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EFFECT OF THREE DIFFERENT PROCESSING TECHNIQUES OF SOYBEAN ON NUTRITIONAL AND GROWTH PERFORMANCE OF JAPANESE QUAIL (*Coturnix japonica*)

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ABSTRACT: The experiment investigated the effects of various soya bean groups (boiled, fermented, and roasted) on Japanese quail at 3 weeks old. 160 Japanese quail were randomly assigned to four treatments (control, boiling soya beans, fermented soya beans, roasted soya beans) with four duplicates each. The 12-week trial lasted. Data on weekly body weights and feed conversion ratio were analyzed using analysis of variance (ANOVA) and Tukey's honestly significant at 5% probability test. The result shows there are significant differences in weekly weights of Japanese quail at weeks 1 (828.12-1083.24g), 2 (1026.47-1362.02g), and 3 (1325.69-1528.20g) with the highest observed in birds in treatment 2 (boiled soya beans). The maximum FCR was in week 1 for all treatments, while the lowest was in treatment 3 for weeks 5 and 9 (0.83; $P<0.05$). Week 1 to week 12 feed conversion ratio decreases. The birds' feed conversion ratios varied significantly ($P<0.05$). The quails in treatment 4 (roasted soybeans) had the greatest weekly weight after the trial (1742.34g). Thus, quails in treatment 3 (roasted soybean) had the best development performance than the control, boiled and fermented. So it is advised that roasted soybean can be an efficient diet for Japanese quails for maximum performance.

Keywords: Growth performance, Feed conversion ratio, Nutrient; Processing techniques, Roasted soybean.

INTRODUCTION

Quail is a pheasant-family bird and Japanese quails are sexually dimorphic than the wild common quail (*Coturnix coturnix*). Japanese quail breeds vary in commercial outputs (Chang et al., 2005; Rehman et al., 2021). Popularity of Japanese quail is in related to meat and eggs; it's used for egg and meat production throughout Asia, Europe, America, and the Middle East. Small size, fast generation turnover, and high egg yield make it a popular bird (Vali, 2008). Quail meat and eggs are low in cholesterol, fat, but high in protein, making them suitable for diabetics and hypertensive individuals (Onyenweaku et al., 2018; Jeke et al., 2018). Quails provide economical animal protein to rural and urban inhabitants. This will improve meat and egg supply while reducing health risks (Akinola, 2018).

Soybean meal is the main plant protein source in commercial poultry diets (Fowler, 2018). Monogastric animals can't use raw Soya bean meal because of Anti-Nutritional Factors (ANFs) (Ebrahimi-Mahmoudabad and Taghinejad-Roudbaneh, 2011). Anti-nutritional factors (ANFs) affect metabolism and nutrition (Coulibaly et al., 2011). Raw unprocessed Soya bean meal (SBM) reduces broiler development, feed efficiency, pancreatic gland hypertrophy, and amino acid digestibility and availability (Gilani et al., 2005). Heat-processed Soya bean meal (SBM) enhanced broiler chicks' body weight, growth, feed intake, and conversion ratio. Extrusion, boiling, toasting, and roasting may diminish Transient Ischemic Attack (TIA) and Panick attack (PA) in soybeans to inactivate or eradicate ANFs in chicken diets (Ari et al., 2012). Cooking, autoclaving, and microwaving remove anti-nutritional factors from soybeans. Information of comparing soybean heat processing on chicken performance is limited (Akande and Fabiyi, 2010; Heger and Wiltafsky, 2016).

Encouraging Japanese quail production in Nigeria will enhance animal protein intake and improve farmers' and labs' understanding of these popular birds (Vali, 2008). Feeding data gaps have hampered commercial quail production; too much protein causes nitrogen excretion and poor egg production in quails (Dos Santos et al., 2016). Compared to hen eggs, quail eggs have more fat and more protein (Genchev, 2012) since their 1992 debut in the Nigerian poultry market, they've acquired popularity because of their short generation interval, quick development rate, and disease tolerance (Arora et al, 2011).

