

Replacement Value of Soybean Meal and Maize with Raw or Boiled Pigeon Pea Seed Meal in Exotic Pullet Diets

*Amaefule, K. U., Onwuchuruba, C. F. and Okereke, O. C.

Department of Animal Nutrition and Forage Science, College of Animal Science and Animal Production, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.

*Corresponding author amaefulekevin@gmail.com

Target Audience: Poultry farmers, Animal Scientists, Feedmillers.

Abstract

A study to determine the replacement value of raw or boiled pigeon pea seed meal (PSM) for soybean meal and maize in the diets of exotic pullets (1-56 d) was conducted with 324 pullet chicks. The experimental design was 2 x 5 factorial in a completely randomized design (CRD). The factors were form (raw and boiled) and inclusion level (0, 15, 20, 25 and 30%) of PSM in the diets. Each treatment was replicated three times with 12 pullet chicks per replicate. Measurements were live weight at 8th week, weight gain, feed and protein intakes, feed conversion ratio (FCR) and protein efficiency ratio (PER). Results showed that raw or boiled PSM included as 15, 20, 25 and 30% of the diet replaced 20.16, 26.87, 33.60 and 40.30% maize, respectively and correspondingly 25.92, 34.59, 43.21 and 51.89% soybean meal, respectively. Pullets fed raw PSM diet had significantly ($P < 0.05$) higher feed intake (32.26 g), FCR (5.11), daily protein intake and significantly ($P < 0.05$) lower PER (1.10) and cost per kg of diet (N58.78) than pullets fed boiled PSM diet. Diet of 25% PSM significantly ($P < 0.05$) lowered daily weight gain more than 0, 15 and 20% PSM diets did. Cost per kg diet also significantly ($P < 0.05$) decreased with increasing levels of PSM in the diets. The conclusion was that raw or boiled PSM could be included up to 30% in pullet chicks' diets, replacing 40.30% maize and 51.89% soybean meal.

Keywords: Exotic pullets; maize; pigeon pea seed meal; replacement; soybean meal.

Description of Problem

Animal protein consumption by average Nigerians has not improved over the past decade due mainly to high cost of animal products occasioned by high cost (mainly of feed) of production among other factors. Also eggs, which used to be cheap, have also gone beyond the reach of most people, especially the low

income earners and rural individuals. Poultry feeds have continued to be expensive due to high cost of soybean meal, maize and fish meal (1). The availability of these feedstuffs depend much on yields per season, economic policies of government as they affect agriculture, industrial processing

activities and importation of raw materials.

Pigeon pea seeds have been identified to have low human food preference and no industrial use as at now in Nigeria (2, 3, 4). It is available in commercial quantities throughout the year and could be sourced in any part of Nigeria and neighboring countries. Previous studies have shown that pigeon pea seeds could be a valuable energy and protein source for broilers (2, 1) and pullets (3, 4); the result which showed that pullets could be fed 10% raw, boiled, toasted or soaked PSM diets without adverse effect on performance.

However, there is the need to determine the replacement value of pigeon pea seed meal for soybean meal and maize, and also the appropriate inclusion level of raw or boiled PSM that would ensure adequate pullet growth and performance. The objective of this study was to determine the replacement value of raw or boiled pigeon pea seed meal for soybean meal and maize in the diets of exotic hybrid pullets.

Materials and Methods

The study was conducted at the Research and Teaching Poultry Farm, Michael Okpara University of Agriculture, Umudike. Feedstuffs and drugs were procured from Umuahia, Abia State and day-old chicks from Obasanjo Farms, Ottah, Ogun State, Nigeria.

Feed and water were provided *ad libitum* to the birds. Brooding was done with

kerosene stoves placed under galvanized metal hovers while electric bulbs (100 W) provided light at night for additional five hours. The house was a deep litter open-sided one with dwarf walls covered with wire gauze. The chicks were vaccinated against *Gumboro* (7, 21 and 35th day) and Newcastle diseases (14, 28 and 42nd day), and were also given coccidiostat at 2nd, 5th and 7th week.

