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EFFECT OF AFRICAN BLACK PLUM SEED NUT *(VITEX DONIANA)* MEAL DIETS SUPPLEMENTED WITH GINGER (*ZINGIBER OFFICINALE*) OR YEAST (*SACCHAROMYCES CEREVISIAE)* ON GROWTH PERFORMANCE AND ECONOMIC ANALYSIS OF STARTER BROILER CHICKENS.

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ABSTRACT

This experiment which was conducted for a period of four weeks to evaluate the effect of African black plum seed nut meal supplemented with ginger or yeast on growth performance and economic analysis of starter broiler chickens. A total of two hundred and forty (240) day-old Marsh broiler chicks were used for the experiment. The birds were randomly allocated to eight dietary treatments laid out in a 2 × 4 factorial arrangement. The two hundred and forty (240) day-old broiler chicks were divided into (2) groups of 120 birds, each group received ABPSNMD at inclusion levels of (0, 5, 10, and 15%) supplemented with 200ppm of either yeast or ginger respectively. Each of the group was further divided into 4 treatments of 30 birds each replicated 3 times with 10 birds. The result revealed that all parameters measured were significantly ($p < 0.05$) influenced by ABPSNMD treatment on the performances of broiler chickens. Bird fed ABPSNMD supplemented with yeast recorded significant ($p < 0.05$) high final weight and weight grain while bird fed ginger showed significant ($p < 0.05$) increase for feed conversion ratio and feed intake. The result of the economic analysis revealed that the feed cost naira per kilogram gained to produce a broiler chicken reduced with increased inclusion levels of ABPSNMD. Meanwhile, ginger dietary supplementation revealed the highest feed cost naira per kilogram gained.

Keywords: African black plum seed nut, broiler chicken, yeast, ginger and growth performance

INTRODUCTION

The major constraint to effective poultry production in Nigeria is the high cost of production, particularly feeding. Poultry feeding as reported by (Oladokun and Johnson (2016); Durunna *et al.* (2000); Olomu (1995)) reported that cost of feeding constitutes the greatest recurrent cost (70-80%) in poultry production. Feed alone accounts for up to 75% of total cost of broiler production (Ubosi, 2000). The high cost of conventional feed ingredients especially maize and soya bean, has increased feeding cost of livestock production, especially for poultry (Anyanwu *et al*., 2022) and has made many farmers to seek for alternative ways to improve feed utilization for overall animal performance and profitability (Bassey *et al*., 2022).

Consequently, a large reduction in feed cost is achievable through the use of unconventional feed resources (Aderibigbe, 2019). The use of unconventional feed ingredients that would ensure high productivity of the poultry bird which are cheap and readily available without creating any competition between livestock and humans could be considered as such in seed or leaves of trees for maximum profit in livestock production (Aderibigbe., 2019). Many seed of trees in our locality are underutilized and do not receive much attention due to lack of information on their nutritional compositions and physical qualities (Ajayi *et al.*, 2018). Seeds on the other hand, can contain anti-nutritional substances but could be rich sources of oil, protein, fibre and minerals for human consumption and animals, such could be seen in Africa black plum seed nut (Amah and Okogeri, 2019).

Africa black plum (*Vitex doniana)* seed is among the numerous tree plant seed that contain high amount of protein and potentials for improving animal productivity (Adejumo *et al.*, 2013). It is an indigenous tropical plant distributed across tropical sub-Saharan, Africa's coastal savannas and savanna woodland. The tree is none domesticated, but it is often found at the Centre of West African villages. It is found in northern, eastern and western Nigeria (Amah and Okogeri, 2019) V*tex doniana* is commonly known as Black plum in English, '*Dinya'* (Hausa), *'Oriri'* (Yoruba) and '*Uchakoro*' (Igbo) (Adeyina *et al.*, 2017). The fruits are oblong, about 3 cm long, green when young, turning purplish-black on ripening and with a starchy black pulp. It has good taste when consumed and each fruit contains one hard, conical seed, 1.5-2 cm long, 1-1.2 cm wide (Amah and Okogeri, 2019). *Vitex doniana* seed nut contains CP of 17.51 %, Dry matter of 76.70 %, Ash of 6.00 %, Crude fiber of 3.70 % and Ether Extract of 3.00 (Obadire *et al*., 2023). In addition, phytochemical analysis revealed that *Vitex doniana* seed contain anti-nutritional factors such as phenol, saponin, tannin and flavonoids (Adejumo *et al.*, 2013). Yet it could be a good source of economically valuable non-conventional feed stuff for livestock animals (Amah and Okogeri, 2019). Obadire *et al*., (2023) reported reduced productive performance when fed broiler chickens above 10% inclusion level of African black plum seed nut meal. The reduced productive performance value may be due to the high content of toxic and anti-nutritional factors such as phenol, saponin, Alkaloids, tannin and flavonoids in African black plum (Adejumo *et al.*, 2013). Therefore, there is need for the use of feed

additives which are considered appropriate to improve the nutritive value of the non-conventional by-products (Amit *et al*., 2019).