The aim of this experimental trial study is to evaluate the effect of three different processed diets of soya bean (boiled, fermented and roasted) on growth performance of Japanese quail. The Specific objective is to assess soybean diet with the best feed conversion ratio (FCR).

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MATERIALS AND METHODS

Experimental location

The study was carried out at a location that was 570 meters above mean sea level and had a longitude of 5.5145^0 East and latitude of 7.7983^0 North. According to the climate classification of the region under investigation, relative humidity levels range from 57 to 92 percent and mean daily temperatures range from 68 to 90 degrees Fahrenheit. The drier season runs from November to March, while the wetter season runs from April to October. The yearly rainfall ranges from 500 to 3000 millimeters.

Ethical approval

This study was carried out after being approved ethically Under the Animal Research Act of 1985, approved by an Animal Research Ethics Committee (AREC) of the university which is required for the use of any experimental animal for research and teaching.

Experimental birds

A total of 160 Japanese quail 3 weeks old, consisting of both males and females were purchased at a private farm in Nigeria. The birds were grouped into 4 treatments including the control, making 10 birds per replicate. On the first week of arrival, the birds were fed with the layer's marsh (control), which is an adjustment period before being grouped according to replicate. Sexing was done starting from the 5th week to the 7th week using the difference in breast coloration which was creamy coloration for females while reddish brown with a speckled pattern in males. Also, sexing was done by venting the cloaca (excretion of white foams which is only peculiar to the male only). The experimental trial study duration was for 12 weeks.

Experimental management

The poultry house was cleaned, washed (cement floor), and fumigated a week before the arrival of the birds with proper disinfectants. The surroundings were cleared of bushes and sprayed with contact herbicides to prevent insects and rodents that may endanger the birds. Cages were cleaned, and wood shavings were used as bedding, which is subject to change once a week. One week adjustment phase was carried out in which they were fed with layer marsh before feeding them as per treatment.

Experimental design

160 Japanese quails were used and assigned into four experimental treatments with 4 replicates of 10 Japanese quails each in a Completely Randomized Design (CRD). The experimental groups are: Treatment 1 (T_1); the control; which the purchase feed is; Treatment 2 (T_2); Boiled and dried soya bean with cassava flour; Treatment 3 (T_3); Fermented and Dry soyabean with cassava flour; Treatment 4 (T_4); Roasted soya bean with cassava flour.

Table 1 - The composition of three treatments diets.

Ingredients	T_1	T_2	T_3	T_4
Maize	58.4	58.4	58.4	58.4
Soybean	35.4	-	-	-
Fermented + dried soya bean	-	21.15	-	-
Roasted soya bean	-	-	21.15	-
Boiled + dried soya bean	-	-	-	21.15
Cassava flour	-	14.25	14.25	14.25
Limestone	1.5	1.5	1.5	1.5
Dicalcium phosphate	2	2	2	2
Fish meal	2	2	2	2
Salt	0.25	0.25	0.25	0.25
Layer premix	0.25	0.25	0.25	0.25
Lysine	0.1	0.1	0.1	0.1
Methionine	0.1	0.1	0.1	0.1
Total	100	100	100	100

Table 2 - Calculated composition diet for Japanese quails

Analytical values	T_1	T_2	T_3	T_4
Metabolizable Energy (kcal/kg)	2500	2985.12	2998.32	2885.37
Crude Protein (%)	16.5	18.3	18.1	17.8
Crude Fibre	6	5.2	5.29	8.53
Calcium	3.6	0.45	0.95	0.77
Phosphorus	0.45	0.16	0.15	0.16
Lysine	0.8	2.06	0.88	2.09
Methionine	0.34	0.53	0.43	0.57

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Experimental procedures

Birds randomly assigned to replicates by Completely Randomized Design (CRD). Each replicate received the appropriate treatment feed and water ad libitum. Leftovers were weighed weekly in plastic bags. Bird weight was measured weekly. Daily egg counts were taken. Weekly cleaning of trash picked up. When needed, birds were given antibiotics, anti-stress drugs, and vitamins.

