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Growth Performance, Nutrient digestibility and haematological parameters of Red Sokoto bucks fed varied levels of Irish potato (*Solanum tuberosum*) peels

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Target audience: Ruminant Nutritionist and Livestock farmers.

Abstract

The study aimed at evaluating the performance, nutrient digestibility, nitrogen balance and blood parameters of Red Sokoto bucks fed varying levels of Irish potato peels diets. Irish potato peels (IPP) were collected at different restaurants and chips Joints in Samaru Zaria and dried for 7 days. Twelve (12) bucks with an average weight of 8.66±0.2kgkg were randomly distributed into four treatment diets containing Irish potato peels at 0, 10, 20 and 30% inclusion levels respectively with 3 bucks per treatment in a completely randomized design (CRD). The experiment lasted for 84 days. Result showed that Average final weight, average weight gain average daily feed intake and feed cost (₦/kg)were significant (p<0.05) affected by the inclusion level of Irish potato peels. The highest average final weight, average weight gain and average daily feed intake were observed for bucks fed 30% Irish potato peels inclusion. Crude protein and nitrogen free extract digestibility were significantly (p<0.05) influenced by the inclusion of Potato peels.All parameters measured for nitrogen retention was significantly (p<0.05) affected by the treatment diets except for nitrogen intake. The results obtained showed no significant (p<0.05) difference in packed cell volume and lymphocytes. Total white blood cell count and haemoglobin were significantly (p<0.05) influenced by the dietary treatments. It was therefore concluded that feeding buckswith varying level of Irish potato peels significantly increases weight gain, nutrient digestibility and a reduction in the cost of production.

Key words: Intake, Weight gain, Haematology, Red Sokoto Bucks, Irish Potato

Description of problem

The increase in the production levels of food crops in Nigeria has brought about an unprecedented amount of crop residues and by-products (e.g straws, haulms, stovers cobs, vines, peels, brans, leaves, chaff etc) as left over after crop harvest [1]. These potential feed resources described as non-conventional feeds are fundamental to farming systems that produce both crops and livestock [2]. These by-products abound in both the rural villages and the urban cities that are not sufficiently utilized by livestock farmers as potential feed resources for feeding livestock. Some residues usually of plant origin have been classified as kitchen waste [3] or

common household waste. Prominent among these are yam peels, sweet potato peels, Irish potato peels, and cassava peels. Others may include cocoyam peels, rice bran, cowpea husks, maize husks, banana peels, and plantain peels. These household wastes are materials that are not yet fully explored and utilized as potential livestock feed.

However, waste is an expensive and sometimes unavoidable result of human activity. It includes plant materials, agricultural, household, industrial, and municipal wastes and residues. The disposal of agricultural wastes into land and water bodies is common and has been of serious ecological hazards. In developing countries, there is a growing interest concerning the utilization of organic wastes generated by the food processing sector and through other human endeavours. This has led to a new policy geared towards complete utilization of raw materials so that little or no residue is left to pose pollution problem [4].

These household and kitchen wastes could be used after processing as feedstuffs as they contain nutrients such as crude protein from 1 – 23%, fibre from 2 – 52% and metabolizable energy as high as 20 MJ/kg dry matter. Hence small ruminants fed with these feedstuffs are healthier and heavier [5]. For instance, cassava peels, yam peels, Irish potato peels, are used in ruminant diet as an energy source. This study aimed at determining the effect of inclusion levels of Irish potato peels on feed intake, weight gain, nutrient digestibility and haematological indices in Red Sokoto bucks.

Materials and Methods

Experimental Site

The experiment was carried out at the Animal Farm of Animal Science Department, Ahmadu Bello University Zaria, Kaduna State, Nigeria. Zaria is located within the Northern Guinea Savanna Zone between latitudes 11^0 12' N and longitudes 7^0 33' E; at an altitude of 610m above sea level [6].

Experimental Material

The experimental material Irish Potato (*Solanum tuberosum* L.) was collected from different Restaurants within Samaru, zaria. The peels were sundried, crushed to a size ranging between 1.5-2.5mmto allow for easy mixing with the other ingredients in the concentrate feed. It was then bagged in polythene bags (Jimbo® bags) and stored in a room until it was needed for the study. Also, the other ingredients used includes maize offal, cotton seed cake, rice bran, salt and bone meal.

