Investigation of Usefulness of Food Waste as A Source of Broiler Chicken Feed

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Abstract

The management of food waste is a significant issue in many countries, with a large portion of edible food being discarded instead of being consumed [1]. These wastes, have contributed to the environmental problems [2]. There is a need to find a way of converting this waste into useful materials to overcome the environmental problems[3]. Therefore, this study is designed to convert some food wastes into broiler chicken feed. Food-waste used includes banana and pineapple peels, cray fish wastes, egg shell, and groundnut cake crumbs, were collected at under G area, of LAUTECH, Ogbomoso, Oyo State, Nigeria. Theywere sorted, dried, and ground into fine particle. The wastes was formulated into chicken feed in ratio (3:1:2:2:2), (5:2:1:1:0.5). The commercial feed which contain maize, soy bean meal, palm kernel cake, wheat bran, fish meal,blood meal and oyster shell. Was used as control feed measured by weighing 100g of commercial feed per day. Proximate analysis was carried out for the formulated and controlled samples. The formulated feeds were portioned into two, and the controlled feed was also introduced as the third portion. The broiler chicks were fed and weighed weekly with the control and formulated feed.The level of crude protein(CP), crude fat (CF), ether extracts (EE) and ash content (AC), were observed to be higher than controlled sample.The broiler chicken which were fed with the formulated feed were observed to be more agile, active, and taller, than the controlled chicken, but not as fat as the control broiler chicken. There was no record of mortality from the broiler fed with formulated feed. The carcass yield, which is a critical factor in broiler chickens production for the samples, was found in the range of 81-87%. It can be concluded that the formulated feed from the food waste is a potential chicken feed.

Key words: Food waste; Broiler chicken feed; Proximate analysis

Introduction

The poultry industry in Nigeria – one of its most vibrant agricultural sectors – is on the verge of collapse. As the average price of feed ingredients has risen by over 168% in the last 3 years, some farmers are walking away from their livelihoods as profits drop and security risks remain high [4]. On average, a 25kg of poultry feed [5], made mainly from maize, soybean, wheat, and millet, rose from N3600 in 2019 to between N8500 and N10, 000 in July 2023, according to market surveys by the Centre for Journalism and Innovation Development (CJID) [6]. In order to overcome the problem of high cost of chicken feed problem, food waste has now been considered as a potential source of chicken feed [7, 8]. Food waste has several negative effects on the environment. When food is lost or wasted, all the resources that were used to produce this food - including water, land, energy, labor and capital go to waste [9, 10].

The more the food that rots in landfills, the more methane gases created, which is one of the most harmful greenhouse gases that contributes to global warming and climate change [11].

Food waste generation and its handling has been a global problem for decades and roughly thirty three percent of the edible food produced for human consumption, valued at 1 trillion USD, is wasted. [10]. Food is wasted across all supply chain, such as farms, manufacturers, restaurants and food services and homes.[10], discussed nutrients that can be found in some selected food waste which can adequately replace some expensive poultry feed ingredients. He only stopped at determination of nutrients present in food waste.[12], examined the feasibility of using restaurant food waste such as rice, vegetables e.t.c as chicken feed. It was observed that the food waste is a potential feed for organic chicken.

There are nutritional values in food wastes which are used as poultry feed [13], some of these waste include, cray fish waste meal, egg shell, pineapple peel, banana peel and groundnut cake crumbs [14]. The food wastes typically contain nutrient, proteins carbohydrates and fats [15], also help to reduce green house gas emission.Therefore, this study utilized food waste in producing formulated chicken feed.

Material and Methods

Materials

Food waste collection

The materials used include:- Chicken feeder, Incubator, Lighting, Cage, Drinker Environment control system, Housing, Manure cleaning equipment, Desiccators, Weighing balance. Formulated feeds include: banana peel, pineapple peel, cray fish waste, egg shell, and groundnut cake crumbs. The food waste was collected from local vendors around under G area, Ogbomoso, Oyo State. Nigeria

Methods

The waste was sorted, cleaned, and processed into a uniform feed supplement using a combination of grinding and mixing the food waste [16].