Experimental diets

Raw seeds were cleaned of dust and other unwanted materials, milled with a SKIOLD^R Feed Mill (SAEBY SKIOLD, Type A4 20222, SAEBY Jernstoberi & Maskinfabrik A, SAEBY-Denmark) to pass through a 2 mm sieve and used to formulate the raw pigeon pea seed meal diets. Boiling of raw seeds in hot water (100°C) was for 30 minutes as described by (4), sun dried and also milled to pass through 2 mm sieve. Each of the raw or boiled PSM was included in the diets at graded levels of 0, 15, 20, 25 and 30%. This gave a total of nine isoenergetic and isonitrogenous diets. The composition of the experimental diets as shown in Table 1 was formulated to meet the nutrient requirements (5) of the pullets.

Experimental design and data collection

The experimental design was 2 x 5 factorial in a completely randomized design (CRD). Each treatment was replicated three times. Three hundred and twenty-four day-old Isa Brown pullet chicks were randomly allotted to nine treatment diets at day old. There were 36 birds per treatment and 12 chicks per replicate.

The pullets were weighed at the beginning of the experiment and subsequently on a weekly basis. Final live weight minus initial live weight gave weight gain. Feed offered to the birds minus quantity not consumed gave feed intake while a 20 kg top loading weighing scale (Goat Brand[®]) was used to weigh feed and birds. Weighing of the birds took place in the morning hours (7.00-8.00 am local time).

Chemical and data analyses

Data collected were subjected to analysis of variance (ANOVA) for a 2 x 5 factorial in a CRD (6). The differences among treatment means were separated using Duncan's Multiple Range Test (7). General Linear Model of SPSS (Version 15.0) was used in the statistical computations.

Results and Discussion

Results

The inclusion of 15, 20, 25 and 30% raw or boiled pigeon pea seed meal (PSM) in the pullet diets replaced 20.16, 26.87, 33.60 and 40.30% maize, respectively in the diets and corresponding 25.92, 34.59, 43.21 and 51.89% soybean meal, respectively.

The form of pigeon pea seed meal (raw or boiled) in the pullet diets significantly ($P < 0.05$) influenced all performance indices relative to the control diet as shown in Table 2. Raw PSM diets depressed daily live weight gain of

pullets between the 2nd and 3rd week except 15% raw PSM diet that had similar growth rate with pullets fed control diet while live weight gain generally accelerated from the 4th to 5th week, with an extension to the 7th week by pullets fed 15% raw PSM diet (Figure 1). At the 8th week (56 d), the control diet gave the highest live weight gain followed by 20% raw PSM diet. With boiled PSM diets, live weight gain was depressed at the 3rd and 4th week for pullets fed 20 and 30% boiled PSM diets while for those fed 25% boiled PSM and control diets, live weight depression occurred between the 6th and 7th week (Figure 2).

Pullets fed raw PSM diet had significantly ($P < 0.05$) higher daily feed intake, feed conversion ratio (FCR), daily protein intake and significantly ($P < 0.05$) lower protein efficiency ratio (PER) than pullets fed boiled PSM diet (Table 2). Daily feed intake of pullets fed raw or boiled PSM diets increased steadily up to the 3rd week and slightly between 3rd and 5th week (Figures 3 and 4). There was a sharp increase in feed consumption by pullets fed raw PSM and control diets between 5th and 6th week, which thereafter dropped at the 7th week (Figure 3). The feed intake pattern of pullets fed boiled PSM diets (Figure 4) differed from that of those fed raw PSM diets from the 5th week. Generally, the intake of raw PSM diets peaked at 6th week while that of boiled PSM diets was at 7th week.

Table 2: Effect of Form of pigeon pea seed meal in the diet on Performance and feed cost of pullets (1-8 weeks).