Feeding and management of animals

Twelve Red Sokoto bucks with average weight of 8.8kg were used for the study. Two weeks prior to the commencement of the experiment, the pens were thoroughly washed and cleaned with detergent and disinfectant (Izal) and allowed to dry. The animals were treated with prophylactics, dewormed with albendazole and were given Terramycin long acting (TLA) antibiotic injection at (1.0ml/10kg body weight) against bacterial infections. While ecto-parasites were checked using Ivermectin (Ivomec®) at (2.0ml/10kg body weight). The animals were randomly allotted to four dietary treatments with three animals per treatment in a

Completely Randomized Design. The animals were housed individually in an open-sided, well-ventilated pen which was bedded with wood shavings to serve both as litter materials and beddings and each pen was equipped with feed and water troughs. The animals in first treatment (control) were served with the formulated concentrate diets at 0% inclusion level of Irish Potato (*Solanum tuberosum* L.), while the remaining three treatments were included at 10, 20 and 30% levels of inclusion. Animals were fed the concentrate containing varying levels of Irish Potato (*Solanum tuberosum* L.) peels 2.5 percent of their body weight. The diet was offered asa single meal (at 08h) in the morning. Clean drinking water was provided to the animals daily *ad libitum.* The experiment lasted for 90 days after an initial adjustment period of 7 days.

Data Collection

The Red Sokoto bucks were weighed individually at the start of the experiment. Weekly body weight gain was determined throughout the experimental period. Daily feed intake was measured by subtracting the leftover from the total feed given to the bucks per head per day. Then, a calculated daily intake in each treatment were used to calculate live weight change and was determined by the difference in weight from the previous weight.Nutrient digestibility was conducted by the daily collections of faeces and urine from each of the bucks for the five days of the experiment after feeding known quantities of feed.

At the end of the experiment, three (3) bucks from each treatment group were randomly selected and bled between 8am and 9.30am through the jugular vein. Three millimetres (3 mL) ofblood collected from each of these bucks was stored in a plastic sample bottles containing anticoagulated ethylene diamine tetra acetate (EDTA), to prevent the blood from clotting.

Blood Sample Analysis

The blood sample was then taken to pathology and microbiology laboratory, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria for the determination of white blood cell count, packed cell volume (PCV), haemoglobin(Hb), total protein(TP), neutrophil and lymphocyte.

Statistical analysis

All data generated were expressed as means with the standard errors and subjected to analysis of variance (ANOVA) according to standard procedure using the General Linear Model (GLM) procedures of Statistical Analysis System [7]. Duncan's Multiple Range Test (DMRT) of the same software, was used to compare means that are found to be statistically significant [8] and significant difference were tested at 5% probability level.

Results and Discussion

Proximate composition of the experimental diet containing varying inclusion levels of Irish potato peels

The results of the proximate composition of the experimental diet containing varying inclusion levels of Irish potato peels fed to growing Red Sokoto bucks is shown in Table 2. Ten percent inclusion of Irish potato peels had the highest DM value (91.55%), while 30% inclusion level had the least DM value (90.77%). Dried Irish potato peels has been considered as an energy feedstuff and a cereal substitute for

Table 1: ingredient composition of the experimental diets

Ingredients(kg)	Inclusion level with Irish potato peel (%)			
	0	10	20	30
Maize offal	45.91	39.48	33.04	26.66
Cotton seed cake	33.39	29.82	26.26	22.64
Rice bran	20.00	20.00	20.00	20.00
Irish potato peels	0	10	20	30
Bone meal	0.50	0.50	0.50	0.50
Common salt	0.20	0.20	0.20	0.20
Total	100	100	100	100
Calculated analysis				
Crude protein	16.01	16.00	16.00	16.00
ME(Kcal/kg)	3018.66	3013.76	3013.68	3012.98

Table 2: Proximate Composition of Experimental Diets and Irish Potato Peels(IPP)

Parameter (%)	Inclusion level with Irish potato peel (%)				IPP
	0	10	20	30	
Dry matter	91.51	91.55	90.99	90.77	92.93
Crude protein	15.03	15.63	15.36	15.07	6.90
Crude fibre	9.45	10.13	9.75	9.16	2.86
Ether extract	2.21	2.03	1.95	1.97	0.32
Ash	8.08	7.37	7.83	7.08	9.52
Nitrogen free extract	65.87	64.84	65.11	67.40	71.30

ruminants because of its high dry matter percentage. Crude protein (CP) of the experimental diet ranged from 15.03% in 0% inclusion level to 15.63% in 10% inclusion. The Irish potato peel crude protein composition was 6.90%, this value is lower than the value reported by (Joyce, B. 2014). Protein values of Irish potato peels varies with specie, varieties and season of harvest. Crude fibre (CF) ranged between 9.16% in 30% inclusion level to 10.13% in 10% inclusion. Nitrogen free extract highest value was recorded in 30% inclusion level and the least recorded in 10% inclusion level. The starch content of the Irish potato peel depends on the peeling process while steam peels contained approximately 28% starch, abrasion peels has been reported to have about twice as much starch (51%) as in steam peels, since more potato flesh is removed during the abrasion process [9].

