

ECONOMIC EVALUATION AND IMPLICATIONS OF NUTRITIONAL POTENTIAL OF SESAME SEED MEAL (*Sesamum indicum*) IN THE DIET OF GROWING SNAILS (*Archachatina marginata*)

Comment [AS1]: Can it be replaced with the word BENEFITS?

Abstract

This study was conducted to evaluate the economic implications and effect of feeding snail with sesame seed meal (SSM) as replacement for groundnut cake meal fraction of the diet on performance characteristics, carcass analysis and cost benefits. A total of one hundred and twenty snails of mean weight 175 ± 2.7 g was randomly allotted into four dietary treatments replicated three times and each replicate contained ten snails per replicate in a completely randomized design. Four diets were formulated to contain SSM at 0% (SSM₁) Control, 50% (SSM₂), 75% (SSM₃), 100% (SSM₄) as replacement for soybean meal fraction in the diet of growing snails. The diets were formulated to contain about 24% crude protein and energy of 2400 kcal/kgME. Data were collected on Feed intake, weight gain, shell length, thickness and width, Feed conversion ratio and cost per weight gain. The results show that the mean total feed intake was significantly influenced by the varying inclusion of SSM in the diet ($P < 0.05$). The mean total weight gain followed the same pattern with the feed intake. The highest mean weight gain was ($P < 0.05$). The feed conversion ratio (FCR) which is the ratio of feed intake to weight gain was relatively the same in all the treatments. The lowest cost per weight (CPW) gain of N170.61 was recorded in the diet containing high level of SSM₄ (100%) inclusion in the diet while the highest CPW gain of N221.88 was recorded in the control diet containing 0% SSM₁. It is however interesting also to note that as feed intake (kg) increases, CPW (N) gain reduces. The dressing percent (DP) of the snail was significantly influenced by the dietary treatments.

Comment [AS2]: ?????

Comment [AS3]: No need to write definition in the abstract.

Comment [AS4]: No need.

Key words: Sesame, Dressing percentage, Snails, Feed conversion, Feed intake

Introduction

One of the major limitations to the efficient snail rearing is the availability of quality feed at affordable price (Omole, *et al.*, 2012). The protein feed stuff mainly used in livestock production in Nigeria are groundnut cake, soybean meal and fish meal, etc. (Omole, *et al.*, 2012; Odeyinka, 2014). The high cost of groundnut cake meal as a source of animal protein necessitates looking for alternative source of animal protein which is affordable and available. Sesame seed meal is nutritious and contain high protein level of about 46% crude protein. Sesame seed meal has been used in the diet of broilers and layers with impressive results on growth performance and carcass yield (Farran, *et al.*, 2000, AlHarthi and Deek, 2009; Agbuluet *et al.*, 2010). Groundnut cake meal is expensive than SSM, the prevailing cost of GNC/kg during the course of this experiment groundnut cake was N385 while the cost of SSM/kg is N235. There is paucity of information in the use of SSM in the diet of snails hence this study was conducted to determine the economic implication and effect of feeding snail with sesame seed meal as replacement for groundnut cake meal fraction of the diet on performance characteristics and carcass analysis.

Comment [AS5]: Add reference.

Comment [AS6]: Can you explain a little why you did the study in snails?

Materials and methods

A total of one hundred and twenty snails of mean weight 175 ± 2.7 g were randomly allotted into four dietary treatments replicated three times and each replicate contained ten snails per replicate

in a completely randomized design. The snails were acclimatized for one week before the commencement of the feeding trial. Four diets were formulated to contain SSM at 0% (SSM₁) Control, 50% (SSM₂), 75% (SSM₃), 100% (SSM₄) as replacement for soybean meal fraction in the diet of growing snails. The diets were formulated to contain about 24% crude protein and energy of 2400 kcal/kgME (Table 1). Feed intake and weight gain were measured on daily and weekly basis with the use of sensitive weighing balance, respectively. Feed intake was calculated by subtracting the left-over feed from the feed given while the weight gain was calculated by deducting the initial weight from the final weight. Shell length and width were measured on weekly basis with vernier caliper. Micrometer screw gauge was used to measure the shell thickness on weekly basis. Feed conversion ratio was calculated as the ratio of feed intake to weight gain. Feed cost and cost per weight gain were also calculated. Carcass analysis was carried out at the end of the feeding trial by randomly selecting eight snails from each treatment and weighed separately. Each snail was killed by striking the shell with a club. The shell, foot and visceral were separated and weighed separately. The chemical composition of the feed and the meat were determined according to the method of A.O.A.C. (1990). All data were subjected to statistical analysis using analysis of variance and the means were separated if they are significantly different using Duncan Multiple Range Test (SAS, 1999).

Comment [AS7]: Put the data in the manuscript.