In the last decade, there has been growing interest in the use of natural herbs and medicinal plants as feed additives in poultry diets to maximize their potentials (Amit *et al*., 2019). Ginger is one of such natural herbs and medicinal plants that can serve as feed additives with a wide range of medicinal effects. Ginger is the rhizome of the plant *Zingiber officinale* and belongs to the family Zingibeaceae, which includes aromatic herbs with fleshy, tuberous or non-tuberous rhizomes, which often have tuber-bearing roots (Zhang *et al*., 2020). It has long served as a popular culinary and traditional medicinal herb (Al-khalaifah *et al*., 2022). Ginger inclusion in the broiler diet can safely be used to enhance the production performance, immune response, and antioxidative status of broiler chickens (Al-khalaifah *et al.*, 2022). Ginger contains several effective compounds, such as gingerol and gingerdione that exert strong antioxidant activity. In addition, they serve as phytogenic which could be used in animal feed to improve production performance, when included in poultry feed, it has properties similar to those of antibiotics (Arshad *et al*., 2014). These natural feed additives lower enteric pathogen microbial loads and improve nutrient digestion and absorption, feed consumption and high nutrients utilization which improve growth performance of the broiler chickens (Khan *et al*., 2017; Elfaky 2010).

Consequently, baker's yeast (*Saccharomyces cerevisiae)* is a good food, that is, it is rich in protein and is an uncommonly good source of the B-Vitamins, it provides a valuable source of nutrients that are important in low-meat or vegetarian diets (Osita *et al.,* 2020). Yeast could therefore be a performance enhancer through improvement in protein utilization and a significant retention of crude fibre (Olayemi *et al*., 2020). Furthermore, yeast has been reported to improve body weight gain, feed intake and feed conversion ratio of poultry birds (Obadire *et al.*, 2022; *Oke et al*., 2016)).This attribute of yeast could be traced to its content beta-glucans which has growth promoting and immune-enhancing effect (Paryad and Mahmoudi, 2008; Parks *et al.*, 2001).

Hence, there is need to explore utilization of *Vitex doniana* seed- nut supplemented with additives in poultry which information are scares. Similarly, there is need to ascertain the adequate inclusion level in poultry formulation without negative effects on health of the birds. This research therefore, determined the nutritive effect of *Vitex doniana* seed nut supplemented with additives on performance of broiler chickens.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at the Poultry Unit, Livestock Teaching and Research Farm, Federal University Dutse, Jigawa State. Dutse is located on longitude 9.34° E and Latitude 11.76°N and has an elevation of 431.36 meters above sea level (Encarta, 2007).

Processing of test ingredient

Matured African black plum fruits were purchased in Dutse ultra-modern market, Jigawa State. The fruits were manually peeled to expose the pulp (edible part) and this was removed to obtain the nut (contained the seed). The nut were sun dried, crushed, milled and incorporated into broiler feed formulation.

Experimental birds and Design

Two hundred and forty (240) day-old broiler chicks were purchased from a reputable hatchery and the test ingredients were purchased from Dutse Modern market. The experiment was arranged in a 2 by 4 factorial design. The two hundred and forty (240) day-old broiler chicks were divided into (2) groups of 120 birds, each group received either 200ppm yeast or ginger supplements at levels (0, 5, 10, and 15%) respectively. Each of the treatment was further divided into 4 Treatments, replicated 3 times with 10 birds each. The birds were given the experimental diets from day-old *ad libitum* until they reach four (4) weeks of age.

Management of Experimental Birds

The birds were reared intensively on deep litter housing system. Normal vaccination schedules and medications were strictly adhered to. Feed and clean water were supplied *ad libitum*. The crude protein and metabolizable energy contents of the feeds at both phases were balanced within the recommended range (NRC, 1994).

