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PROXIMATE COMPOSITION AND ANTI–NUTRITIONAL FACTORS OF IRISH POTATO (*Solanum tuberosum L.*) Peel MEAL AND ITS EFFECT ON THE PERFORMANCE AND CARCASS CHARACTERISTICS OF WEANER RABBITS

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ABSTRACT

The effect of replacing maize with lrish potato peel meal (IPMP) in the diets of weaner rabbits was investigated. Twenty rabbits of mixed sexes with an average initial weight of 766.67 – 783. 33g were randomly allotted to four dietary treatments of 5 rabbits per treatment in a completely randomized design (CRD). Diet 1 was the control and is devoid of IPPM while diets 2, 3 and 4 contained IPPM at 10, 20 and 30% levels, respectively. Feed and water were provided *ad–libitum* throughout the study period that lasted 56 days. Data were collected on feed intake, weight gain and were used to calculate other growth parameters. Proximate analysis and anti –nutritional factor analysis were carried out. At the end of the trials, two animals from each treatment were slaughtered, dissected, eviscerated and dissembled for carcass evaluation. IPPM had a dry matter content of 88.69%, nitrogen free extract of 87.16% and metabolisable energy of 3401.39 kcal/kg. The content of anti–nutrients are phytate 1.24%, tannins 0.26%, oxalate 0.24% and cyanide 3.40%. There were significant ($p<0.05$) differences in weight gain, feed intake, feed to gain ratio, feed cost/kg gain and mortality across treatments. Diets 2 and 3 compared favourably with the control. Results of carcass analysis show significant ($p<0.05$) differences in dressing percentage and percentages of Head, liver, lungs heart, loin, limbs, stomach, small intestines and skin across treatments. Results indicate that sun –dried IPPM can be included up to 20% level in feed thus reducing the cost of rabbit production.

Keywords; anti nutrient, carcass, rabbits, weaner, performance

INTRODUCTION

One great challenge of Africa today is the production of sufficient food for its ever increasing population. This is due to the rate of increase in human population which is not matched with increased food production. Nigeria is richly endowed with a variety of animal protein sources, yet is unable to provide this animal protein in sufficient quantity to meet the requirement of its citizenry. FAO (2008) report recommended a minimum requirement of 54g of animal protein/person/day to be consistent with a balanced diet, sadly Nigerians consume less than 10g/day. Low protein consumption is a general problem in Nigeria and other developing countries (Ogundupe,1996). This is due to the shortage of animal products which has led to the current high prices making them too expensive and unaffordable to an average Nigerian (Kpanja *et al*, 2019).

Increasing the animal protein intake at a reasonable cost to increase the diet quality of the populace has been part of the agricultural policy and the use of micro animals have been suggested (Aduku and Olukosi, 1990). This requires directing efforts to the production of animals that are highly prolific with short generation intervals (Akinmutimi and Anakebe, 2008). Rabbit is one of such animal which holds a lot of promise for increasing the supply and intake of animal protein in developing countries. Rabbits have high fecundity with short generation interval (Aduku and Olukosi, 1990) they multiply and grow rapidly producing 6-8 kids or more and kindle 3-4 times yearly with gestation periods of 23-28 days. They produce high quality meat and can convert forage and kitchen wastes into meat with high efficiency (Aduku *et al*, 1991; Nworgu and Ogbosuka, 2003).

A major constraint to monogastric animal production is nutrition (Akinmutimi, 2006). Conventional feedstuffs such as maize, soyabeans, groundnut cake etc are expensive (FAO 1985). There is a quest to look for alternative non conventional feedstuffs that may be cheap, readily available and can replace conventional feedstuffs. Kitchen wastes such as yam peel, cassava peels, plantain peels and others have been explored for their feeding values in rabbit nutrition (Aduku, 1991; Nworgu and Ogbosuja, 2003; Akinmutimi *et al*, 2006).

Potato peels is one major kitchen waste that is yet to be explored in animal nutrition particularly, rabbit nutrition.