Economic gain

Economic gain was calculated as a ratio between the return of weight gain and the cost of feed intake. The price of ingredients and selling one kg of quail ($1.00/kg) was calculated based on the price in the local market at the time of the experiment.

Statistical analysis

All data collected has been subjected to analysis of variance (ANOVA) using the general linear model (GLM) of SAS (2008) employed, means has been separated using Tukey's honesty significance at 5% probability test.

RESULTS AND DISCUSSION

Result of effect of the soybean diet on growth performance of Japanese quail is presented in table 3. The table shows that there are significant differences (P<0.05) in the weekly weights of Japanese quail at weeks 1(828.12 - 1083.24g), 2 (1026.47 - 1362.02g), and 3(1325.69 - 1528.20g). Thus, birds fed heat-processed soybean were considered to be more efficient users of feed in terms of growth performance, probably due to higher nutrient availability, than those fed raw soybean meal. This is similar to findings from several authors who reported that soybean meal heat procedures improve the nutritive value and remove anti-nutritive factors in poultry diets, causing better growth performance of broiler chickens: dry heating, extrusion, cooking, roasting (Prachayawarakorn et al., 2006). In addition, Tousi-Mojarrad et al. (2014) reported that broiler chickens fed full-fat roasted soybean showed inferior growth performances than those fed steamed or extruded products.

It was attributed to the fact that steaming was superior to roasting or extrusion in the destruction of TIA (Trypsin inhibitor activity). Ari et al. (2012) corroborated it because all the thermal processing soybean methods examined by them (extrusion, cooking, toasting and roasting) reduced TIA (trypsin inhibitor activities) and PA (phytic acid) compared to unprocessed soybean. The reduction in TIA observed in the experiment of Ari et al. (2012) was consistent with the report of Aviles-Gaxiola et al. (2017), who indicated that steaming was more effective than roasting in trypsin inhibitor activities (TIA) inactivation while PA reduction is best achieved through roasting. The observed variations From week 4 to week 12, were not significant which is similar to what Janocha et al. (2022), reported that heat-processed full-fat soybeans in broiler diets at a level of 15% and reported that Body weights of animals at 6 weeks of age was not adversely affected.

The result of Table 4 showed significant differences (P<0.05) in the feed conversion ratio of the birds. The highest FCR was observed in week 1 for all treatments but was not significant (P>0.05). There were no significant differences (P>0.05) at weeks 1, 3, 4, 6, 8, 10, 11, and 12, however, there are significant differences (P<0.05) at weeks 2(1.22–1.61), 5(0.83–1.11), 7(0.99–1.13) and 9(0.83–1.05) with birds on control diet having the highest feed conversion ratio. The lowest Feed Conversion Ratio was observed in treatment 3; Roasted soya beans for weeks 5 and 9 (0.83). The Feed Conversion Ratio was observed to be decreasing with increasing age from week 1 to week 12.

Table 3 - Effects of soya diets on growth performance of Japanese quails

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
T_1	833.12^{b}	1026.47^{a}	1364.29^{ab}	1438.72	1541.52	1510.26	1525.64	1502.4	1570.2	1599.82	1615.58	1632.14
T_2	1083.24^{a}	1362.02^{b}	1528.20^{a}	1493	1492.21	1551.54	1539.17	1521	1593.43	1606.46	1626.33	1655.98
T_3	828.12^{b}	1062.14^{a}	1330.76^{b}	1423.71	1581.84	1593.16	1569.84	1534	1562.34	1577.64	1599.41	1623.87
T_4	873.05^{ab}	1064.43^{b}	1325.69^{b}	1475.35	1560.32	1656.4	1667.04	1639	1678.09	1702.04	1717.65	1742.34
P-Value	*	*	*	NS	NS	NS	NS	NS	NS	NS	NS	NS

^{a,b} means on the same row with different superscripts are significantly difference;. T_1: The control, T_2: Boiled soya bean, T_3: Fermented soya bean, T_4: Roasted soya bean. *p<0.05; NS; not significant

