Apparent Nutrient Digestibility of Growing Japanese Quail Birds (*coturnix coturnix japanica*) Fed Diets Containing Graded Level of Ginger (*zingiber officinale*) Waste Meal

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ABSTRACT

The experiment was carried out to investigate the effect of graded levels of ginger (Zingiber officinale) waste meal on the nutrients digestibility of Japanese quails (Coturnix coturnix japanica). The experiment lasted for four (4) weeks and a total of two hundred and eighty-eight (288) Japanese quails of two (2) weeks old of mixed sexes were used. The birds were randomly allocated into four (4) dietary treatments with four (4) replicates. T_1 (diet contained 0 % ginger waste meal), T_2 (diet contained 35% ginger waste meal), T_3 (diet contained 40 % ginger waste meal) and T_4 (diet contained 45 % ginger waste meal). The parameters measured during the experiment were daily feed intake and daily feaces voided. All data were subjected to one-way analysis of variance (ANOVA) using SPSS and where differences occurred, Duncan Multiple Range Test was used to separate the means. The results showed that there were significant ($P<0.05$) differences in all parameters measured. It was observed that birds on 35 % replacement level of ginger waste meal had the highest digestibility value for crude protein, crude fibre, Ash, Ether extract and Nitrogen free extract than other treatments. In conclusion, ginger waste meal could be used to replace maize up to 35 % in the diets of growing Japanese quails without any negative effect on apparent nutrient digestibility.

Keywords: Japanese quail, ginger waste meal, apparent nutrient digestibility

INTRODUCTION

Nigeria is the largest economy in Africa with a population of over 174 million persons. This amazing data calls for a sustained approach to provide its citizens with quality food especially safe and affordable animal protein. Unfortunately, the level of animal protein intake is absolutely low at 4.5g/day per caput (USDA, 2013). This level of animal protein intake is not befitting of a nation that is the largest economy in Africa and the 26th in the world. One way of increasing the protein supply is to diversify poultry production, as well as increasing the production of other micro-livestock species with a short generation interval (Usman *et al.*, 2008). Japanese quail (*Coturnix coturnix japonica*) is among such micro-livestock animal which is described as an excellent and cheap source of animal protein for Nigerians (Babangida and Ubosi, 2006). Japanese quail are hardy birds that thrive in small cages and are inexpensive to keep. Japanese quail has high prolific tendencies, short generation interval, fast growth rate and can survive in small cages (Odunsi *et al.*, 2007). Feed cost for intensive poultry production is said to be the highest between (60 - 80 %) of the total production cost (Oruseibio and Smile, 2001). The increasing cost of feed ingredients in livestock production have been identified as a serious constraint to meeting the demand for animal protein especially in developing countries (Adejinmi *et al.*, 2010). Maize is a major ingredient used in livestock feed, but competition between man and livestock for maize has resulted in high cost of the cereal. The high cost of maize has necessitated a search for alternative energy-rich feed ingredients for compounding livestock feed. In Nigeria, large quantities of agricultural and agro industrial by-products are

produced and most of them are regarded as waste and classified as non-conventional feed stuffs. The competition between human beings and livestock for available cereal has resulted in high cost of feed production, and consequently higher cost of such livestock. It has therefore become necessary to search for cheaper, but equally effective means of making such feed. Ginger is a plant rich in many phenolic compounds, hence the spicy aroma, taste, fragrance. In the root rhizome are naturally high plant based chemicals known as phytochemicals believed to possess antibacterial and anti-viral agents that protect the plant from natural flora. The rhizome ginger is a plant extensively cultivated in Nigeria and many other countries of the world; it is processed into various products for human consumption. The by-product here is referred to as ginger waste meal (Onimisi *et al.*, 2006).

MATERIALS AND METHODS

Experimental Site

The research work was conducted at the Quail unit of the old Teaching and Research Farm of the Department of Animal Production, Federal University of Technology, Bosso Campus, Minna, Niger State, Nigeria. Minna lies between latitude 9° 28' N and 9° 37' N and longitude 6° 23' E and 6° 33' E with annual rainfall of 1000 - 1500 mm, and temperature range of 28 °C – 42 °C. The vegetation is Southern Guinea Savanna. (Climate-data.org, 2019).

Experimental Materials

The materials and ingredients used for the experiment includes deep litter pen, wooden cages, feeders and drinkers, charcoal, rechargeable lamps, clean water, weighing balance, Japanese quails, sun - dried cassava peel meal, molasses, groundnut cake, maize offal, fish meal, bone meal, limestone, premix salt, synthetic methionine, lysine and vitalyte®.

