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Proximate, Electrolyte and Biochemical Profile of Rabbits Fed with *Tridax procumbens* Residue Meal in Replacement of Vitamins and Minerals in Lapai Niger state Nigeria

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ABSTRACT: Proximate, electrolyte and biochemical profile of rabbits fed with Tridax residue meal replacing Vitamin and Mineral were evaluated in Lapai, Niger State, Nigeria using standard techniques. The dietary treatments evaluated were 20%, 40%, 60%, 80% and 0% inclusion level of Tridax. The results obtained did not follow any pattern except Urea, Globulin and Creatinine which had significant (P<0.05) decrease in the serum biochemical profile. The highest value for crude fat was seen in feed3 with value of 11.33±0.30 and the lowest was recorded in the control feed with value of 10.38±0.21. There was no significant difference in crude protein between feeds 1 and 2 with values of 58.13±0.15 and 56.13±0. 15 but feeds feeds3, 4 and the control feed showed significant difference at (P<0.05) The result of Chloride shows no significant differences (P<0.05) in feeds1, 2 and 3, with values of 7.26±0.96, 7.25 ±3.74 and 7.55±4.81 also feeds4 and the control feed shows no significant difference with values of 6.55±2.67 and 6.46 ± 0.96 but there is significant difference between feeds1, 2, 3 and feeds4 and control feed. The prepared feed supplemented with 20 and 40% Tridax is promising compared to others, hence could be used as a supplement in the feed of rabbit which can be consumed in place of red meat. Also the low cholesterol level in the feeds makes it idle for people with cardiovascular related problem. Thus, the cost of production of feed can be reduced using Tridax plant as a substitute for Vitamin and mineral premix. It is recommended that further studies on the optimum level of inclusion of Tridax plant to be established.

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Meat demand has increased dramatically for decades now. The primary drivers of this increase in meat demand are rising population, improved technology, and rising affluence. However, per capita meat consumption has lagged, particularly in industrialized countries, because protein is the most expensive dietary item. Expensive protein supply from traditional animals such as cattle, goat, sheep, pig, and chicken has necessitated the quest for new protein sources that are inexpensive, widely available, and pose little competition to man (Cherwon, 2020). The production of rabbits (*Oryctolagus cunniculus*) is a veritable way of reducing protein deficiency in Nigeria (Ajala and Balogun, 2004). Rabbits are known to have high potentials and good attributes, these includes high rate of growth, efficient conversion of forage to meat, very short gestation period, low cost of production, very high nutritional quality of meat, which includes

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low cholesterol, fat and sodium levels. Rabbits are also known for their high protein level of about 20.8% (Biobaku and Oguntona, 1997). *Tridax procumbens Linn* commonly known as "coat buttons" or "Tridax daisy", is a perennial herb belonging to the family *Asteraceae*. *Tridax procumbens* is widespread and abundant especially in fallow fields, agricultural fields and disturbed wastelands. It is reported to grow in most states in Nigeria. The leaves of *Tridax procumbens* are cooked and eaten as a vegetable and the plant is widely reported in folkloric medicine for its antimicrobial activity and potential to treat wounds, inflamed skin, mouth sores, skin infections, rheumatism, body heat, epistaxis, bronchial catarrh, dysentery and diarrhea. The plant is traditionally used to treat yellow fever, typhoid fever, high blood pressure and diabetes (Amagbegnon *et al.*, 2021). The objevtive of this study is to evaluate the proximate, electrolyte and biochemical profile of rabbits fed with *Tridax procumbens* residue meal in replacement of vitamins and minerals in Lapai Niger state Nigeria

MATERIALS AND METHODS

The research was carried out at the department of Biological sciences, faculty of Natural science, Ibrahim Badamasi Babangida University main campus Lapai Niger state Nigeria which lies the latitude of 9.064^{o} N and longitude of 6.5618 ^{o} N.

Experimental plants: The Tridax plant were collected from Ibrahim Badamasi Babangida university main campus. The yellow maize, soya beans and vitamin premix were purchase at the market. The blood samples were collected from the abattoir in Minna.

Fig. 1: Tridax Plant

Experimental animals: Twenty weaner rabbits of mixed sexes with an average initial weight of 0.70 kg of eight weeks age were sourced from the Rabbit Unit of Ministry of Livestock and fisheries Minna, Nigeria.