Sample collection

Twenty five(25) day old broiler chickens were purchased for organic chicks breeding test. The chicks were collected at the early hours of the day. The chicks were portion into three, and kept differently in cages.

Preparation of food waste-based chicken feed

The collected food waste was subjected to the following treatment:-

- **Sorting**: The collected food waste was sorted to remove non - edible such as nylon, plastic or metals from the food waste.
- **Washing and heat treatment**: The food waste was washed with clean water and then steamed with hot water to kill microbes that may be present.
- **Chopping:** The food waste was cut or grounded to smaller pieces to make it easier for the chicken to consume.
- **Drying**: The ground food waste was dried to remove moisture content.
- **Formulation**: After pre - treatment, the food waste was mixed together in different form ration to form a balanced chicken meal.

Proximate Analysis

The proximate analysis of the three samples was carried out at the Department of Animal Production and Health laboratory, LadokeAkintola University of Technology, Ogbomoso, Oyo State. Nigeria.

RESULTS AND DICUSSION

Results

The result of proximate analysis of the samples was shown in table 1. Table 2, 3 and 4 shows growth performance for broiler chickens fed with sample A, sample B and control sample respectively. Table 5 and 6 shows the weekly and overall feed conversion rate of the three test group respectively.

Table 1 Proximate analysis

Description	Crude protein	Crude fiber	Ether extract	Moisture	Ash
Sample A	36.75	18.75	9.40	5.00	21.10
Sample B	49.00	8.20	9.20	4.00	29.00
Control Sample	49.00	7.00	8.00	6.50	6.00

Sample A consist of banana peel, pineapple peel, crayfish waste, egg shell and groundnut cake crumbs mixed at the ratio of 3:1:2:2:2 respectively.

Sample B consist of banana peel, pineapple peel, crayfish waste, egg shell and groundnut cake crumbs mixed at the ratio of 5:2:1:1:0.5 respectively

Control sample, a commercial chicken feed consist of maize, soy bean, palm kernel cake (PKC), wheat bran, fish meal, blood meal, oyster shell and premix vitamin.

Discussion:

The amount of crude protein present in each sample is shown in table 1. Sample B was observed to contain the same amount with the control sample. However, sample A contained low amount of the nutrient. It shows that Sample B is a good source of crude protein. Sample B has the highest crude fiber which is 18.75%, crude fiber in chicken feed helps to build the cellulose and hemicellulose it is also known as roughages, which little amount is needed in birds. The normal range is 7%.Sample A has the highest ether extract. In chicken feed, ether extract refers to the percentage of fat or lipid. It is also the total fat present in chicken feed.Which is good for the formulated feed.

The moisture content in chicken feed must be normal, if too much can lead to mold growth and too small can lead to low pellet quality and palatability. Sample B has the lowest moisture content.Sample B has the highest ash content, which is the mineral content of the feed. It is made up of calcium, potassium and magnesium for strong bones and muscles.Finally

the ash content in sample A and sample B feed is high compare to the control sample. This help the broiler chicken fed with sample A and B to be more active and agile.

Growth performance

From Table 2, 3 and 4, which shows the growth performance of the three test groups, namely T_1, T_2, and T_3? It can be seen that the rate of average consumption in T_1 and T_2 are similar and lower than that of the controlled test T_3. Similarly, the weight gain was significant in the test T_1 and T_2 (formulated feed) but considerably lower than the weight gain observed in the controlled test T_3. It is revealed in Table 2, 3 and 4 that there was a rapid weight gain in T_3 at the early stage than, it was noticed in T_1 and T_2 (formulated feed). This also shows that the formulated feed is a good source of feed which will be good for the broiler chicken when given to them now and later in future.