Source of Experimental Birds and Other Ingredients

Two hundred and seventy-two (272) two weeks old Japanese quails were purchased from National Veterinary Research Institute, Vom Plateau State Nigeria, for the purpose of this study. All the ingredients used for the diet formulation were purchased locally from Gwadabe Market, along Western by-pass, Minna. Groundnut cake, vitamin mineral premix, lysine, methionine, fish meal and bone meal were purchased at Farida shop in Gidan Matasa, Bosso, Minna, while ginger waste meal were purchased from Kafanchan in Giwa Local Government Area of Kaduna State.

Preparation of Experimental Diets

Diets were formulated such that treatment 1 (T_1) had no ginger waste meal (control), while treatments 2, 3 and 4 (T_2, T_3 and T_4) contained 35 %, 40 % and 45 % ginger waste meal respectively.

Management of Experimental birds

Clean drinking water was supplied ad-libitum throughout the experimental period. Routine observations of bird's behaviour and cleaning of the pen, drinkers, feeders, provision of clean drinking water and feed were carried out daily, to prevent any form of infection. Anti-stress (Vitalite®) was administered in drinking water throughout the experiment due to weather changes. At two weeks of age, antibiotic was administered (Tetracycline) for 5 days, through drinking water as prevention against bacterial infection.

Digestibility Trial

Digestibility study was carried out at the end of the growing phase of the experiment (fourth week). The birds in each of the treatment groups were weighed and sacks were placed in each of the replicate pens for seven days for the total collection of excreta samples, with an adjustment period of two days. The total sample collection lasted for five days. Each day's collection was oven-dried for five days and sealed in a foil paper in a desiccator jar for laboratory analysis. Clean drinking water was supplied daily and feed was given to all the birds in each treatment measured equally and the total droppings were collected, for proximate analysis using (Association of Analytical Chemist AOAC, 2000) methods. The formula used to calculate the digestibility is shown below:

$$\text{Nutrient digestibility} = \frac{\text{Nutrient intake in feed} - \text{Nutrient voided in feaces}}{\text{Nutrient intake in feed}} X\ 100$$

RESULTS AND DISCUSSION

The apparent nutrient digestibility of Japanese quails feed diets containing graded levels of ginger waste is shown in Table 1. All treatments had digestibility values of over 50 %, which means they utilized the nutrient beyond average and they have high nutrient digestibility. The results showed that crude protein, Crude fibre, Ash, Ether extract, Dry matter and nitrogen free extract were significantly affected ($P<0.05$). Birds fed diets 2 and 3 (35 % and 40 % ginger waste) recorded significantly ($P<0.05$) higher digestibility value in Crude protein, Crude fibre, Ash and Nitrogen free extract over the control group (0 % ginger waste meal). There were significant differences ($p<0.05$) among the (CP, CF, Ash, EE and DM). This could be attributed to stimulation of digestive enzymes by bioactive compound of ginger and thus overall improvement of digestion. According to Windish *et al.* (2008), ginger has favorable influence on gut function, which is the primary mode of action for growth promoting feed additives. Platel and Srinivasan, (2000) stated that spices enhance the activity of pancreatic lipase, amylase, trypsin and chymotrypsin by 22-27 %, 32-51 %, 63-81% and 12- 38 % respectively. The high digestibility effect may be linked to phenolic compound present in ginger extract which enhance digestion, by stimulating the endogenous enzyme in the guts of broiler chickens (Duwa *et al.*, 2020). Karangiya *et al.* (2016) also reported that incorporation of garlic powder or extract influenced ash and crude fibre digestibility in broilers chickens.

CONCLUSION

From this study it can be concluded that ginger waste meal can be included in Quails diet without any adverse effect. However, birds fed with diet containing 35 % and 40 % ginger waste meal inclusion level were found to have performed better in terms of nutrient digestibility compared to other inclusion level (45 %) and the control (0 %) ginger waste meal inclusion level.

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Table 1: Apparent nutrient digestibility of Japanese quail birds fed diets containing graded level of ginger waste meal

Parameter	T_1 (0 %)	T_2 (20 %)	T_3 (40 %)	T_4 (60 %)	SEM
Crude protein (%)	65.[illegible]^a	62.39^b	60.92^{ab}	55.29^c	0.62
Crude fibre (%)	60.07^a	54.11^c	52.47^c	56.09^b	0.70
Ash (%)	80.94^a	67.91^c	69.74^{ab}	81.60^{ab}	0.97
Ether extract (%)	74.69^b	80.50^a	62.09^{ab}	77.79^{ab}	1.65
Dry matter (%)	91.29^{ab}	90.89^b	88.40^{ab}	80.64^c	0.77
NFE (%)	67.90^{ab}	90.19^b	67.61^{ab}	64.91^c	0.75

abc: Means on the same row with different superscript are significantly (p<0.05) different, T_1- 0 % ginger waste meal, T_2-20 % ginger waste meal, T_3-40 % ginger waste meal, T_4 - 60 % ginger waste meal, SEM - Standard error of means, NFE - Nitrogen free extract