Table 4 - Effect of soya bean diets on feed conversion ratio of Japanese quails

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
T_1	1.56	1.22^{b}	1.08	1.15	1.11^{a}	1.08	1.09^{ab}	1.07	1.03^{a}	1.04	1.01	0.98
T_2	1.97	1.56^{a}	1.18	1.15	0.99^{ab}	1.03	1.04^{ab}	1.03	1.00^{a}	1.03	1.01	0.94
T_3	1.76	1.46^{ab}	0.91	1.04	0.83^{b}	0.94	0.99^{b}	0.98	0.83^{b}	0.96	0.95	0.9
T_4	1.97	1.61^{a}	1.15	1.13	1.00^{ab}	1.1	1.13^{a}	1.18	1.05^{a}	1.03	1.06	1.03
P-Value	NS	*	NS	NS	*	NS	*	NS	*	NS	NS	NS

^{a,b} means on the same row with different superscripts are significantly difference;. T_1: The control, T_2: Boiled soya bean, T_3: Fermented soya bean, T_4: Roasted soya bean. *p<0.05; NS; not significant

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CONCLUSION

The quails that were given the treatment of roasted soy beans had the greatest average weekly weight at the conclusion of the trial, which was 1742.34 grams. This weight was numerically larger than the average weekly weight of the quails that were given the other treatments. Therefore, the quails in treatment 3 (roasted soy beans) have the best development performance, which indicates that this therapy is the most successful compared to the others (control, boiled and fermented). The feed conversion ratio was seen to decrease with increasing age from week 1 to week 12, with the greatest feed conversion ratio happening in the first two weeks of life. This trend was observed from week 1 to week 12.

Ethical consideration

Ethical issues including plagiarism, consent to publish, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been checked by the authors which command respect in Nigeria by the ethical committed monitory team.

DECLARATION

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Authors' contribution

Ekeocha collated the whole manuscript; Oluwadele and Okiki analyzed the data, Aganga interpreted the data and Olubiyo involved in data collection

Conflict of interest

Author has not declared any conflict of interest

REFERENCES

Akande KE and Fabiyi EF (2010). Effect of processing methods on some antinutritional factors in legume seeds for poultry feeding. International Journal Poultry Sciences 9(10): 996-1001. DOI: https://www.doi.org/10.3923/ijps.2010.996.1001

Akinola LF and Ekine OA (2018). Evaluation of commercial layer feeds and their impact on Performance and egg quality. Nigerian Journal of Animal Science, 20(2): 222-231. DOI: https://www.doi.org/10.4314/tjas.v20i2

Ari MM, Ayanwale BA, Adama TZ, and Olatunji EA (2012). Evaluation of the chemical composition and anti-nutritional factors (ANFs) levels of different thermally processed soybeans. Asian Journal of Agricultural Research, 6 (2): 91-98. Doi: https://dx.doi.org/10.3923/ajar.2012.91.98

Aviles-Gaxiola S, Chuck-Hernandez C, and Serna Saldıvar SO (2018). Inactivation Methods of Trypsin Inhibitor in Legumes: A Review. Journal of Food Science, 83(1): 17-29. DOI: https://doi.org/10.1111/1750-3841.13985

Chang GB, Chang H, Liu XP , Zhao WM, Ji DJ , Mao YJ , Song GM , and Shi XK (2007). Genetic diversity of wild quail in China ascertained with microsatellite DNA markers. Asian-Australasian Journal of Animal Sciences, 20:17831790. DOI: https://doi.org/10.5713/ajas.2007.1783

Coulibaly A, Kouakou B, Chen J (2011). Phytic acid in cereal grains: structure, healthy or harmful ways to reduce phytic acid in cereal grains and their effects on nutritional quality. American Journal of Plant Nutrition and Fertilization Technology, 1: 1-22. DOI: https://www.doi.org/10.3923/ajpnft.2011.1.22

Dos Santos CG, Garcia EA, Filho JAV, De Molino A, Pelicia K and Daniella AB (2016). Performance of Japanese quails fed diets with low-protein and isoleucine. Acta Scientiarum-Animal Sciences, 38: 219-225. Doi: https://doi.org/10.4025/actascianimsci.v38i2.29533 .