Feed formulation: Yellow maize and soybean were ground into powder. The Tridax plant were shade dried for 7 days and crushed to powdered form and then Incorporate with the mixture of yellow maize, soybean, vitamin premix and blood meal Tetracycline was added to the blood meal to serve as an antibiotic**.**

Table 1: Formulation of Tridax residue meal

Ingredients	Cntr(g)	F_1 (g)	F_2 (g)	F_3 (g)	F_4 (g)
Tridax	0.00	20.00	40.00	60.00	80.00
Soybeans	32.00	25.00	20.00	15.00	5.00
Maize	57.00	44.00	29.00	14.00	4.00
Blood meal	10.00	10.00	10.00	10.00	10.00
Premix	1.00	1.00	1.00	1.00	1.00
Total	100.00	100.00	100.00	100.00	100.00

Moisture content determination: The moisture content of the sample was determined by using AOAC (2005).
Determination of Ash Content: The ash content of the sample was determined using the procedure outlined in AOAC (2005).

Determination of crude fibre: The crude fiber of the sample was determined using the method of the AOAC (2006).

Protein content determination: The method of AOAC (2010) was adopted using micro-kjeldahl apparatus. The technique was based on the transformation of protein nitrogen and other nitrogen compound such as nitrate and nitrite into ammonium sulphate by acid digestion with strong acid.

Determination of Lipid: Fat content was determined using the procedure outlined by AOAC (2005).Using the Werner Schmidt method of fat hydrolysis.

Biochemical and Electrolyte analysis: Five experimental diets were formulated and assigned as diets 1, 2, 3, 4 and 5. Diet 1 was the conventional rabbit meal/feed which include Soya beans, maize, blood meal, vitamin and mineral premix which served as the control without Tridax plant, while Diets 2, 3, 4 and 5 were dietary treatments in which Tridax was used to

replace vitamin and mineral at 20, 40, 60 and 80% respectively.

At the end of 8 weeks of the feeding trial two rabbits per treatment were randomly selected for blood evaluation. The rabbits were slaughtered by severing the jugular vein to collect blood. Five (5) ml of blood was collected separately from each of the selected animal into EDTA (ethylenediamine tetra acetic acid) bottles for haematological parameters and bottles without anticoagulant were used for biochemical indices.

The haematological parameters were determined using Cell-DYN 3500 Hematology Analyzer (Abbott Diagnostic Division, Santa Clara CA). The Manufacturers operation manual recommended settings and calibration for rabbit haematology were applied. Blood samples with EDTA anticoagulant were used for the determination of the selected haematological parameters (Archetti *et al*., 2008).

The serum biochemical parameters were determined at 37° C a random-access clinical analyzer (SYNCRON CX5-DELTA, Beckman Coulter, and Fullerton, U.S.A.) using kits by the same firm. The parameters and the respective methods applied are: aspartate aminotransferase (AST) - Henry method; alanine aminotransferase (ALT) - Henry method; creatinine - colorimetric, Jaffè method; urea - enzymatic colorimetric, urease method; (Amadori *et al*., 1997). Alkaline phosphtase was determined with the enzyme kits (Techon Diagnostics, Tarry-town, NY) as outlined by Hewitt *et al.* (1989).

Other parameters obtained were analyzed calorimetrically for total protein (TP) by the Biurette method with kits (Plasmatec; Plasmatec Laboratory products Ltd., UK). Albumin (Ab) concentration was determined by the bromocresol green (BCG) method (Peters *et al*., 1982). Cholesterol concentration was determined using the Biurette method of Coles, (1986). Bicarbonate was determined by the enzymatic method reported by Forrester *et al*. (1976) using phosphoenolpyruvate (PEP) as a reagent. Plasma electrolytes were determined electrochemically with Ektachem ion-selective electrode slides for chloride, sodium and potassium. Blood calcium was assayed with Calcium Ektachem slides. Appropriate calibrator (Eastman Kodak Co.) was used for the assay (Hewitt *et al*., 1989).

Statistical Analysis: The result were analyzed using ANOVA (statistical analysis software) 2001 to compere the means and Fisher Least Significant (LSD) difference to separate the means at ($P < 0.05$).

