				
	$DWMP_{0.0}$	**$DWMP_{1.25}$**	**$DWMP_{2.5}$**	**$DWMP_{3.75}$**	**SEM**
Initial weight (g/b)	111.12	104.17	104.17	104.17	4.34
Final weight (g/b)	286.28	458.33	307.84	311.11	9.01
Total feed intake (g/b)	455.10	414.10	436.67	463.33	52.23
Daily feed intake (g/b)	59.27	65.01	62.38	66.20	7.46
Body weight gain (g/b)	2200.00	3000.00	2733.33	3100.00	578.31
FCR (g feed g-1 gain)	3.89	1.86	1.98	1.82	1.034
Mortality (%)	71.00	49.67	71.00	75.00	14.780

3.2. Feed Consumption

In this study, the feed intake of the treatment groups was not significant (P>0.05). This observation is similar with the result obtained by [2] who observed no significant difference on feed intake of albino rats fed varying levels of DWMP. The results however showed that birds fed varying levels of DWMP consumed more feed compared to control diet. The higher feed intake observed on birds fed watermelon based diets could be due to higher fibre and lower energy level of the watermelon peels and birds eat to satisfy their energy needs [9].

3.3. Body Weight Gain

There was no significant (P>0.05) difference on body weight gain at starter phase. This observation is in line with result obtained by [2] who observed no significant difference on body weight gain of starter broilers fed varying levels of DWMP. It is also similar to the result of [10] who reported no significance difference on body weight gain of weaner rabbit fed varying levels of DWMP. Birds fed $DWMP_{1.25}$ and $DWMP_{3.75}$ had the highest weight which did not differ significantly (P>0.05) from the other treatments. This can be attributed to the relatively higher feed consumption, since this is a major determinant of feed conversion ratio and body weight gain of meat-type poultry [9].

3.4. Feed Conversion Ration

The lower body weight gain recorded in the birds fed $DWMP_{0.0}$ and $DWMP_{2.5}$ could be associated with poor feed conversion ratio (FCR). The better FCR observed in birds fed varying levels of DWMP compared to control diet suggests the ability of the birds to utilize available nutrients in the feed. The report of [2] supports the findings of this study, implying that birds fed varying levels of DWMP had better FCR than the control.

3.5. Mortality

The lower mortality was observed on birds fed $DWMP_{1.25}$ while a higher value of 75% was recorded on the birds fed $DWMP_{3.75}$. The mortality of the groups fed $DWMP_{0.0}$ and $DWMP_{2.5}$ were also similar (Table 2). The mortality could not be blamed on the DWMP diet as the inclusion level is very low.

3.6. Cost Benefit Analysis

The cost of inclusion watermelon peels in starter broilers diets is presented in Table 3. Results showed no significant ($P>0.05$) difference on feed cost, cost of feed consumed, cost of feed per Kg weight gain, cost of total revenue and gross margin.

Table 3 Cost analysis of starter broiler birds fed diets containing graded levels of DWMP

Parameters (₦)	**Treatments**				
	$DWMP_{0.0}$	**$DWMP_{1.25}$**	**$DWMP_{2.5}$**	**$DWMP_{3.75}$**	**SEM**
Cost of feed	4637.00	4379.00	3758.00	3692.00	1.967
Cost of feed consumed	45441.00	41986.33	36569.00	30159.00	1.000
Cost of feed per Kg Weight Gain	3.10	5.23	5.50	4.87	0.961
Cost of total revenue	7300.00	8250.00	8516.67	4650.00	0.886
Gross margin	29627.33	24027.00	34495.67	41151.00	?

3.6.1. Cost of feed

Result of the present study indicated that higher cost of feed was obtained in $DWMP_{0.0}$ (Table 3). This finding is in line with the report of [11] who stated that cost feed account for about 70% of the total cost of poultry production out of which 95% is used to meet the requirement for the main ingredients supplying energy and protein. However, cost per kg feed reduced as the dietary inclusion level of DWMP increased. This could be due to cheaper cost of test ingredient (watermelon peels) than wheat offal. [12] reported that the inclusion of unconventional feedstuffs in starter broiler diets minimizes cost of production.

3.6.2. Cost of feed consumed

From the result (Table 3) obtained, birds fed control diet consumed high feed worth ₦45441.00, while those fed DWMP at 3.75% consumed least feed values of ₦30159.00.

3.6.3. Cost of feed per Kg weight gain

The cost of production of 1 kg of starter broiler was cheaper with watermelon peel based diets when compared with the wheat offal based control diet (Table 2). Similarly, the result showed that feed cost per kg weight gain was highest in bird fed DWMP at 2.5% and lowest in control diet. Feed cost per kg weight gain increased with increase in FCR, which agree with that of Onu et al. (2016) who reported that increased in FCR increased feed cost per Kg weight gain.

3.7. Total Revenue

The total revenue generated was highest for the chickens served $DWMP_{2.5}$ (₦8616.67). Revenue obtained from the sale of all birds stood at ₦28716.667 chickens.

3.8. Gross Margin

The highest gross margin was obtained in $DWMP_{3.75}$. This did not differ ($P>0.05$) from $DWPM_{0.0}$, $DWMP_{1.25}$ and $DWMP_{2.5}$. This is attributed to the low cost of watermelon peels and to the high energy contributed by the peels.

4. Conclusion

It can be concluded that DWMP can be included up to 3.75% in the diets of starter broiler birds, replacing 75% of wheat offal, without affecting feed intake, weight gain, feed conversion ratio and economic characteristics; and reducing the cost of feed.

Compliance with ethical standards

Acknowledgement

We will like to acknowledge the management and staff of the department of Agricultural Education, Adamu Augie College of Education Argungu for permission to use the poultry house, equipments and facilities to conduct the research. We will also like to acknowledge watermelon and poultry marketers in Argungu market for permission to buy and use the product.

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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Authors short profile

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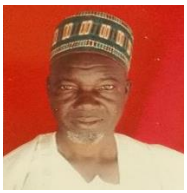	**Haruna Argungu Musa** Chief lecturer also head of the Department of Agricultural Education, Adamu Augie College of Education Argungu, Kebbi State, Nigeria. I study bachelor of agriculture (B. Agriculture) Usmanu Danfodiyo University Sokoto, Nigeria and masters of agriculture (M.Sc. Animal Forestry) at University of Ibadan, Nigeria. I have presented papers at different academic conferences. I also published many papers with colleaques online. I am a man of integrity, honesty and kindness.
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