Table 1: Gross Composition of the Experimental diet (0-4 weeks) (g/kg)

	Inclusion level of ABPSNMD (g/kg)							
	Yeast				Ginger			
Ingredients	0	5	10	15	0	5	10	15
Maize	44.05	44.05	44.05	44.05	44.05	44.05	44.05	44.05
Soya bean meal	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
Ground nut cake	8.60	8.60	8.60	8.60	8.60	8.60	8.60	8.60
Fish meal	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Wheat offal	15.00	10.00	5.00	0.00	15.00	10.00	5.00	0.00
Bone meal	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Oster shell	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
ABP	0.00	5.00	10.00	15.00	0.00	5.00	10.00	15.00
Yeast	+	+	+	+	--	--	--	--
Ginger	--	--	--	--	+	+	+	+
Total	100	100	100	100	100	100	100	100
Determined Analysis (%)								
ME (MJ/kg)	11.15	11.21	11.27	11.20	11.15	11.21	11.27	11.20
Crude protein (%)	24.31	24.20	24.17	24.10	24.28	24.21	24.19	24.09
Ether extract (%)	4.25	4.20	4.20	4.17	4.29	4.26	4.20	4.18
Ash (%)	6.00	5.61	5.54	5.54	5.89	5.75	5.75	5.69
Crude fibre (%)	3.93	4.24	4.38	4.41	3.93	4.29	4.20	4.15
Dry mater (%)	94.23	94.75	94.61	94.81	94.94	94.1	94.09	93.89

ABP: African black plum

Data Collection

The birds were weighed at the beginning of the experiment and weekly thereafter (initial weight, daily weight gain and final body weight). Feed intake was measured by the difference between feed offered and the leftover. The market cost of the feed including the market price of the additives at the time of the experiment was used to calculate the feed cost (₦ / kg), total feed cost (₦) and feed cost (₦ /kg gain).

Proximate analysis and chemical composition

The experimental diet and the excreta of each treatment were analysed for their proximate constituents according to A.O.A.C (1995) procedure.

Statistical Analysis

Data collected were subjected to analysis of variance using GenStat 64-bit 17.1 Edition. Significant Means differences were separated using Student-Newman-Keuls test

The model of the experiment is as follows:

Y_{ijkl} = $\mu + D_i + E_j + (DE)ij + \sum ijk$
μ = Population mean
D_i = Single effect of dietary inclusion levels of ABPSNMD
E_j = Single effect of dietary supplementation of feed additives (ginger or yeast)
DE_{ij} = Interaction effect of dietary inclusion levels of ABPSNMD supplementation with additives (ginger or yeast)
$\sum_{ijk}$ = Random residual error

RESULTS

Proximate composition of African black plum seed nut (ABPSN)

The proximate composition of African black plum seed-nut (ABPSN) is as shown in Table 2. The result of the proximate revealed ABPSN to contained 94.66% dry matter. However, the crude protein and crude fiber content contained values 18.75 and 4.22% respectively. The ether extract and Ash content of ABPSN ranged between 7.55% and 4.88%.

Table 2: Proximate composition of African black plum seed nut

Parameter	Composition (%)
Protein	18.75
Ether extract	7.55
Ash	4.88
Crude Fibre	4.22
Dry Matter	94.66

Table 3 showed the main effect of ABPSNMD on the growth performances of starter broiler chickens. The result revealed that all parameters measured were significant ($p < 0.05$) for the treatment imposed on the birds. The final weight and weight gain of birds fed control diet had slightly higher values than birds on other treatment groups which recorded statistically similar values for final weight and weight gain across the dietary treatments. However, birds fed 15% ABPSNMD obtained an increased feed intake and Feed Conversion ratio (FCR) respectively. Closely followed were birds fed 10% ABPSNMD while the least feed intake and Feed Conversion ratio (FCR) values were recorded for birds fed control diet (0% ABPSNMD). The main effect of additives supplementation on the growth performance of starter broiler chickens. Bird fed diet supplemented with yeast showed significant ($p < 0.05$) improved final weight and weight gain. Meanwhile, bird fed diet supplemented with Ginger obtained significant ($p < 0.05$) higher feed intake and feed conversion ratio compared to birds on yeast diet.

Table 3: Main effect of ABPSNMD supplementation with yeast or ginger on the growth performances of starter broiler chickens (0-4 weeks)

	ABPSNMD inclusion levels (g/kg)						Additives			
Parameters	0	5	10	15	SEM	p value	Yeast	Ginger	SEM	p value
Initial weight(g/bird)	40.20	40.17	40.15	40.13	0.08	0.221	40.10	40.10	0.06	0.884
Final weight(g/bird)	801.80^{a}	764.90^{b}	764.00^{b}	757.70^{b}	8.55	<.001	782.80^{a}	761.40^{b}	6.04	0.003
Weight gain(g/bird/d)	27.19^{a}	25.89^{b}	25.85^{b}	25.63^{b}	0.30	<.001	26.50^{a}	25.80^{b}	0.22	0.003
Feed intake(g/bird/d)	46.76^{d}	47.92^{c}	50.19^{b}	51.13^{a}	0.38	<.001	48.20^{b}	49.80^{a}	0.27	<0.001
FCR(g/bird)	1.72d	1.85^{c}	1.94^{b}	1.99^{a}	0.03	<.001	1.82^{b}	1.93^{a}	0.02	<0.001