RESULTS AND DISCUSSION

Table 1 represents the chemical composition of the formulated rabbit feed (pellet) and showed no significant difference in the moisture content between the control feed and feed 1 with values of 8.05±0.41 and 8.02±0.08 also, significant difference was not seen between feed2 and feed3 with values of 7.58 ±0.25 and 7.16±0.20 but there was significant difference between feed4 with a value of 6.46±0.15 and all other feeds at ($P<0.05$). The Ash content showed no significant difference between feeds 1, 3 and 4 with values of 9.07±0.36, 9.76±0.25 and 9.13±0.20 at ($P<0.05$) but there was significant difference in the control feed and feed2 with values of 7.19±0.17 and 8.73±0.32, were feed3 recorded the highest value of 9.76±0.25 as against the control feed with a value of 7.19±0.17. There was no significant difference in the crude fibre between feeds 1, 2, 3 and the control with values of 5.30 ± 0.26, 5.56 ± 0.30, 5.43 ± 0.37 and 4.30 ± 0.26 at ($P<0.05$) but feed4 was statistically significant as compared to other feeds with a value of 6.20 ± 0.30 which is also the highest value while feed3 recorded the lowest value of 4.30 ± 0.26. There was no significant difference in crude protein between feeds 1 and 2 with values of 58.13 ± 0.15 and 56.13 ± 0. 15 but feeds feeds3, 4 and the control feed showed significant difference at ($P<0.05$) with values of 52.00 ± 2.00, 40.70 ± 1.12 and 55.34 ± 0.12 with feed1 recording the highest value while feed4 recorded the lowest. There was also no significant difference in crude fat between feeds1, feeds2 and the control feed with values of 10.45 ± 1.38, 10.45 ± 1.38 and 10.38 ± 0.21. Feeds 3 and 4 also showed no significant difference at ($P<0.05$) with values of 11.33 ± 0. 30 and 11.20 ± 0.03 but showed significant difference when compared to feeds1, feeds2 and the control feed. The highest value for crude fat was seen in feed3 and the lowest was recorded in the control feed. Table 2 represents Serum electrolyte profile of rabbits fed Tridax and other related plants. The result of Chloride shows no significant differences ($P<0.05$) in feeds1, 2 and 3, with values of 7.26 ± 0.96, 7.25 ± 3.74 and 7.55 ± 4.81 also feeds4 and the control feed shows no significant difference with values of 6.55 ± 2.67 and 6.46 ± 0.96 but there is significant difference between feeds1, 2, 3 and feeds4 and control feed. With respect to Calcium, feeds1 / 2, and also feeds3 / Control feed shows no significant difference with values of 12.56± 0.95 and 12.25 ± 3.13, also 11.55± 4.74 and 11.11 ± 3.13 at ($P<0.05$). There is also no significant difference in feed4 with a value of 5.06 ± 2.95 but it differs statistically as compared to all other feeds. The results for potassium shows no significant difference between feeds 1 and 3 with values of 4.25 ± 1.12 and 4.55 ± 4.44 but differs statistically from feeds 2, 4 and the control feed which have values of 5.25 ± 3.11a,

3.55 ± 3.20 and 2.95 ± 1.12 at (P<0.05). No significant difference at (P<0.05) was observed among all feeds for Phosphorus but feeds 1, 2 and the control with values of 6.35 ± 0.91, 6.25 ± 0.23 and 6.25 ± 0.23 differs statistically from feeds 3 and 4 which have values of 5.55 ± 0.18 and 4.55 ± 0.16.

Table 1. Results of the proximate analysis of formulated feed of Tridax and other related plants in the diet of hybrid rabbit

Parameters	Control	$Feed_1$	$Feed_2$	$Feed_3$	$Feed_4$
Moisture	8.05±0.41^a	8.02±0.08^a	7.58 ±0.25^b	7.16±0.20^b	6.46±0.15^c
Ash	7.19±0.17^c	9.07±0.36^a	8.73±0.32^b	9.76±0.25^a	9.13±0.20^a
Crude fibre	4.30 ± 0.26^b	5.30 ± 0.26^b	5.56 ± 0.30^b	5.43 ± 0.37^b	6.20 ± 0.30^a
Crude protein	55.34 ± 0.12^b	58.13 ± 0.15^a	56.13 ± 0. 15^a	52.00 ± 2.00^c	40.70 ± 1.12^d
Crude Fat	10.38 ± 0.21^b	10.45 ± 1.38^b	10.40 ± 0.36^b	11.33 ± 0. 30^a	11.20 ± 0.03^a