Results and discussion

The chemical composition of the sesame seed meal and groundnut cake meal showed that the crude protein and crude fibre were relatively the same (Table 2). The results of growth performance of the snails fed varying levels of SSM in the diet is shown in Table 3. The mean total feed intake was significantly influenced by the varying inclusion of SSM in the diet ($P < 0.05$). The increased feed intake from SSM₁ to SSM₄ could be due to differences in protein level in the diet. Snails tend to eat more when the protein level of the diet increases (Omole, *et al.*, 2012; Hamzat, and Longe 2014; Odeyinka, 2014; Omoyinmi, *et al.*, 2014). The mean total weight gain followed the same pattern with the feed intake. The highest mean weight gain was ($P < 0.05$) was recorded in the diet containing 100% SSM as replacement for groundnut cake meal (GNC). The feed conversion ratio (FCR) which is the ratio of feed intake to weight gain was relatively the same in all the treatments. The relatively the same FCR reported in the study is an indication that SSM could be used to replace GNC in the diet of growing snails. The FCR reported in this study was in agreement with observation of several authors who reported FCR ranging between 3.78 and 4.21 (Omole *et al.*, 2007; Hamzat and Longe *et al.*, 2014;). There was no significant difference in the mean shell length and values ranged between 9.78 and 9.79mm as shown in Table 3. Also, the mean shell width thickness also was not significantly influenced by the dietary treatments ($P > 0.05$). This observation also buttressed the fact that SSM could be used as replacement for GNC. Also, there was no case of shell deformity in all the treatments. The zero mortality recorded could be due to proper management practice such as cleaning of the environment, regular washing of feed and water troughs, proper shading and others as recommended by different authors (Omole *et al.*, 2007; Hamzat and Longe *et al.*, 2014). The zero mortality reported could also be due to fact that the test ingredient used in this study was well processed and preserved and did not have any deleterious effect on the snails. (Farran, *et al.*, 2000, AlHarthi and Deek, 2009; Agbuluet *et al.*, 2010). The report of zero mortality was an indication that sesame seed meal could be used as feed resource for snail. The result of cost analysis is shown in Table 4, the cost/kg feed reduced from N54.67 in SSM₁, to N43.25 in SSM₄, also the total feed cost reduced as the level of SSM in the diet increased from 0% in

Comment [AS8]: In the introduction part, explain this sentence briefly if you can, in one or two sentences. Just explain how the physiology works. (with reference)

Comment [AS9]: No need to explain FCR as you have already mentioned in introduction.

Comment [AS10]: Write as *et al.*, not *et. al.*

Comment [AS11]: Prefer not to use the word 'also'. You can write these sentences as follows- Given that the dietary supplements had no discernible effect on the mean shell width thickness and no cases of shell deformity were found, as shown in Table 3, it can be concluded that the GNC can be substituted with SSM.

Comment [AS12]: Write it as - The cause of zero mortality, as reported, could be due to the fact that the test ingredient used in this study was....

SSM1 to 100% in SSM4. The lowest cost per weight gain (CPW) was recorded in the diet containing high level of SSM in the diet (control diet) while the highest CPW was recorded in the control diet containing 0% SSM. The lowest cost/kg feed, total feed cost and cost per weight gain reported in this study could due to high price of GNC compared to SSM. The prevailing market price of GNC during course of the feeding trials was N385 while the cost of SSM was N235. The reduced cost reported in this study was in agreement with several authors that replaced conventional feed stuffs, such as maize, soya bean meal, groundnut cake meal with unconventional ones such as noodle waste meal, chicken offal meal, kenaf grain meal, kola testa meal etc. (Omole, *et al.*, 2012; Hamzat and Longe 2014; Odeyinka, 2014). The lowest cost/weight gain reported is an indication that sesame seed meal could be used to replace groundnut cake at reduced cost. The dressing percent (DP) of the snail was significantly influenced by the dietary treatments as shown in Table 5. The DP was relatively the same in SSM1, SSM2 and SSM3 ($P>0.05$) while the highest DP was recorded in SSM4. The offal/ live weight and shell/live weight percent were not significantly influenced by the varying inclusion of sesame seed meal as in the diet. The highest dressing percent recorded in SSM4 could be due to increased crude protein level of the sesame seed meal as early discussed. The dressing percent recorded in all the treatments fell within the range recorded by several authors (Omole *et al.*, 2014; Hamzat and Longe, 2014).

Comment [AS13]: Did the control not contain 0% SSM?

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Conclusion

It could be concluded that groundnut cake meal could be substituted partially or wholly with sesame seed meal without any adverse effect on feed intake, weight gain and dressing percentage. The cost per weight gain was reduced at high inclusion of sesame seed meal in the diet of snail.

Comment [AS17]: Conclude this sentence with the advantages and nutritional value of SSM (according to the results obtained from your research).

Comment [AS18]: Add more references.

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Table 1: Gross Composition of Experimental Diet.

