PERFORMANCE AND COST BENEFITS OF SNAILS (*Archachatina marginata*) FED DIETS CONTAINING NOODLE WASTE AS REPLACEMENT FOR MAIZE

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Astract
Noodle waste (NW) (a by-product from wheat noodle processing industry) which attract little cost was used to replace maize fraction of the diet of snail in order to reduce feed cost. A total of 120 adult snails (*Archachatina margi*nata) of mean weight 173.42 ± 3.5g of about 9 months of age were used for the feeding trial. Four diets were formulated to contain NW at 0% (A_1) Control, 50% (A_2), 75% (A_3) and 100% (A_4) as replacement for maize fraction in the diet of adult snails. Completely randomized design was used for the trial and each treatment was replicated thrice with 10 snails per replicate. The diets were formulated to contain about 24% crude protein and energy of 2400 kcal/kgME. Data were collected on intake, weight gain, shell length, thickness and width, feed efficiency, feed conversion ratio, dressing percentage, feed cost and cost per weight gain. Results showed that no significant differences were observed in the mean feed intake, weight gain and feed conversion ratio (P>0.05). The dressing percent of the snails was relatively the same in all the treatments (P>0.05). The results of cost analysis showed that cost /kg feed and total feed cost reduced as the level of NW in the diet increased. It was concluded that NW could replace maize fraction of the diet at reduced cost
Key words: Dressing Cost/weight gain, dressing percentage, feed efficiency, rice noodle waste, snails.

Introduction:
Maize, soybean meal, groundnut cake meal etc constitutes major feed ingredients commonly used Nigeria and Africa in general. The cost of aforementioned feed ingredients are high, hence there is need to look for alternative sources that can be used as substitute without affecting performance of the animal adversely. A lot of studies have been conducted in the use of alternative feed ingredients such as biscuit waste, bakery waste and cassava by-products as partial or total replacement for maize with a desirable results without affecting the carcass, growth and health status of livestock adversely (Longe,1987; Eniolorunda *et al.*, 2008; Kehinde,2009; Omole,*et.al.*,2012). There are lots of food processing industries in South Western Nigeria with different by-products. Noodle waste is a by-product from wheat noodle processing industry and it readily available where feed ingredients are sold in Nigeria. The protein content is high and relatively similar to that of maize (Eniolorunda *et al.*, 2008). The cost of noodle waste is relatively low compared to that of maize and it is considered as a waste product, a kilogramme of maize during the course of the feeding trial was ₦120.00 while the same quantity of NW was sold for ₦85.00/kg. Noodle waste has been included in the diet of laying chicken which has resulted in increased hen day production and reduction in the cost of feed without any adverse effect on health status of the birds (Eniolorunda *et al.*, 2008). There is paucity of information on the use of NW in the diet of snails, hence this study was conducted to determine the effect of feeding growing snail with noodle waste as partial or total replacement for maize fraction of the diet on feed intake, weight gain, feed efficiency, dressing percentage and cost benefits.

MATERIALS AND METHODS

The experiment was carried out at the Snailery Unit of the Institute of Agricultural Research and Training (I.A.R.& T.), Moor Plantation, Ibadan, Oyo State. Noodle waste (NW) was purchased from a feed mill in Ibadan, Oyo state, Nigeria. It was ground before incorporated with other feedstuffs. A total of 120 adults snails (*Archachatina margi*nata) of mean weight 173.42 ± 2.5g of about 3 months of age were used for the feeding trial. Four diets were formulated to contain NW at 0% (N_1) Control, 50% (N_2), 75% (N_3) and 100% (N_4) as replacement for maize fraction in the diet of growing snails. Completely randomized design was used for the trial and each treatment was replicated thrice with 10 snails per replicate. The diets were formulated to contain about 24% crude protein and energy of 2400 kcal/kgME. (Table 1)
The snails were reared in a cage of 12 compartments and each compartment had a dimension of 0.5x 0.5m^2. All management practices were adhered to as suggested by Bright,1996. Feed intake and weight gain were measured on daily and weekly basis with the use of sensitive weighing balance. 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.

Table 1: Gross composition of the experimental Diets.