^{abc}Means on the same row having different superscripts are significantly different ($p < 0.05$).FCR: Feed conversion ratio

Table 4 showed the interaction effect of ABPSNMD supplemented with additives (yeast or ginger) on the performances of starter broiler chickens. The result revealed that all parameters measured were significant ($p < 0.05$) for the treatment. Birds fed 0% ABPSNMD supplemented with yeast had the highest values for final weight and weight gain. Meanwhile, other treatments recorded statistically similar values of the parameters. Moreover, birds fed 15% ABPSNMD supplemented with ginger revealed an increased feed intake and Feed Conversion ratio (FCR) respectively. Closely followed were birds fed 10% ABPSNMD supplemented with ginger while the least feed intake and Feed Conversion ratio (FCR) values were observed in birds fed yeast control diet (0% ABPNMD with yeast).

Table 4: Interaction effect of ABPSNMD supplementation with yeast or ginger on the growth performances of starter broiler chickens (0-4 weeks)

	ABPSNMD inclusion levels (g/kg)									
	Yeast				Ginger					
Parameters	0	5	10	15	0	5	10	15	SEM	P value
Initial weight(g/bird)	40.30	40.23	40.17	40.03	40.10	40.10	40.13	40.03	0.11	0.247
final weight(g/bird)	820.30^{a}	771.70^{b}	774.20^{b}	765.20^{b}	783.30^{b}	756.20^{b}	755.70^{b}	750.20^{b}	12.09	0.042
weight gain(g/bird/d)	27.85^{a}	26.12^{b}	26.21^{b}	25.90^{b}	26.54^{b}	25.58^{b}	25.56^{b}	25.36^{b}	0.43	0.049
feed intake(g/bird/d)	45.61^{d}	46.69^{d}	50.01^{b}	50.52^{b}	47.91^{c}	49.14^{b}	50.36^{ab}	51.74^{a}	0.53	0.047
FCR(g/bird)	1.64^{d}	1.79^{c}	1.90^{b}	1.95^{ab}	1.81^{c}	1.92^{b}	1.97^{ab}	2.04^{a}	0.04	0.023

^{abc}Means on the same row having different superscripts are significantly different ($p < 0.05$).FCR: Feed conversion ratio.

The main effect of ABPSNMD on the economic analysis of starter broiler chickens (0-4 weeks) is showed in Table 5. The result revealed a slightly numerical difference among the dietary treatments. An increased total feed intake (TFI Kg) was obtained for birds fed 10 % and 15 % ABPNMD. Meanwhile, the least total feed intake (TFI Kg) value was observed in birds fed control diet (0% ABPSNMD). In addition, birds on control diet (0% ABPSNMD) recorded the highest numerical values for feed cost(kg), total feed cost (₦), total weight gain (kg), and feed cost (₦/kg gain). Closely followed were birds fed 5% ABPSNMD while the least value was obtained for birds fed 15% ABPSNMD. The main effect of additives supplementation on economic analysis of starter broiler chickens showed that values obtained for birds on ginger supplemented groups appeared to consistently records slightly higher values of total feed intake (TFI Kg), total feed cost (₦) and feed cost (₦/kg gain) respectively, while values obtained for yeast supplemented groups showed higher values for feed cost (kg) and total weight gain (kg).

Table 5: Main effect of ABPSNMD supplementation with yeast or ginger on the economic Analysis of starter broiler chickens (0-4 weeks)

	ABPSNMD inclusion level (g/kg)				Additives	
Parameters	0	5	10	15	Yeast	Ginger
TFI(Kg)	1.31	1.34	1.40	1.43	1.35	1.39
FC(₦/kg)	628.95	583.56	556.57	537.45	6.25	6.00
TFC (₦)	823.92	781.92	779.20	752.43	8.44	8.34
TWG(Kg)	0.762	0.725	0.725	0.717	0.742	0.722
FC (₦/kg gain)	1082.69	1078.60	1076.24	1071.90	11.37	11.55

TFI = Total feed intake, FC = Feed cost, TFC = Total feed cost, TWG = Total weight gain