Table 3 shows the growth performance of Red Sokoto bucks fed diets containing varying levels of Irish potato peels. Inclusion of Irish potato peel in the bucks' diet significantly ($p<0.05$) influence final weight, weight gain, average daily feed intake and Feed cost/kg. The average weight gain was significantly ($p<0.05$) higher in 30% inclusion and lower in 10% inclusion level, this may be attributed to the level of the voluntary intake of the diet. [10] observed that if voluntary intake of feed by animals is too low, rate of production will be depressed. This factor has thus been described as one of the factors for production in small ruminants [11]. There was a significant difference ($p<0.05$) across treatments in average

daily feed intake and feed cost (' /kg), 30% inclusion had the highest average daily feed intake (247.0g), while 20% inclusion recorded the least value (226.0g). Feed cost (' /kg) was observed to be significantly ($p<0.05$) different across the treatment diets, with 30% inclusion level of Irish potato peels giving the best result in terms of feed cost/kg, while 20% inclusion recorded the least.

Table 3. Growth Performance of Red Sokoto bucks fed diets containing varying levels of Irish Potato Peels (IPP)

Parameter (%)	Inclusion level with Irish potato peel (%)				SEM
	0	10	20	30	
Average initial weight	8.66	8.66	8.66	8.68	0.71
Average final weight	9.64^{b}	9.93^{b}	10.70^{ab}	11.10^{a}	0.56
Average weight gain	0.98^{b}	1.27^{b}	2.04^{a}	2.42^{a}	0.28
Average daily feed intake	235.50^{b}	234.00^{c}	226.00^{d}	247.00^{a}	0.73
Feed cost (₦/kg)	51.70^{a}	54.10^{b}	56.07^{c}	50.00^{a}	0.86

^{abcd} Means with different superscript within the same row differed significantly at $P<0.05$, SEM=standard error means

The result of nutrient digestibility of the Red Sokoto bucks fed different inclusion of Irish potato peels is presented in Table 4. Dry matter, crude fibre and ether extract digestibility shows no significant ($p<0.05$) difference among the treatment diets. Crude protein and nitrogen free extract digestibility were significantly ($p<0.05$) affected by treatment diet. Twenty percent (20%) inclusion level of Irish potato peel significantly ($p<0.05$) recorded the highest value in crude protein and nitrogen free extract digestibility, while 0% was the lowest. The most probable explanation for this phenomenon is in the fact that 30% inclusion is higher of which might result in high palatability and better utilization of nutrients by the bucks. This result is similar to the report of [12], who indicated an increase in nutrients digestibility when goats were fed Irish potato peels.

Table 4: Nutrient Digestibility of Red Sokoto bucks fed diets containing varying levels of Irish Potato Peels (IPP)

	Inclusion level with Irish potato peel (%)				
Parameter (%)	0	10	20	30	SEM
Dry matter	76.55	72.21	78.20	73.89	3.88
Crude protein	74.69^{c}	82.92^{ab}	84.21^{a}	76.74^{b}	1.9
Crude fibre	82.00	80.02	85.88	79.35	3.11
Ether extract	82.65	86.97	93.29	86.15	5.07
Nitrogen Free extract	60.42^{b}	64.22^{ab}	72.74^{a}	68.25^{ab}	4.41

^{abc} Means with different superscript within the same row differed significantly at $P<0.05$, SEM=standard error means