Parameter	Raw	Boiled	SEM
Initial live weight (g)	42.62	42.68	0.24
Live weight at 8 th week (g)	415.48	424.83	8.07
Daily weight gain (g)	6.59	6.83	0.15
Daily feed intake (g)	32.58 ^a	29.26 ^b	0.31
Feed conversion ratio (FCR)	5.00 ^a	4.31 ^b	0.12
Daily protein intake (g)	5.86 ^a	5.27 ^b	0.06
Protein efficiency ratio (PER)	1.13 ^b	1.30 ^a	0.03
Cost:			
Cost per kg diet (Naira)	60.22 ^b	60.94 ^a	0.00
Total feed intake (g)	1824.55 ^a	1638.39 ^b	17.15
Total feed cost (Naira)	106.15 ^a	93.89 ^b	1.04
Total weight gain (g)	372.86	382.15	7.10
Cost per kg weight gain (Naira)	299.87 ^a	262.81 ^b	8.28

a, b, c: Means in the same row followed by different superscripts are significantly ($P < 0.05$) different. SEM = Standard Error of Mean. \$1 = 156.00 Naira

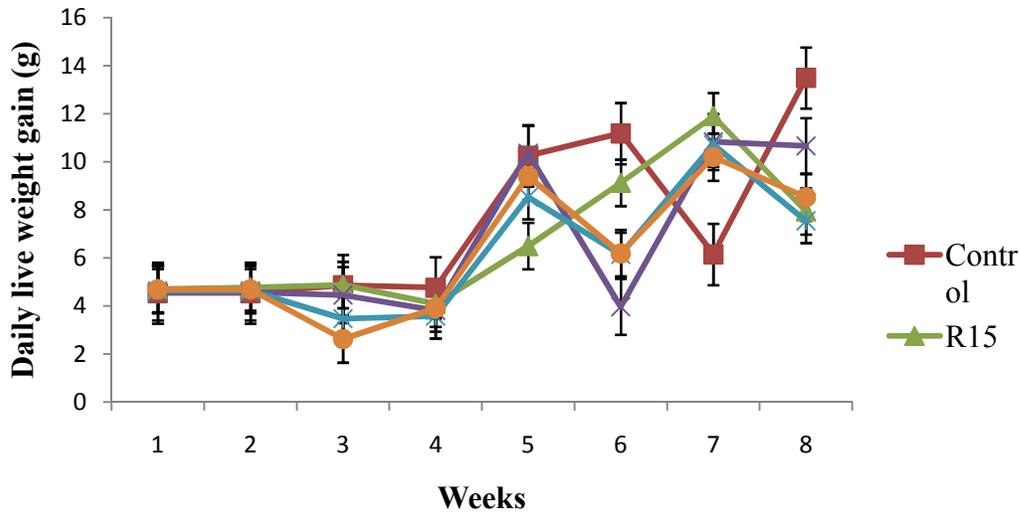


Fig. 1: Average Daily weight gain of Exotic Pullets fed graded levels of raw pigeon pea seed meal diets.

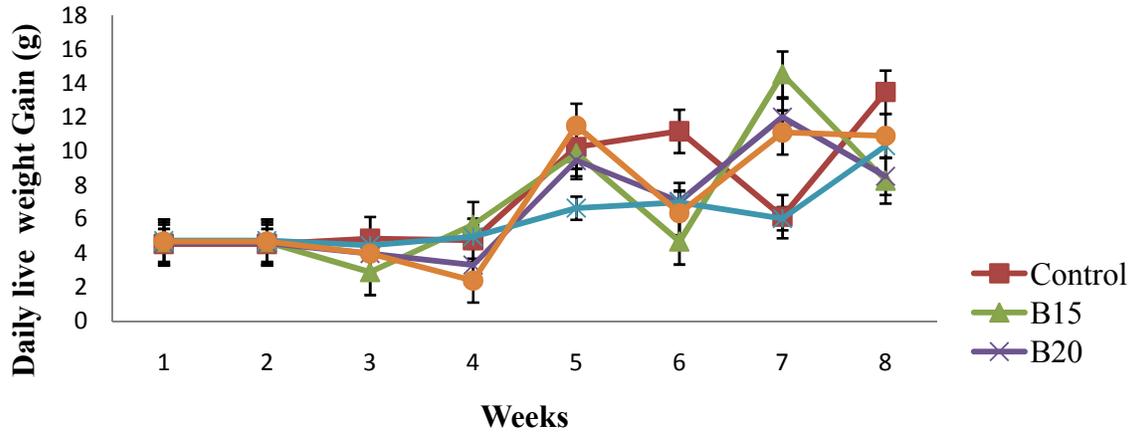


Figure 2: Average Daily weight gain of Exotic Pullets fed graded levels of boiled pigeon pea seed meal diets.