Table 6 showed the interaction effect of ABPSNMD supplemented with yeast or ginger on economic analysis of starter broiler chickens (0-4 weeks). The result revealed numerical increase across the dietary treatments. The birds fed control diet (0% ABPSNMD supplement with yeast) obtained an increased feed cost (kg), total feed cost (₦), total weight gain (kg), compared to birds fed control diet (0% ABPSNMD supplement with ginger) while the least value was obtained for birds fed 15% ABPSNMD supplemented with ginger. Meanwhile, the total feed intake (kg) of birds fed 15 % ABPSNMD supplemented with ginger was increased while the least total feed intake (kg) was observed for birds fed control diet (0% ABPSNMD supplemented with yeast). In addition birds on control diet (0% ABPSNMD supplement with yeast) observed an increased feed cost ₦/kg gain compared to birds fed control diet (0% ABPSNMD supplement with ginger) while the least value was obtained for birds fed 15% ABPSNMD supplemented with yeast.

Table 6 Interaction effect of ABPSNMD supplementation with yeast or ginger on the economic analysis of starter broiler chickens (0-4 weeks)

	ABPSNMD inclusion level (g/kg)							
	Yeast				Ginger			
Parameters	0	5	10	15	0	5	10	15
TFI(Kg)	1.28	1.31	1.40	1.41	1.34	1.37	1.41	1.44
FC(₦/kg)	651.54	591.04	550.54	538.04	601.00	563.37	545.90	525.42
TFC (₦)	833.97	774.26	770.76	758.63	805.34	771.82	769.72	756.60
TWG(Kg)	0.7798	0.7314	0.7339	0.7252	0.7431	0.7162	0.7157	0.7101
FC (₦/kg gain)	1069.47	1058.60	1050.22	1046.11	1083.76	1077.66	1075.48	1065.49

TFI = Total feed intake, FC = Feed cost, TFC = Total feed cost, TWG = Total weight gain

DISCUSSION

The proximate composition of ABPSN revealed it has great potential as protein source to substitute wheat offal in broilers formulation. The crude protein value of 18.75% obtained was at variance with the report of Obadire *et al*. (2023) who reported 17.51%. The ester extract recorded here 7.55% was higher than the value 3.00% reported by (Obadire *et al*., 2023). The crude fiber reported here (4.22%) was higher than earlier work of Obadire *et al*. (2023) who reported 3.70%. The ash value (4.88%) reported was lower than the value (6.00%) reported by Obadire *et al*. (2023). The value of the dry matter here (94.66%) was higher compared to value (76.70%, 90.38%) reported by Obadire *et al*. (2023) and Audu *et al*. (2023) respectively. The variation noticed generally in the proximate composition of ABPSN could be attributed to environmental factors and variation in the seed-nut types used.

The increased similar values of final weight and weights gain observed for birds fed ABPSNMD diet which compared favorably well with birds on control diet both of the experiment is an indication that the bird utilizes the ABPSNMD diets adequately for optimum performances. This result is in line with finding of Cletus *et al.* (2023) who reported higher final weight and weight gain when broilers chickens were fed diet containing 10% *Vitex doniana* leaf meal. Meanwhile, it was in contrast Okukpe *et al.* (2019) also reported that 15g of *Vitex doniana* leaf meal gave an Optimum performance in broiler chicken. The improved FCR observed in 5% ABPSNMD as compared with control diet at 10 and 15% inclusion level showed that ABPSNMD was able to sustain life and maintain metabolic processes as control diets. This also corroborated the earlier finds of Chidi *et al.* (2024) who reported decrease in growth performance as the inclusion levels of *Vitex doniana* leaf meal (VDLM) increases.

The improved final weight and weight gain observed following the inclusion of ABPSNMD supplemented with feed additive regardless of yeast or ginger of the experiment showed that the diet was rich in protein. Meanwhile, birds on yeast supplementation showed better performance compared to those on ginger supplemented. This could be attributed to the effect of oligosaccharides present in yeast which gives rise to the formation of more stable intestinal flora and improved feed intake efficiency as a consequence of better digestion, enhanced gut health which translated to improved growth performance. However, birds on diet supplemented with yeast consume less with the best feed conversion ratio which translated to a higher final weight. This is an indication that the birds utilizes yeast dietary supplementation adequately for optimum performances. This result was in line with the report of Patane *et al.* (2017) who obtained increased body weight gain and reduced feed conversion ratio in chicks fed live yeast. In addition, the result agreed with the findings of Lawrence-Azua *et al.* (2018) who observed improved total weight gain and feed conversion ratio following supplementation of yeast in broiler's diets. Furthermore, yeast has been reported to improve body weight gain, feed intake and feed conversion ratio of poultry birds (Obadire *et al.*, 2022). The increased feed intake noticed in birds fed ginger dietary supplementation compared to yeast dietary supplementation at starter phase compared to finisher phase of the birds showed better protein utilization which contributed to increased protein intake which have resultant effect on the final weight of the birds as reported earlier. This result agreed with the earlier works of Unigwe and Igwe, 2022; Duwa *et al.* (2020) and Karangiya *et al.* (2016). The authors reported significant increase in feed intake following dietary ginger supplementation in broiler chicken diet. Similarly, Mahdy *et al.* (2017); Ogbuewu *et al.* (2017) and Raza *et al*. (2016) respectively reported better improvement in feed intake following ginger dietary supplementation of poultry birds.