The result of nitrogen balance study is presented in Table 5. The value obtained for nitrogen intake showed no significant ($p<0.05$) difference. Nitrogen losses in faeces, nitrogen lossesin urine, total nitrogen losses, nitrogen absorbed, nitrogen balance and percentage of nitrogen intake were significantly ($p<0.05$) affected by the inclusion levels of the Irish potato peels. Faecal nitrogen lossesvalues at different inclusion levels were significantly different ($p<0.05$). The values range between 6.32g/day at 0% inclusion level to 4.17g/day at 20% inclusion levels. This result did not agree with the reported of[13]. They reported that the faecal nitrogen increased with nitrogen ingestion. The highest value of nitrogen intake was recorded at 20% inclusion level, the least value was observed at 0% inclusion level. The values were higher and comparable to the values(4.79-3.35g/day) reported by [14]. Total nitrogen losses values ranged between 8.46-5.59g/day. Nitrogen balance and nitrogen absorbed highest values were recorded at 20% inclusion levels and the least values were also recorded at 0% inclusion level. The values were also higher compared to the 3.29-1.34g/day as nitrogen absorbed recorded by [14]. The result obtained in this study indicated that both the route for output of dietary nitrogen in excess of animal requirement was via urine and faeces.

Table 5: Nitrogen retention of Red Sokoto bucks fed diets containing varying levels of Irish Potato Peels (IPP)

	Inclusion level with Irish potato peel (%)				
Parameter (g/day)	0	10	20	30	SEM
Nitrogen intake	33.62	36.04	37.29	34.46	0.52
Nitrogen losses in faeces	6.32^{a}	5.74^{a}	4.17^{b}	5.48^{ab}	0.37
Nitrogen losses in urine	2.14^{ab}	1.80^{b}	1.42^{c}	2.25^{a}	0.10
Total nitrogen losses	8.46^{a}	7.57^{a}	5.59^{b}	7.73^{a}	0.45
Nitrogen absorbed	25.16^{c}	28.48^{b}	31.70^{a}	26.43^{c}	0.52
Nitrogen balance	31.48^{c}	34.22^{b}	35.88^{a}	31.95^{c}	0.28
% Nitrogen intake (%)	74.80^{c}	79.03^{b}	85.00^{a}	77.35^{b}	1.32

^{abc} Means with different superscript within the same row differed significantly at $P<0.05$, SEM=standard error means

Haematological parameters of Red Sokoto Bucks fed varied levels of Irish potato peels is presented in Table 6.Packed cell volume (PVC), Total Protein and Lymphocytes were not significantly ($p<0.05$) affected by the inclusion levels. There were significant ($p<0.05$) difference in the values obtained for the White Blood Cell, haemoglobin and neutrophils along the inclusion levels. The obtained value of PCV in this study ranging between 21.50 to 26.50% are slightly higher than the value (20.5-25.8) reported by [15], who fed West African Dwarf goats legume leaf meal diets. The value of PCV obtained in this study were very similar and within the normal range of 24-46% in healthy small ruminant animals [15]. White Blood Cell was significantly ($p<0.05$) affected, the highest value was recorded in 0% inclusion level and the

least value was recorded in 10% inclusion level. The observed values in this study are within the range of 4.0-13.00 10^6/mm reported for all goats [16 and 17] for Red Sokoto goat. The moderate White Blood Cell count observed in this study could indicate the absence or low incidence of microbial infection, foreign body or antigen[18] or parasite [19] in the circulating blood. The lymphocytes were higher than the Neutrophils as generally reported for goat and other ruminants [20].

Table 6: Haematological indices of Red Sokoto bucks fed diets containing varying levels of Irish Potato Peels (IPP)

	Inclusion level with Irish potato peel (%)				
Parameter	0	10	20	30	SEM
PCV (%)	26.50	26.20	21.50	22.50	1.35
Haemoglobin (g/100ml)	8.80[a]	8.84[a]	7.15[b]	7.50[b]	0.46
White blood cells (10^6/mm	11.65[a]	9.70[b]	9.80[b]	10.10[a]	0.66
Total protein (g/dl)	8.60	7.50	8.20	9.30	1.78
Neutrophils (%)	8.00[d]	14.50[b]	11.00[c]	15.50[a]	1.94
Lymphocytes (%)	90.20	84.50	87.50	84.51	2.37

[abc] Means with different superscript within the same row differed significantly at P<0.05, SEM=standard error means

Conclusion and application It can be concluded from the result of this study that feeding:

1. Irish potato peels to Red Sokoto bucks will help to reduce feed cost/kg.
2. Inclusion of Irish potato peels in the diet of Red Sokoto bucks also improved crude protein, nitrogen free extract digestibility, nitrogen absorbed, nitrogen retained and N as % intake up to 20% inclusion.
3. Irish potato peels are abundantly available as a cheap alternative source of energy and can be include in the goat diets without any adverse effect on haematological indices

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