Raw PSM diet also had significantly ($P < 0.05$) lower cost per kg feed than boiled PSM and control diets (Table 2). Pullets fed raw PSM had significantly ($P < 0.05$) higher total feed cost than pullets fed boiled PSM diet. Also, the cost per kg live weight gain of pullets fed

raw PSM diets was significantly ($P < 0.05$) higher than that of pullets fed boiled PSM diet. Pullets fed raw or boiled PSM diet did not differ among each other in live weight at 8th week and daily weight gain.

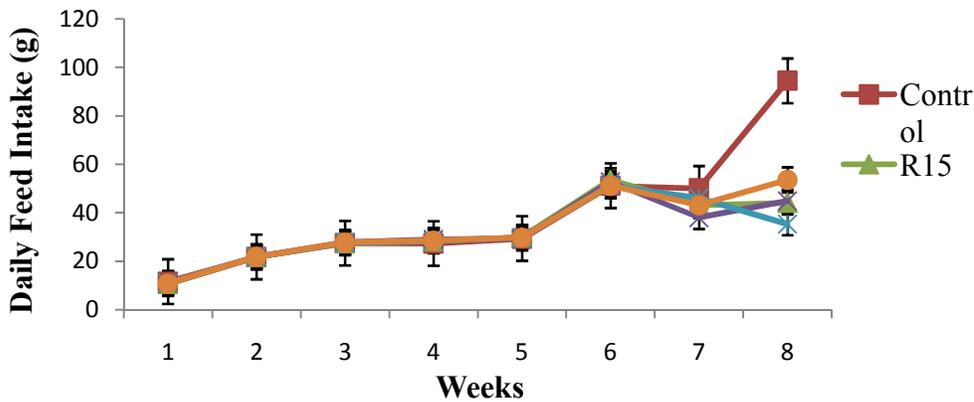


Figure 3: Average Daily Feed Intake of Exotic Pullets fed graded levels of raw pigeon pea seed meal diets.

Raw PSM diet also had significantly ($P<0.05$) lower cost per kg feed than boiled PSM and control diets (Table 2). Pullets fed raw PSM had significantly ($P<0.05$) higher total feed cost than pullets fed boiled PSM diet. Also, the cost per kg live weight gain of pullets fed

raw PSM diets was significantly ($P<0.05$) higher than that of pullets fed boiled PSM diet. Pullets fed raw or boiled PSM diet did not differ among each other in live weight at 8th week and daily weight gain.