The reduced feed cost per kilogram as the inclusion level of ABPSNMD increased as compared to control diet is an indication that ABPSNMD is a cheap readily available feed ingredient that can complement wheat offal in poultry formulation. The reduced feed cost naira per

kilogram gained to produce a broiler chicken with increased inclusion levels of ABPSNMD at both phases of the study implied that it was cheaper to produce a unit weight gain from 1 kg of ABPSNMD compared to wheat offal. This confirmed the report of Adejumo *et al*. (2013) who opinioned that ABPSNMD is a cheap underutilized plant, and locally available. This also aligned the findings of Amah and Okogeri, 2019 who reported *Vitex doniana* to be a good source of economical valuable non-conventional feed stuff for livestock animals. Ginger dietary supplementation displayed superiority for the highest feed cost naira per kilogram gained.

Conclusion and Recommendation

1. 15% inclusion level of ABPSNMD did not affect feed intake which indicates that ABPSNMD based diets are acceptable and palatable to the birds. Therefore, it can be used as a partial replacement for wheat offal with additive supplementation.
2. It's cheaper to produce a unit weight gain of broiler chicken from 1 kg of ABPSNMD irrespective of the inclusion level compared to wheat offal.

REFERENCES

Adejumo, A. A., Alaye, S.A., Ajagbe, R. O., Abi, E.A., & Adedokun, F. T. (2013). Nutritional And Anti – Nutritional Composition Of Black – Plum (*Vitex doniana*). *Journal of Natural Sciences Research*, 3(12), 144–149.

Aderibigbe, T. A. (2019). Impact Of Black Plum (*Vitex doniana*) Leaf Meal On Blood Biochemistry , Hormone And Cholesterol Level Of West African Dwarf Goat-Bucks. *Nigerian Journal of Animal Scienc*e, 21 (3), 238-245.

Adeyina, A. O., Okukpe, K. M., Akanbi, A. S., Ajibade, M. D., Tiamiyu, T. T., & Salami, O. A. (2017). Effects Of Black Plum (*Vitex doniana*) Leaf Meal Inclusion On Performance , Haematology And Serum Biochemical Indices Of Cockerels. *Iranian Journal of Applied Animal Science*,7(3), 99-495.

Ajayi, F., Balogun, O. O., Ovuru, S. S., & Mgbere, O. O. (2018). Reproductive Performance of Rabbits Fed Maize Milling Waste-Based Diets. *African Journal of Biotechnology*, 4(5), 439- 443.

Al-Khalaifah, H., Al-Nasser, A., Al-Surrayai, T.; Sultan, H.; Al-Attal, D., Al-Kandari, R., Al Saleem, H., Al-Holi, A., & Dashti, F. (2022). Effect of Ginger Powder on Production Performance, Antioxidant Status, Hematological Parameters, Digestibility, and Plasma Cholesterol Content in Broiler. Chickens. *Journal* of *Animals science*, 12, 901. https://doi.org/ 10.3390/ani12070901

Amah, U. J., & Okogeri, O. (2019). Nutritional And Phytochemical Properties Of Wild Black Plum *(Vitex Doniana*) Seed From Ebonyi State, *International Journal of Horticulture, Agriculture and Food Science* (*IJHAF)*, 3 (1), 31-36.