Ebrahimi-Mahmoudabad SR, Taghinejad-Roudbaneh M (2011). Investigation of electron beam irradiation effects on anti-nutritional factors, chemical composition and digestion kinetics of whole cottonseed, soybean and canola seeds. Radiation Physics and Chemistry, 80(12):1441-1447. DOI: https:dx.doi.org/10.1016/j.radphyschem.2011.08.003

Fowler J (2018). Nutritional considerations for soybean meal use in poultry diets. In achieving sustainable cultivation of soybeans, Burleigh Dodds Science Publishing, London. Pp. 10. https://www.taylorfrancis.com/chapters/edit/10.4324/9781351114400-16/nutritional-considerations-soybean-meal-use-poultry-diets-justin-fowler-university-georgia-usa

Genchev A (2012). Quality and composition of Japanese quail eggs (*Coturnix japonica*). Trakia Journal of Sciences, 10(2):91-101. http://www.uni-sz.bg/tsj/Vol10N2_%202012/At.Gen4ev.pdf

Gilani GS, Cockell KA, Sepehr E (2005). Effects of antinutritional factors on protein digestibility and amino acid availability in foods. Journal of AOAC International, 88(3): 967-987. https://doi.org/10.1093/jaoac/88.3.967

Heger J, and Wiltafsky M (2016). Impact of different processıng of full-fat soybeans on broiler performance. Czech Journal of Animal Science, 61: 57-66. https://www.agriculturejournals.cz/pdfs/cjs/2016/02/02.pdf

Janocha A, Milczarekm A, Pietrusiak D, Łaski K, Saleh M (2022). Efficiency of Soybean Products in Broiler Chicken Nutrition. Animals (Basel), 12(3):294. DOI: https://doi.org/10.3390/ani12030294

Jeke A, Phiri C, Chitindingu K, and Taru P (2018). Ethnomedicinal use and pharmacological potential of Japanese quail (*Coturnix coturnix japonica*) birdsmeat and eggs, and its potential implications on wild quail conservation in Zimbabwe: A review. Cogent Food and Agriculture, 4(1): 1507305. https://doi.org/10.1080/23311932.2018.1507305

Kashmiri L. Arora and Oreta Samples (2011). Role of Body Weight on Reproductive and Physiological Traits in Japanese Quail Layers (*Coturnix japonica*). International Journal of Poultry Science, 10: 640-643. DOI: 10.3923/ijps.2011.640.643

Onyenweaku EO, Ene-Obong HN, Oko GE, Williams IO (2019). Contribution of eggs and other cholesterol-containing foods to total dietary cholesterol intake, and their influence on serum lipid profile of adults in Calabar, Nigeria. European Journal of Nutrition and Food Safety, 9(4):329-340. https://pesquisa.bvsalud.org/portal/resource/pt/sea-189643

Prachayawarakorn S, Prachayawasin P, and Soponronnarit S (2006). Heating process of soybean using hot-air and superheated-steam fluidized-bed dryers. LWT- Food Science and Technology 39: 770-778. DOI: https://doi.org/10.1016/j.lwt.2005.05.013

Rehman A, Hussain J, MAhmud A, Javed K, Ghayas A, Ahmad S (2021). Comparative evaluation of carcass characteristics and meat quality attributes of Japanese quail among different lines. Turkish Journal of Veterinary and Animal Sciences, 45(4):700-707. doi: https://doi.org/10.3906/vet-2101-60

Tousi-Mojarrad M, Seidavi A, Dadashbeiki A, and Roca-Fernandez AI (2014). Short communication. Effect of soybean meal heat procedures on growth performance of broiler chickens. Spanish Journal of Agricultural Research, 12(1): 180-185. DOI: https://doi.org/10.5424/sjar/2014121-4714

Vali N (2008). The Japanese quail: A Review. International Journal of Poultry Science, 7: 925-931. DOI: https://doi.org10.3923/ijps.2008.925.931

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