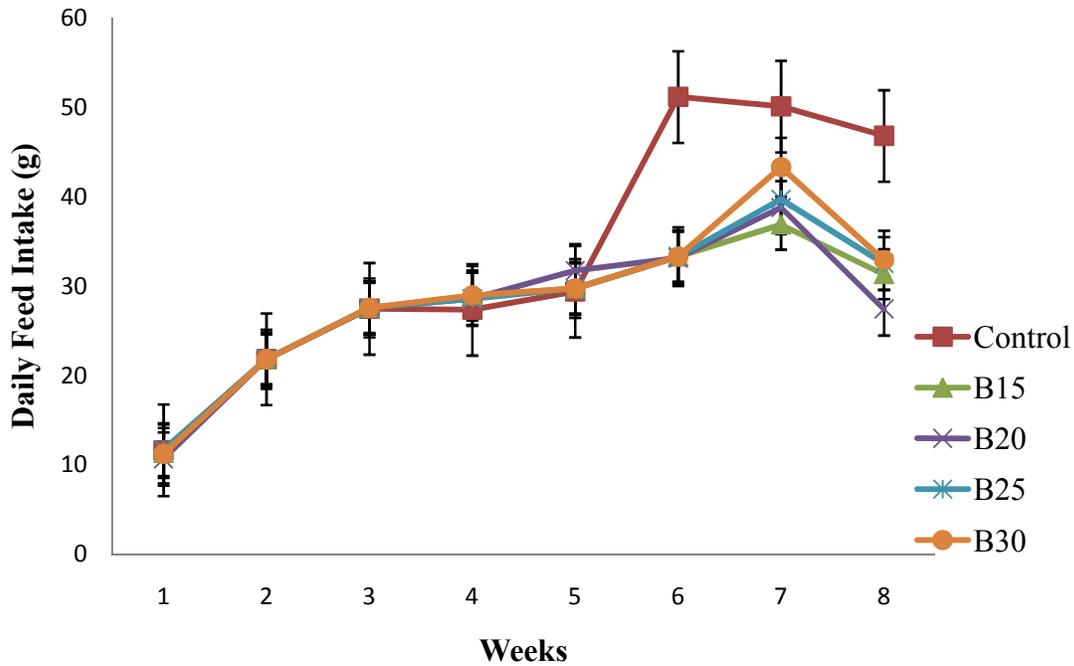


Figure 4: Average Daily feed intake of Exotic Pullets fed graded levels of boiled pigeon pea seed meal diets.

The effect of inclusion level of PSM in the pullet diets on performance and cost is shown in Table 3. There were no significant ($P>0.05$) differences among the pullets fed diets containing 20, 25 and 30% PSM diets in all the performance and cost indices measured. Pullets fed 25% PSM diet had significantly ($P<0.05$) lower daily weight gain and total feed cost than those fed 0% (control) and 15%

PSM diets. There were no significant ($P>0.05$) differences among pullets fed diets of various levels of PSM and control in FCR, and cost per kg live weight gain of pullets. Cost per kg feed significantly ($P<0.05$) decreased with increase in the inclusion level of PSM in the diets. The diet of 0% PSM also produced significantly ($P<0.05$) higher daily feed and protein intakes, and total feed cost than 15% PSM diet.

Table 3: Effect of Inclusion level of pigeon pea seed meal in the diet on performance and feed cost of pullets (1-8 weeks).

Parameter	0%	15%	20%	25%	30%	SEM
Initial live weight (g)	42.73	42.60	42.55	42.73	42.65	0.38
Live weight at 8 th week (g)	461.11 ^a	424.31 ^{ab}	416.06 ^b	386.11 ^b	413.20 ^b	12.75
Daily weight gain (g)	7.47 ^a	6.82 ^{ab}	6.67 ^{bc}	5.97 ^c	6.62 ^{bc}	0.23
Daily feed intake (g)	33.88 ^a	30.03 ^b	29.89 ^b	29.78 ^b	31.01 ^b	0.48
Feed conversion ratio	4.54	4.45	4.50	5.03	4.75	0.19
Daily protein intake (g)	6.10 ^a	5.41 ^b	5.38 ^b	5.36 ^b	5.58 ^b	0.09
Protein efficiency ratio	1.23 ^{ab}	1.28 ^a	1.25 ^{ab}	1.12 ^b	1.20 ^{ab}	0.05
Cost:						
Cost per kg diet (Naira)	65.99 ^a	61.48 ^b	59.98 ^c	58.48 ^d	56.98 ^e	0.00
Total feed intake (kg)	1.90 ^a	1.68 ^b	1.67 ^b	1.67 ^b	1.74 ^b	0.03
Total feed cost (Naira)	125.19 ^a	103.36 ^b	100.37 ^{bc}	97.49 ^c	98.87 ^{bc}	1.64
Total weight gain (g)	418.38 ^a	381.70 ^{ab}	373.51 ^b	343.39 ^b	370.55 ^b	12.76
Cost kg ⁻¹ weight gain (Naira)	299.59	273.46	269.49	293.76	270.41	11.22

a, b, c: Means in the same row followed by different superscripts are significantly ($P < 0.05$) different. SEM = Standard Error of Mean. \$1 = 156.00 Naira

There were significant ($P < 0.05$) interaction effect of form (raw or boiled) and inclusion level of PSM in the diets on the performance of pullets for all the parameters measured (Table 4). Pullets fed 25% raw or boiled PSM diet had live weight at 8th week and daily weight gain that was significantly ($P < 0.05$) lower than that of pullets fed 0% PSM (control) diet. The intake of diets of all levels of boiled PSM was significantly ($P < 0.05$)

lower than those of raw PSM diets. Also, at 30% inclusion level, raw PSM diet gave a significantly ($P < 0.05$) higher feed conversion ratio (FCR) than boiled PSM diet, and consequently, significantly ($P < 0.05$) lower protein efficiency ratio (PER) than boiled PSM diet. At all inclusion levels of PSM in the diets except 0%, pullets fed raw PSM diets had significantly ($P < 0.05$) higher protein intake than those fed boiled PSM diets.