Ingredient (%)	Cost (₦ /kg)	N_1 (0%)	N_2 (50%)	N_3 (75%)	N_4 (100%)
Maize	67	22.00	11.00	5.5	0.0
Noodle waste	60	0.0	11.00	16.5	22.0
*Othersfeed ingredients		78.0	78.0	78.0	78.0
Total		100.0	100.0	100.0	100.0
Cost/kg (N)		59.89	58.79	56.23	55.34
Calculated Composition					
Crude protein (%)		24.02	24.39	24.48	24.08
Metabolizable energy (kcal/KgME)		2405.2	2398.7	2389.23	2378.34

**Others fixed ingredients: G.N.C. – 10.0; Soybean meal -24; rice-bran -14.75; Fish meal -4; Bone meal - 2.15;Brewer dry grain-12.8 , Oyster shell – 9.70; Methionine - 0.1; Lysine - 0.1; Premix 0.25; Salt-0.1.*

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 and cost per weight gain was calculated. Carcass analysis was carried out at the end of the feeding trial. All data were subjected to analysis of variance and where differences were observed, means were further separated by the Duncan's Multiple Range Test (SAS, 1999).

Results and Discussion

The results of chemical composition of the test ingredient and experimental diets are shown in Table 2. The protein content of NW was 10.02% which was relatively similar to

Table 2 : Determined Proximate Composition of the Maize, Noodle waste and Experimental diets

Parameters	Maize	Noodle waste	N_1 (0%)	N_2 (50%)	N_3 (75%)	N_4 (100%)
Dry Matter	93.78	92.74	94.92	93.45	94.78	93.62
Crude Protein	9.89	10.02	23.47	23.56	23.87	24.22
Crude Fibre	5.76	4.58	4.87	4.82	4.41	4.39
Ether Extract	6.78	8.34	4.95	4.98	5.01	5.32
Ash	11.89	12.24	10.67	10.98	11.07	11.43
Nitrogen Free Extract	65.68	64.82	56.04	55.66	55.64	54.64

the report of Eniolorunda *et al.,* (2008) while the protein content of the maize was 9.89. The protein content of the two ingredients were relatively the same hence the two ingredients could be used as substitute for each other. The fibre content of NW was a bit lower than that of maize. The ether extract of NW was higher than that of maize. The protein content of the experimental diets fell within recommended values of protein requirements for growing snails as reported by Hamzat,(2004) and Omole *et al.*, (2012). No Significant difference was observed in the mean total feed intake of the snails fed diet containing varied levels of NW (P>0.05).

The mean total weight gain was not significantly different across the treatments (P>0.05) (Table3) (P>0.05).The mean shell length, width and thickness were not significantly different from one another as the level of NW in the diet increased (P>0.05). The feed conversion ratio was not significantly different from one another (P>0.05) across the treatments. The results of carcass composition (Table 3) revealed that the dressing percentage across the treatments were relatively the same (P>0.05) and it ranged between 43.56 and 44.23%, this implies that NW could be used as substitute for maize in the diet of snail. The results of the dressing percentage compared favourably with the reports of Hamzat (20040, Adikwu, (2012), and Omole *et al.,* (2012). The results of cost analysis showed that cost /kg feed and total feed cost reduced as the level of NW in the diet increased (Table 3).

Table 3 Summary of performance of snail fed noodle waste as replacement for maize.

Parameters	N_1 (0%)	N_2 (50%)	N_3 (75%)	N_4 (100%)	± SEM
Initial weight (g)	173.78	172.23	172.03	174.21	3.26
Final weight (g)	359.02	359.71	358.87	358.02	5.68
Total weight gain (g)	185.24	187.48	186.04	183.81	4.68
Total feed intake (g)	627.96	633.68	628.82	623.11	10.13
Feed conversion ratio (g)	3.39	3.38	3.38	3.39	0.26
Shell length increment (g)	10.34	10.27	10.33	10.23	0.31
Shell width increment	8.75	8.56	8.47	8.45	0.21
Shell thickness increment	0.12	0.12	0.13	0.12	0.03
Dressing percent (%)	43.89	43.78	43.58	43.65	1.98
Total feed cost (₦)	54.50 [a]	53.32 [a]	50.21 [b]	50.02 [b]	1.78
Total weight gain (g)	0.19	0.19	0.19	0.19	
Cost/weight gain (₦ /kg)	286.84 [a]	280.63 [a]	264.26 [b]	263.26 [c]	3.89

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

The lowest cost/weight gain was recorded in the diet containing 100% NW as replacement for maize while the highest cost/weight gain was recorded in the diet containing 0%NW. The reduction in feed cost was due to low cost of NW compared to maize. Based on weight gain, feed intake, feed conversion ratio, cost per weight gain and dressing percentages which was relatively the same, it could be concluded that NW could replace maize fraction of the diet of snails up to 100% without any adverse effect on performance but at reduced cost.

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