Irish Potato(*Solanum tuberosum L*.) is an important staple crop for human consumption. Potatoes are either eaten raw or processed into value–added products to meet the demand especially of fast foods and other convenience industries (Schieber *et al*, 2009). They are usually peeled during processing for domestic and industrial uses.

Potatoes are produced and consumed in large quantities in Nigeria. As a consequence of increased production, domestic consumption and processed potato products, considerable amounts of wastes are generated annually. The peels are the major portion of processing, produces waste that present a severe disposal problem to the home and potato industry, because the wet peels are prone to rapid microbial spoilage (Kpanja *et al* 2019). They also contain an array of nutritionally and pharmacologically interesting components such as phenolic compounds, glycoalkaloids and cell wall polysaccharides which may be used as natural anti–oxidants, precursors of steroid hormones and dietary fibre (Schieber *et al*, 2009).

However, some work has been done on the inclusion of potato peel meal in rabbit diets. This study is therefore designed to evaluate the nutritive value of potato peel meal based diet on the growth performance of weaner rabbits. The objective of the study is to determine the proximate composition and anti-nutritional factors on sundried lrish potato peels, its effects on the performance and carcass characteristics of weaner rabbits and the economic implication of using Irish potato peel meal based diets in rabbit nutrition.

MATERIALS AND METHODS

The study was carried out at the Teaching and Research Farm of the Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria. Twenty weaner rabbits of mixed sexes and breeds with an average initial weight of 766.67g – 783.33g were used for the experiment. They were housed individually in hutches where each hutch has a tray built under it for collecting faeces and urine. They rabbits were allocated into four dietary treatments in a complete randomized design. Each treatment had five replicates with five animals per treatment. Feed and water were provided *ad-libitum* throughout the 56 days experimental period.

Irish potato peels were gathered from commercial fryers and some restaurants and households in Wamba town of Nasarawa State. The peels were sun-dried and milled before analysis and then incorporated into the diets. Four diets were formulated as shown on table 1: T1 is devoid of the peels and serve as control while T2, T3 and T4 had Irish potato peels replacing maize at 10, 20 and 30%, respectively.

Samples of the sun-dried lrish potato peels were taken to the laboratory for proximate analysis and that of anti-nutritional factors at the Bio-chemical Laboratory of the Department of Animal Science and Food Research Programme laboratory of Institute for Agriculture Research, (IAR), Ahmadu Bello University, Zaria.

Initial weights of the rabbits were taken on the 1st day of the experiment. They were weighed weekly to know the weight gain which is used to calculate average weight gain. Feed consumption is also measured weekly as well as water consumption. At the end of the feeding trial, two rabbits were randomly selected from each treatment and used for carcass analysis. The rabbits were weighed before being slaughtered, dissected and eviscerated. They were dissembled into whole cut and each primal part and organ was weighed. The data collected was subjected to analysis of variance, significant differences among treatment means were separated using the Duncan multiple range test in the SAS package.

RESULTS AND DISCUSSION

On the proximate composition and anti-nutritional composition of sun-dried Irish potato peels, the dry matter content of 88.68% obtained is similar to the 88.80% reported for yam peels by Igwebuike *et al*, 2009. The proximate composition of Irish potato is presented in table 2. Irish potato has a crude protein of 7.56% lower than 11.06% and 11.33% reported for yam peels by Inaku (2001) and Akinmutimi *et al*, (2006), respectively. It has a crude fibre content of 2.36%, ether extract is 0.36% and ash 2.56%. Those values are lower than those reported for yam peels but higher nitrogen free extract (87.16%) reported by Inaku, 2011. It has a metabolisable energy value of 3401.39 kcal/kg.

The proximate composition shows that Irish potato peel meal could be good energy source in livestock diets and result of anti-nutrients indicates they are within tolerable limits hence may not have any negative effects if included in livestock diets. It is presented in table 2.