Table 4: Effect of Interaction between Form of pigeon pea seed meal and inclusion levels in the diets on pullet (1-8 weeks) performance.

Parameter		0%	15%	20%	25%	30%	Mean
Initial live weight (g)	Raw	42.73	42.57	42.44	42.76	42.62	42.62
	Boiled	42.73	42.64	42.66	42.69	42.68	42.68
	Mean	42.73	42.61	42.55	42.73	42.65	
	SEM	F= 0.24	IL= 0.38	F x IL =	0.51		
Weight at 8 th week (g)	Raw	461.11 ^a	419.44 ^{ab}	414.90 ^{ab}	387.50 ^b	394.45 ^b	415.48
	Boiled	461.11 ^a	429.17 ^{ab}	417.22 ^{ab}	384.72 ^b	431.94 ^{ab}	424.83
	Mean	461.11 ^a	424.31 ^{ab}	416.06 ^b	386.11 ^b	413.20 ^b	
	SEM	F= 8.07	IL=12.75	F x IL =	18.57		
Daily weight gain (g)	Raw	7.47 ^a	6.73 ^{abc}	6.65 ^{abc}	5.83 ^c	6.28 ^{bc}	6.59
	Boiled	7.47 ^a	6.91 ^{abc}	6.69 ^{abc}	6.11 ^{bc}	6.95 ^{ab}	6.83
	Mean	7.47 ^a	6.82 ^{ab}	6.67 ^{bc}	5.97 ^c	6.62 ^{bc}	
	SEM	F= 0.15	IL= 0.23	F x IL =	0.34		
Daily feed intake (g)	Raw	33.88 ^a	32.43 ^{ab}	31.81 ^{ab}	31.41 ^b	33.37 ^{ab}	32.58 ^a
	Boiled	33.88 ^a	27.64 ^c	27.97 ^c	28.16 ^c	28.65 ^c	29.26 ^b
	Mean	33.88 ^a	30.03 ^b	29.89 ^b	29.78 ^b	31.01 ^b	
	SEM	F= 0.31	IL= 0.48	F x IL =	0.80		
Feed conversion ratio	Raw	4.54 ^{bc}	4.89 ^{abc}	4.80 ^{abc}	5.43 ^a	5.31 ^{ab}	5.00 ^a
	Boiled	4.54 ^{bc}	4.01 ^c	4.19 ^c	4.62 ^{abc}	4.19 ^c	4.31 ^b
	Mean	4.54	4.45	4.50	5.03	4.75	
	SEM	F= 0.12	IL= 0.19	F x IL =	0.30		
Daily protein intake (g)	Raw	6.10 ^a	5.84 ^{ab}	5.72 ^{ab}	5.65 ^b	6.01 ^{ab}	5.86 ^a
	Boiled	6.10 ^a	4.97 ^c	5.03 ^c	5.07 ^c	5.16 ^c	5.27 ^b
	Mean	6.10 ^a	5.41 ^b	5.38 ^b	5.36 ^b	5.58 ^b	
	SEM	F= 0.06	IL= 0.09	F x IL =	0.14		
Protein efficiency ratio	Raw	1.23 ^{abc}	1.16 ^{bc}	1.16 ^{bc}	1.03 ^c	1.05 ^c	1.13 ^a
	Boiled	1.23 ^{abc}	1.39 ^a	1.33 ^{ab}	1.21 ^{abc}	1.35 ^{ab}	1.30 ^b
	Mean	1.23 ^{ab}	1.28 ^a	1.25 ^{ab}	1.12 ^b	1.20 ^{ab}	
	SEM	F= 0.03	IL= 0.05	F x IL =	0.07		

a b, c, d, e, f, g, h, i: Means in the same row followed by different superscripts are significantly ($P < 0.05$) different. SEM = Standard Error of Mean. F = Form; IL = Inclusion Level; F x IL = Form x Inclusion Level interaction.