Ingredient (%)	SSM₁ (0% SSM)	SSM₂ (50% SMM)	SSM₃ (75% SSM)	SSM₄ (100% SSM)
Maize	22.00	22.00	22.00	22.00
Groundnut cake meal	24.00	12.00	6.00	0.00
Sesame seed meal	0.00	12.00	16.50	22.00
*Others	54.0	54.0	54.0	54.0
Total	100.0	100.0	100.0	100.0
Cost/kg feed (N/kg)	104.67	100.89	96.67	83.25
Calculated analysis				
Crude protein (%)	23.63	24.02	24.32	24.47
Metabolizable energy (kcal/KgME)	2438.1	2411.6	2401.3	2383.3

Comment [AS19]: In all the tables, check the font style and font size. It should be same.

*Other fixed ingredients: B.D.G- 12.8, Rice bran- 15, Fish meal-4, Soy bean meal-10, Bone meal-2.15, Oyster shell-9.8, Premix-0.25

SSM- Sesame seed meal

Table 2: Determined Proximate Composition of the SSM and the Experimental diets

Parameters	SSM	Ground nut cake meal	SSM ₁ (0% SSM)	SSM ₂ (50% SMM)	SSM ₃ (75% SSM)	SSM ₄ (100% SSM)
Dry matter	97.72	96.24	93.77	93.78	94.15	93.23
Crude Protein	48.87	45.36	23.35	23.45	23.89	24.18
Crude Fibre	2.75	3.28	9.35	9.79	10.59	10.75
Ether Extract	4.23	5.56	4.28	4.67	4.72	4.88
Ash	6.64	7.78	9.68	9.69	9.79	10.12
Nitrogen Free Extract	37.51	40.02	53.34	52.40	51.01	50.07

SSM- Sesame seed meal

Table 3 Summary of Growth performance of growing snails fed varying levels of SSM in the diet.

Parameters (Means)	SSM ₁ (0% SSM)	SSM ₂ (50% SMM)	SSM ₃ (75% SSM)	SSM ₄ (100% SSM)	±SEM
Initial weight (g)	154.15	154.69	152.92	138.08	5.89
Final weight (g)	342.67 ^b	344.69 ^b	346.33 ^{ab}	350.5 ^a	6.45
Total weight gain (g)	188.52 ^b	190.00 ^{ab}	193.41 ^{ab}	212.42 ^a	5.39
Total feed intake (g)	780.41 ^c	779.77 ^b	789.56 ^a	810.49 ^a	8.72
Feed conversion ratio	4.13	4.10	4.08	3.81	0.14
Shell length increment (mm)	9.78	9.78	9.79	9.81	1.02
Shell width increment (mm)	8.34	8.35	8.35	8.38	0.49
Shell thickness increment (mm)	0.11	0.11	0.13	0.13	0.01
Mortality (Number)	0.00	4	2	0	

Means along rows with different superscript are significantly different from each other (P<0.05)

SSM- Sesame seed meal

Table 4: Cost analysis of growing snails fed varying levels of SSM in the diet.

Parameters (Means)	SSM ₁ (0% SSM)	SSM ₂ (50% SMM)	SSM ₃ (75% SSM)	SSM ₄ (100% SSM)	±SEM
Total weight gain (kg)	0.19	0.19	0.19	0.21	-

Total feed intake (kg)	0.78	0.78	0.79	0.81	-
Cost/kg feed (N)	104.67 ^a	100.89 ^b	96.67 ^c	83.25 ^d	2.12
Total feed cost (N/kg)	81.64 ^a	78.69 ^{ab}	76.36 ^{ab}	67.43 ^b	2.22
Cost/weight gain (N/kg)	429.68 ^a	414.15 ^b	401.89 ^c	321.09 ^d	4.78

SSM- Sesame seed meal

Table 5 Carcass analysis of growing snails fed varying levels of SSM in the diet.

Parameters (Means)	SSM ₁ (0% SSM)	SSM ₂ (50% SMM)	SSM ₃ (75% SSM)	SSM ₄ (100% SSM)	±SEM
Live weight (g)	343.10 ^b	344.71 ^{ab}	347.73 ^a	350.23 ^a	4.12
Shell weight (g)	79.32	79.79	80.66	81.39	4.13
Offal weight (g)	69.61 ^b	71.15 ^b	73.34 ^a	73.97 ^a	1.35
Foot weight (g)	150.75 ^b	151.66 ^b	154.97 ^{ab}	159.95 ^a	5.86
Dressing percent (%)	43.81 ^b	43.87 ^b	44.44 ^{ab}	45.67 ^a	2.01
Offal/live weight (%)	20.23	20.58	21.03	21.12	2.18
Shell/live weight (%)	23.05	23.08	23.13	23.24	2.27

Means along rows with different superscript are significantly different from each other (P<0.05)

SSM- Sesame seed meal

Comment [AS20]: Signify it underneath the table.

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