Performance of weaner rabbits fed varying levels of sun-dried Irish potato peel meal based diet is presented in table 4. There were significant differences ($P<0.05$) on weight gain, feed intake, feed to gain ratio, feed cost/kg gain and mortality across treatments. Those on T2 (10%) had higher ($P<0.05$) weight gain and superior feed to gain ratio compared to rabbits fed T4 (30%). Feed intake is higher in T1 and differed significantly from T3 and T4 that were significantly similar and they also differed from T2. On feed to gain ratio, T1, T2, and T3 are similar ($P>0.05$) and they differed significantly ($P<0.05$) from T4. For feed cost per kg gain, T4 had the highest and also differed significantly ($P<0.05$) from T2 and T3 that were similar ($P>0.05$). T2 and T4 had similar ($P>0.05$) mortality values and differed significantly ($P<0.05$) from T1 which also differed from T3 that recorded no mortality. T1, T2 and T3 had similar final weight gain that differed from T4.

The significant increase in feed intake with increasing levels of Irish potato meal in the diets may be attributed to the lower metabolisable energy of Irish potato peel meal. This observation agreed with that of Inaku (2011) for birds fed yam peel meal. It also agreed with the report of Alozie *et al*, (1987) who reported same as Inaku. They all reported that birds on yam peel meal consume higher in order to meet their energy requirement. The result followed the same pattern as the final weight of rabbits obtained in the study.

There was cost saving with the use of Irish potato peel meal at 10% and 20% level in the diet of rabbits. This result in considerable reduction in the cost of feeding which is about 70% cost of production, by extension makes the product more affordable to consumers. This agreed with the reports of Akinmutimi and Onen (2008); Ekenyem *et al*, (2006) and Inaku, (2011) that reported lower feed cost/kg gain with increasing levels of yam peel meal in poultry diet. Results from this study indicates that Irish potato peel meal could serve as replacement for more expensive, conventional energy sources in livestock feed formulation and rabbit in particular.

Effect of feeding varying levels of Irish potato peel meal on carcass characteristics is presented on table 5. There were significant differences ($P<0.05$) in dressing % and that of head, liver, lings, heart, loin, limbs, stomach, small intestine and skin. They were significantly ($P<0.05$) higher in T4 than T2 but similar to T1 and T3. Head, lungs, heart, loin, fore limbs and hind limbs were significantly higher ($P<0.05$) in rabbits on T2 compared to other treatments. This may be due to numerically higher live weight of the rabbits in this group.

Liver was significantly higher on those on Irish potato peel meal than those on control. This could be due to anti-nutritional factors such as glycoalkaloids and other phenolic compounds that are toxic. Liver plays a major role in detoxification of anti-nutritional factors. Based on the result on growth performance, rabbits on T2 and T3 compared favourably with T1 (control) with respect to weight gain, feed intake, feed to gain ratio and feed cost/kg gain. However, rabbits in T3 exhibited no mortality during the trial.

CONCLUSION AND RECOMMENDATIONS.

From the trial and based on growth and carcass quality, it was concluded that;

- 10 and 20% inclusion levels of Irish potato meal compared favourably with the control in weight gain, feed conversion ratio and feed cost/kg gain.
- 30% level compares favourably with control in carcass quality
- Sun-dried Irish potato meal can place maize up to 30% level in rabbit nutrition.

It is recommended that 20 percent Irish potato peel can be included in the diet of weaner rabbits to reduce feed cost. Detailed mineral and vitamin analysis of the peels should be carried out to know its suitability for other uses in human and livestock nutrition.

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Table 1: Composition of Experimental diets

	Graded levels of Irish potato peels (%)			
Ingredient	0.00	10.00	20.00	30.00
Maize	49.31	39.93	30.55	21.15
Soya bean (ff)	7.00	7.00	7.00	7.00
Irish potato peel	0.00	10.00	20.00	30.00
Wheat offal	8.00	8.00	8.00	8.00
GNC	31.79	31.17	30.55	29.95
Bone meal	2.50	2.50	2.50	2.50
Limestone	0.20	0.20	0.20	0.20
Lysine	1.15	1.15	1.15	1.15
Salt	0.30	0.30	0.30	0.30
Premix	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00

Table 2: Proximate Composition of Sundried Irish Potato Peels

Parameters	% composition
Dry Matter (%)	88.68
Crude Protein (%)	7.56
Crude Fibre (%)	2.36
Ether Extract (%)	0.36
Ash (%)	2.56
Nitrogen Free Extract (%)	87.16
Metabolisable Energy (Kcal/kg)	3401.39

Biochemistry laboratory: Department of Animal Science, Ahmadu Bello University, Zaria.