The effect of interaction between form of PSM and inclusion level of PSM in the diets on cost is shown in Table 5. The 0% PSM (control) diet had significantly ($P < 0.05$) higher cost per kg diet than

either raw or boiled PSM diet at any other level of inclusion. Increase in the level of inclusion of either raw or boiled PSM in the diets also significantly

($P < 0.05$) reduced the cost (Naira/kg) of the diets.

Pullets fed 15, 20, 25 and 30% boiled PSM diets had non-significant ($P > 0.05$) differences in their total feed cost, all of

which were significantly ($P < 0.05$) lower than that of pullets fed 0% PSM diet while for those fed raw, pullets fed 25% PSM diet had significantly ($P < 0.05$) lower total feed cost than those fed 0 and 15% PSM diets.

Table 5: Effect of Interaction between Form of pigeon pea seed meal and inclusion level in the diets on feed cost of pullets.

Parameter		0%	15%	20%	25%	30%	Mean
Cost per kg feed (₦)	Raw	65.99 ^a	61.18 ^c	59.58 ^e	57.98 ^g	56.38 ⁱ	60.22 ^b
	Boiled	65.99 ^a	61.78 ^b	60.38 ^d	58.98 ^f	57.58 ^h	60.94 ^a
	Mean	65.99 ^a	61.48 ^b	59.98 ^c	58.48 ^d	56.98 ^e	
	SEM	F= 0.00	IL=0.00	F x IL =	0.01		
Total feed intake (kg)	Raw	1.90 ^a	1.82 ^{ab}	1.78 ^{ab}	1.76 ^b	1.87 ^{ab}	1.82 ^a
	Boiled	1.90 ^a	1.55 ^c	1.57 ^c	1.58 ^c	1.60 ^c	1.64 ^b
	Mean	1.90 ^a	1.68 ^b	1.67 ^b	1.67 ^b	1.74 ^b	
	SEM	F= 0.02	IL=0.03	F x IL =	0.04		
Total feed cost (₦)	Raw	125.19 ^a	111.12 ^b	106.15 ^{bc}	101.98 ^{cd}	105.37 ^{bc}	106.15 ^a
	Boiled	125.19 ^a	95.60 ^{de}	94.58 ^e	92.99 ^e	92.37 ^e	93.89 ^b
	Mean	125.19 ^a	103.36 ^b	100.37 ^{bc}	97.49 ^c	98.87 ^{bc}	
	SEM	F=1.04	IL=1.64	F x IL =	2.34		
Total weight gain (g)	Raw	418.38 ^a	376.88 ^{ab}	372.45 ^{ab}	344.74 ^b	351.83 ^b	372.86
	Boiled	418.38 ^a	386.53 ^{ab}	374.56 ^{ab}	342.03 ^b	389.27 ^{ab}	382.15
	Mean	418.38 ^a	381.70 ^{ab}	373.51 ^b	343.39 ^b	370.55 ^b	
	SEM	F=7.10	IL=12.76	F x IL =	18.52		
Cost/kg LW gain (₦)	Raw	299.59 ^{ab}	299.17 ^{ab}	286.18 ^{abc}	314.83 ^a	299.57 ^{ab}	299.87 ^a
	Boiled	299.59 ^{ab}	247.74 ^{bc}	252.79 ^{bc}	272.68 ^{abc}	241.26 ^c	262.81 ^b
	Mean	299.59	273.46	269.49	293.76	270.41	
	SEM	F= 8.28	IL=11.22	F x IL =	16.56		

a b, c, d, e, f, g, h, i Means in the same row followed by different superscripts are significantly ($P < 0.05$) different.

SEM = Standard Error of Mean. F = Form; IL = Inclusion Level; F x IL = Form x

Inclusion Level interaction. LW = Live weight. \$1 = 156.00 Naira

Discussion

The stepwise increase in the inclusion level of raw or boiled pigeon pea seed meal (PSM) in the diets of pullet chicks

from 15 to 30% led to about 6.70% decrease in the requirement of maize and 8.60% decrease in the quantity required of soybean meal for each 5% increase in

the inclusion level of PSM in the diets. At 30% inclusion level, raw or boiled PSM could replace 40.30 and 51.89% maize and soybean meal, respectively by weight showing that raw or boiled PSM could be a good energy and protein source in pullet diets as has been reported by (4).