Amit K. P, Prafulla, K., & Saxena, M. J. (2019). Feed Additives in Animal Health, *Nutraceuticals in Veterinary Medicine*, Pp 345-353 https://doi.org/10.1007/978-3-030-04624-8_23

Anyanwu, N. J., Osuji, V. C., Etela, I., Kalio, G. A., & Ekpe, I. I., (2022). Variation in Growth performance Characteristics Of Broiler Finisher Birds Fed Three Different Leaf Meals as Additive. *Nigerian Journal Of Animal. Sciences*, 24 (1), 139-146

AOAC (1995). Official methods of analysis. Association of analytic chemicals. Washington, D.C., USA. Bahram S, Alexander Y, Mohammedi A, Raveendra R. K, Jake A, Nitish B., & Shayan S. (2021). Effect of Vitamins A, D, E, and C on the chicken's immune system. *Poultry sciences*, 100 (4), 100930

Arshad, H. R. Fahad, M. S., & Aly, S. M. (2014). Active ingredient of ginger as potential candidates in the prevention and treatment of diseases via modulation of biological activities. *International journal of physiology, pathophysiology and pharmacology*, 6(2), 125-136

Audu, R., Garba, Y., & Rano, N. B. (2023). Influence of African Black Plum (*Vitex doniana*) Plant Parts Supplementation on Growth Performance and Economics of Production of Sahel Bucks. *Nigerian Journal of Animal Science and Technology*.6 (2), 35–46

Bassey, E. P. Michael, U.G. Ekpo I. E., & Premier D. (2022). Potentials of rice husk as energy supplement in poultry broiler production. *International Journal of Avian & Wildlife Biology*, 6(1), 21–25

Chidi, U. L, Cordelia I. E., & Odia P. N. (2024). Growth Performance, Haematological and Serum Biochemistry of Broilers Fed Diets Containing *Vitex doniana* Leaf Meal. *Revista de Ciências Agroveterinárias* 23 (1), 89-98 DOI: 10.5965/223811712312024089

Cletus, O. O., Sanda, Z. M., & Wafar, R. (2023). Effecta of Dietary Supplementation of *Vitex doniana* (Black Plum) Leaf Meal on Growth Performance, Blood Parameters, Carcass Traits, And Relative Organ Weights of Brioler Chickens.*Farm Animal Heaith and Nutrition*, 2(2), 18-23.https://dio.org/10.58803/fahn.v2i2.16

Durunna, C. S., Udedibie, A. B. I., & Anyanwu, G. A. (2000). Combination of Maize /Sorghum Based Dried Brewers' Grains, Cocoyam Corn and Cassava Tubes Meals as Substitute for Maize in the Diet of Laying Hen. In: Proceedings of the 25th Annual Conference of the Nigerian Society for Animal Production, Umudike, 19 -23 March, Pp.169-173.

Duwa, H., Amaza, B., Dikko, M., Raymond, J., & Paullyne, U. O. (2020). Effect Of Ginger (*Zingiber Officinale*) On The Growth Performance And Nutrient Digestibility Of Finisher Broiler Chickens In Semi Arid Zone Of Nigeria. *Nigerian Journal of Animal. Science*, Vol 22 (3), 279-286.

Elfaky, O. A. (2010). Effect of Dietary Supplementation of Yeast (*Saccharomyces cerevisiae*) on Performance and Carcass Characteristics of Broiler Chicks. Master of Science (poultry production) University of Khartoum.

Encarta (2007). Encarta Encyclopedia by Microsoft Incorporations, USA.

Karangiya, V.K., Savsani, H., Shrikant, H., Soma Patil, D., Garg, D., Murthy, K.S., & Vekariya, S.J. (2016). Effect of dietary supplementation of garlic, ginger and their combination on feed intake, growth performance and economics in commercial broilers. Veterinary World, 9 (3), 245250. doi: 10.14202/vetworld.2016.245-25

Khan, R., Naz, S., Nikousefat, Z., Tufarelli, V., Javdani, M., Qureshi, M., & Laudadio, V. (2017). Potential applications of ginger (*Zingiber offcinale*) in poultry diets. *World's Poultry Science Journal*, 68, 245–252.

Lawrence-Azua, O. O., Awe, A. O., Saka, A. A., Okotie, U. J., Ayodele, O. A., & Isegbe, E. I. (2018). Effect of yeast (*Saccharomyces cerevisiae*) supple-mentation on the growth performance, haematological and serum biochemical parameters of broiler chicken, *Nigerian Journal of Animal. Science.* 20 (1), 191-199.