Table 3: Concentration of Anti-nutritional Factors in Sun Dried Irish Potato Peels

Anti-nutritional factors	% composition
Tannins	0.26
Oxalate	0.24
Phytate	1.24
Cyanide	3.40

Food Research Programme Laboratory of Institute for Agriculture Research, (IAR), Ahmadu Bello University, Zaria.

Table 4: Effects of Graded Levels of Sundried Irish Potato Peels Meal Based Diets on the Performance of Weaner Rabbits.

	Treatments				
Parameter	T1	T2	T3	T4	
	(0%)	(10%)	(20%)	(30%)	SEM
Initial weight (g)	766.67	783.33	766.67	766.67	68.21
Final weight(g)	1200.00^{a}	1200.00^{a}	1183.30^{a}	933.30^{b}	81.22
ADWG (g)	20.12^{ab}	20.83^{a}	19.40^{ab}	13.69^{b}	1.92
ADFI (g)	60.16^{a}	54.16^{c}	53.16^{c}	58.19^{b}	1.92
Feed to gain ratio	2.99^{a}	2.60^{b}	2.74^{a}	4.25^{c}	0.25
Feed cost/kg (~~₦~~)	162.98^{ab}	146.85^{bc}	142.31^{bc}	202.17^{a}	13.85
Mortality (%)	40.00^{b}	60.00^{a}	0.00c	60.00^{a}	14.14

abc= means in the same row with different superscripts are significantly different ($p<0.05$)
SEM = Standard Error of Mean, ADFI= Average Daily Feed Intake,

Table 5: Effects of Graded Levels of Sun Dried Irish Potato Peels Meal Based Diets on the Carcass Characteristics of Rabbits. Results Expressed as Percentage of Live Wight.

	Treatments				
Parameter	T1	T2	T3	T4	
	(0%)	(10%)	(20%)	(30%)	SEM
Live Weight (g)	1100.00^{b}	1175.00^{a}	1174.98^{a}	1025.00^{c}	59.08
Slaughter weight (g)	1015.57^{b}	1097.71^{a}	1105.74^{a}	975.00^{c}	51.66
Dressed weight (g)	804.45^{b}	834.89^{a}	875.54^{a}	775.01^{b}	46.94
Dressing percent (%)	73.13	71.01	74.51	75.61	6.23
Prime parts and organ weight expressed as a percentage of live weight					
Head (%)	9.82^{b}	14.82^{a}	9.85^{b}	12.23^{ab}	1.14
Liver (%)	3.85^{b}	5.28^{a}	4.85^{a}	4.98^{a}	0.25
Lungs (%)	0.88^{b}	1.62^{a}	1.03^{b}	0.84^{b}	0.11
Heart (%)	0.27^{b}	0.51^{a}	0.32^{b}	0.39^{ab}	0.05
Kidney (%)	1.26	1.25	1.27	1.21	0.11
Thigh (%)	18.95	23.56	19.08	20.14	1.68
Loin (%)	12.32^{b}	16.71^{a}	12.00^{b}	10.51^{b}	0.96
Fore limb (%)	0.87^{b}	1.81^{a}	0.77^{b}	1.15^{b}	0.16
Hind limb (%)	2.20^{b}	3.65^{a}	2.25^{b}	2.59b	0.29
Stomach wt (%)	1.53^{b}	2.10^{a}	1.70^{ab}	1.32^{b}	0.15
Small intestine (%)	3.80^{ab}	4.45^{ab}	3.12^{b}	4.79^{a}	0.41
Large intestine (%)	5.67	5.73	4.55	6.15	0.60
Skin (%)	8.31^{b}	12.62^{a}	9.36^{c}	11.12^{b}	0.36

abc= Means within the same row with different superscripts differ significantly ($p<0.05$) SEM= Standard Error of Means