Exotic pullets fed boiled PSM diets had no superior daily weight gain and live weight at 8th week of life over those fed raw PSM diets, thus confirming the earlier report by (4) that Bovan Nera pullets fed raw, boiled or other processed forms of PSM diets had non-significant differences in their daily weight gain and final live weight at 56 days. The PSM diets were not inferior to the 0% PSM (control) diet suggesting that PSM is as good as maize and soybean meal in energy and protein supply. The depression of daily live weight gain between the 2nd and 4th week could be attributed to use of dietary nutrients for feather development and maintenance of homeostasis rather than muscle or tissue growth as reported by (8). This period may also correspond to the beginning of the second molt of the pullets (9).

The increase in the consumption of raw PSM diet when compared with the boiled PSM diet could be an attempt by the pullets to meet nutrient requirements from a diet that contained some anti-nutritional substances (10; 11; 12; 13) as has been observed with broilers (2; 14). However, the higher intake of the control diet relative to the PSM diets could be due to higher growth rate (daily weight

gain) of the pullets. These results of feed intake are contrary to earlier results obtained with Bovan Nera pullets (4) that there were no significant differences in feed intake of pullets fed raw or boiled PSM diets. This could be attributed to differences in the genotype of the pullets as Isa Brown pullets were used in this study.

The boiling of pigeon pea seeds for pullet diets increased the cost per kg of diet relative to the raw seed meal diet pointing out the economic importance of boiling the seeds apart from the biological significance. This increase in cost per kg of diet in association with feed intake pattern could not increase total feed cost and feed cost per kg live weight gain of the pullets fed boiled PSM diet. This suggests that it is more economical to boil pigeon pea seeds for pullet diets than using the raw seed meal form. It could also be observed that raw PSM diet gave lower total feed cost than the 0% PSM diet while the two had similar cost per kg live weight gain suggesting that despite differences in feed intake and daily weight gain, the feed cost of raising pullets to 8th week was the same with respect to raw or control diets. These observations had been made by (4).

Pullets fed 25% PSM diet had inferior daily weight gain compared to those fed other diets, although this did not influence other performance indices measured. This suggests that pullet chicks could perform well with as high as 30% PSM diet. The superior performance shown by pullets fed control diet over

those fed raw PSM diet could be due to the presence of anti-nutritional substances in PSM (12; 13). However, these differences could not influence feed conversion ratio (FCR) and protein efficiency ratio (PER) of pullets fed control diet relative to those fed PSM diets. PSM diets reduced total feed cost with the greatest reduction by 25% PSM diet probably due to lower feed intake of the pullets. However, cost per kg live weight gain was not affected even when the PSM diets were compared with the control diet. This could be an indication that pullet chicks (1-56 d) could be fed diet of up to 30% PSM without adverse effect on performance and feed cost.

Boiled PSM, irrespective of the level in the diets reduced feed and protein intakes and this was attributed to the differences in the two forms (raw or boiled) of PSM in feed and protein intakes of the pullets.

Conclusion and application

1. Raw or boiled PSM could replace 40.30% of maize and 51.89% of soybean meal in a pullet chick diet.
2. Raw PSM diets could increase daily feed and protein intakes, FCR but also could reduce feed cost.
3. Pullet chicks (1-56 d) could be fed diet of up to 30% raw or boiled PSM without adverse effect on performance.

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But these could not affect other performance indices in the same pattern suggesting that either raw or boiled PSM could be included in the diet of pullets at any of the levels with the expectation that feed and protein intakes shall be influenced.

It was of interest to note that the control diet was not superior to raw or boiled PSM included at any of the levels in the diets, especially when one looked at the FCR and PER obtained in this study. Generally, growth and performance results of pullets obtained in this study are lower than that obtained by (15) with Lohmann Brown pullets fed graded levels (0, 5, 10, 15, 20 and 25%) of Bambarra groundnut offal diets and also the results obtained with Bovan Nera pullets fed raw or processed pigeon pea seed meal (PSM) diets (4).

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