Mahdy, M. S. A., Islam, M. F., Hasan, M. N., Habib, A., & Sikder, M. H. (2017). Effect of dietary supplementation of ginger on feed conversion ratio, carcass physiognomies and haematological parameters inbroiler. *Research in Agriculture, Livestock and Fish* 4 (3), 173-17

Obadire, F. O., Adam Y., Adeoye S. A, Osa, A. O., & Ibiwoye K. O. (2023). Effect of African black plum seed nut (*Vitex doniana*) meal diets on hematological and biochemical indices of finisher broiler chicken, *Australian journal of sciences and technology.* 7, 1-6

Obadire, F. O., Obadire, S. O., Ige, I. P., Osofowora, A. O., Oke, C.O., Oso, A. O., & Jegede, V. A. (2022). Response of Starting Turkeys Fed Malted Sorghum Sprout-Based Diets Supplemented with Higher Levels of Roxazyme G® and Yeast *(Saccharomyces Cerevisiae) Ghanaian Journal of Animal Science*, 13(1): 49-62

Ogbuewu, I. P., Mbajiorgu, C. A., & Okoli, V (2017). Antioxidant activity of ginger and its effect on blood chemistry and production physiology of poultry. *Comparative Clinical Pathology* 28, 655–660 16

Oke, F. O., Oluwatosin, O.O., Adeyemi, O. A., Oso, A. O., Jegede, V. A., Osofowora, A. O., Olorunisola, R. A., & Adeoye, A. A. (2016). Performance characteristics and digestibility of Finisher turkeys fed diets containing malted sorghum sprout with varying combinations of additives. Nigerian Journal of Animal Production, 43(1), 77-85 10.21608/SVUIJAS.2023.247492.1315

Okukpe, K. M., Lawal, M. O., Sanni, K. M., Adeyina, A. O, Alli, O. I., DeCampos, J.S., & Aderibigbe, T. A. (2019). Impact of Black plum (*Vitex doniana*) leaf meal on blood biochemistry, hormone and cholesterol level of West African dwarf goat-bucks. *Nigerian Journal of Animal Science*, 21 (3), 238-245.

Oladokun, V. O., & Johnson, A. (2016). Feed Formulation Problem in Nigerian Poultry Farms : A Mathematical Programming Approach. *American Journal of Scientific and Industrial Research* 3(1): 14-20

Olayemi, W. A., Rabiu, L. A., Akapo, A. O., Oso, O. A. & Ogunleye, T. (2020). Interaction effects of dietary ginger (*Zingiber officinale*) and yeast (*Sacharomyces cerevisiae*) supplementation on performance, carcass yield and gut micro flora of

broiler chickens. Nigerian Society for Animal Production.*Nigerian Journal of Animal Production*, 47(2), 89–99.

Olomu, J. M. (1995). Monogastric Animal Nutrition, Principles and Practice. Jackem Publications, Benin City, Nigeria Pp. 69 – 104.

Osita Ch. O, Ani A. O , Oyeagu, Ch. E, Akuru E. A., Ugwuowo L. C, Udeh V. C. & Oliobi U. J. (2020). Effect of different levels of dietary inclusion of *Saccharomyces cerevisiae* on growth performance and hematological parameters in broiler birds. *Bulgarian Journal of Agricultural Science*, 26 (5), 1024–1028

Parks, C. W., Grimes, J. L., Ferket, P. R. and Fairchild, A. S. (2001). The effect of mannan oligosaccharides, bambermycins, and virginiamycin on performance of large white male market turkeys. *Poultry Science*, 80: 718–723.

Paryad, A., & Mahmoudi, M. (2008). Effect Of Different Levels of Supplemental Yeast (*Saccharomyces Cerevisiae*) On Performance , Blood Constituents And Carcass Characteristics of Broiler Chicks. *African Journal of Agricultural Research*. 3 (12), 835-842,

Patane Atul, S. K., Premavalli, A.V., Omprakash, J., John, K., & Hudson, G. H. (2017). Effect of dietary yeast supplementation on the production performance of broilers. *International Journal of Advanced Biological Research*, VOL.7 (2), 222-228.

Raza, T., Chand, N., Khan, R.U., Shahid, M.S., & Abudabos, A.M. (2016). Improving the fatty acid profile in egg yolk through the use of hempseed (*Cannabis sativa*), ginger (*Zingiber officinale*), and turmeric (*Curcuma longa*) in the diet of Hy-Line White Leghorns. *Archives Animal Breeding*, 59 (2), 183– 190.

Ubosi. C. O (2000). Poultry Production in the Livestock Industry in Nigeria. A Paper Presented at the Avian Symposium 4 April 2000 Maiduguri, Nigeria.

Unigwe, C. R., & Igwe, I. R. (2022). Effects of garlic (*Allium sativum*) and ginger (*Zingiber officinale*) powders on the growth performance and haematology of broiler chickens *Nigerian Journal Animal Science, 24 (2), 141-153*

Zhang, M., Rong, Z., Dan, W., & Shuju, W. (2020). Ginger (*Zingiber officinale*) and its bioactive components are potential resources for health beneficial agents. *phytotherapy research.* Pp 1-6.