Table 2 Growth performance for sample one

Period (week) **Test Experiment T_1**	**Average total feed consumption (g)**	**Average Weight gain (g)**
Wk 1	76.9	70
Wk 2	163.73	30
Wk 3	270	110
Wk 4	366.75	170
Wk 5	468.75	180
Wk 6	616.25	180
Wk 7	651.25	320
Wk 8	768.75	100
Wk 9	825	120
Wk 10	850	130
Wk 11	875	130

Table 3 Growth performance for sample two

Period (week) Test Experiment T_2	Average total feed consumption(g)	Average Weight gain (g)
Wk 1	73.8	70
Wk 2	163.75	30
Wk 3	287.14	120
Wk 4	377.14	160
Wk 5	480	180
Wk 6	641.43	180
Wk 7	708.57	300
Wk 8	804.29	120
Wk 9	821.43	100
Wk 10	892	150
Wk 11	928.6	130

Table 4 Growth performance for sample three

Period (week) Control Test T_3	Average total feed consumption (g)	Average Weight gain (g)
Wk 1	85.31	120
Wk 2	163.75	200
Wk 3	286.67	540
Wk 4	675	600
Wk 5	700	200
Wk 6	850	300
Wk 7	1,050	100
Wk 8	1,050	150
Wk 9	1,050	450

Wk 10	1,050	300
Wk 11	1,050	300

Feed Conversion Rate

The results of the comparative test with the three samples of feed (T_1,T_2andT_3) indicates that at the early stage the chicken fed with the convectional feed converted feed efficiently to weight as indicated in table 2. Feed conversion rate is a critical metric in broiler chicken production, as it measures the efficiency of food utilization. The result as indicated in the table 5shows that, the feed conversion rate in T_3 is lower compare to T_1andT_2 at the first four weeks of the experiment, which is the critical period in broiler production as weight gain at the stage is usually rapid and determine how much weight the birds will gain.

Table 5 Weekly Feed Conversion Rate

Period (Week)	T1	T2	T3
Wk 1	1.098	1.054	0.711
Wk 2	5.458	5.458	0.819
Wk 3	2.455	2.392	0.531
Wk 4	2.154	2.357	1.125
Wk 5	2.604	2.667	3.5
Wk 6	3.424	3.564	2.833
Wk 7	2.0351	2.362	10.5
Wk 8	7.688	6.702	7
Wk 9	6.875	8.214	2.333
Wk 10	6.538	8.947	3.5
Wk 11	6.730	7.143	3.5

Table 6 Overall feed conversion rate.

T1		**T2**	**T3**
3.73		3.89	2.54
Carcass yield			
81.65%		81.01%	81.50%
Mortality rate			
No. of birds	9	8	8
Mortality	1	1	0
Mortality rate	11.1%	12.5%	0%

Carcass yield

The carcass yield which is a critical factor in broiler chicken's production, shows that for the three experiments, carcass yield is above 81%. This falls within the ideal carcass yield for broiler chicken. This indicates that the three feed samples are efficient.

Mortality rate

Mortality rate which is a measure of birds that died during specific period is a critical metric in broiler chicken production. It also shows how nutritious and efficient the chicken feed is. From the mortality rate table, it can be seen that only one mortality was recorded for both experiments T_1 and T_2, while there was zero mortality for experiment T_3. One mortality each out of nine and eight birds for T1 and T3 respectively falls within, acceptable rate in broiler's production.

Physical Agility

The birds fed with waste based chicken feed were more agile than those under control experiment. This was due to the presence of egg shell which is very rich in calcium, an essential mineral in chicken's bone development.

Conclusion:

Food waste is produced by various sectors, including households and industries. It constitutes a significant portion of solid waste. This waste is rich in carbon and nitrogen sources, such as carbohydrates, proteins, and fats, which serve as excellent raw materials. One potential application is the use of this food waste as animal feed, promoting its recovery and contributing to sustainable solutions for animal nutrition challenges. Utilizing food waste in this manner could enhance poultry production at a reduced cost while ensuring a balanced diet for consumers. Based on the result obtained, the study proved the feasibility of using food waste as an alternative ingredient in broiler chicken feed production. The result also encourages the promotion of recovery of food waste as a feed for poultry.

The Formulated feed is found to be a good source of nutrientand not harmful to broiler chicken.

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