Mean values with the same super script alphabets on same column are not significantly different at P<0.05

Table 2. Serum electrolyte profile of rabbits fed tridax and other related plants

Parameter	Control	$Feed_1$	$Feed_2$	$Feed_3$	$Feed_4$
Cl^-	6.46 ± 0.96^b	7.26 ± 0.96^a	7.25 ± 3.74^a	7.55 ± 4.81^a	6.55 ± 2.67^b
Ca^{2+}	11.11 ± 3.13^b	12.56± 0.95^a	12.25 ± 3.13^a	11.55± 4.74^b	5.06 ± 2.95^c
K^+	2.95 ± 1.12^d	4.25 ± 1.12^b	5.25 ± 3.11a^a	4.55 ± 4.44^b	3.55 ± 3.20^c
Na^+	101.25± 0.71^a	100.23 ± 0.50^b	101.25±0.91^a	100.15 ± 3.80^b	95.55 ± 2.38^c
P^+	6.25 ± 0.23^a	6.35 ± 0.91^a	6.25 ± 0.23^a	5.55 ± 0.18^b	4.55 ± 0.16^c

Mean values with the same super script alphabets on same column are not significantly different at P<0.05

Table 3 represents biochemical profile of rabbits fed Tridax and other related plants were significant difference (P<0.05) was not seen among all feeds for Albumin. Though feeds 1 and 2 are statistically similar with value of 22.47 ±0.13 and 22.40 ±0.09 but differ statistically from feeds 3, 4 and control which have values of 21.14 ±0.05, 18.81 ±0.20 and 17.00 ±0.13. No significant difference at (P<0.05) was seen in Urea with respect to feed 1and the control feed which have values of 23.24±0.29 and 24.24±0.29 but the two feeds differ significantly to feeds 2, 3 and 4 which have values of 22.01±0.02, 18.53±0.02, 2.42±0.02. The highest value for total protein is observed in feed2 with a value of 55.69 ±0.01, while the lowest value is seen in feeds4 and the control 42.13 ±0.13, 42.10 ±0.01 which shows that there is no significant difference between the two feeds at (P<0.05). There is no significant difference in all other parameters with respect to the biochemical profile as can be seen in the table 3.

Table 3. Biochemical profile of rabbits fed Tridax and other related plants

Index	Control	$Feed_1$	$Feed_2$	$Feed_3$	$Feed_4$
Alb(g/L)	17.00 ±0.13^d	22.47 ±0.13^a	22.40 ±0.09^a	21.14 ±0.05^b	18.81 ±0.20^c
U (mmol/L)	24.24±0.29^a	23.24±0.29^b	22.01±0.02^c	18.53±0.02^d	2.42±0.02^e
TP (g/L)	42.10 ±0.01^d	51.87 ±0.01^b	55.69 ±0.01^a	49.81 ±0.00^c	42.13 ±0.13^d
Gl (g/L)	22.31 ± 22^c	24.62 ±0.04^b	25.31 ±0.02^a	23.19 ±0.25^c	22.03 ±0.06^c
Cr (mmol/L)	1.34 ±0.07^a	1.26±0.07^b	1.27±0.04^b	1.32±0.02^a	1.37±0.06^a
ALP (U/L)	8.80 ± 2.23^a	6.08 ±0.59^c	6.47 ±0.32^c	7.02±0.23^b	7.07 ±0.15^b
ALT (U/L)	74.70± 1.90^a	66.70±2.90^b	68.31±5.78^b	74.51±0.43^a	77.95±1.59^a
AST (U/L)	5.00 ± 0.34^c	5.21±0.53^c	6.02±0.02^b	7.01±0.02^a	3.23±0.02^d
TC (mmol/L)	2.50 ± 0.89^a	2.30 ±1.00^b	2.27 ±1.73^b	2.20 ±3.46^b	2.51 ±5.03^a

Mean values with the same super script alphabets on the same row are not significantly different at P<0.05. Alb: Albumin; U: Urea; TP: Total protein; Gl: Globulin; Cr: Creatinine; ALP: Alkaline phosphatase; ALT: Alanine aminotransferase; AST: Aspartate amino transferase; TC: Total cholesterol.

Tridax procumbens inclusion in rabbit diets can serve as a good source of fibre and protein. The results in this finding reveals a high protein content, this might be as a result of the high content of soybean inclusion during the feed formulation which is also a vital requirement for growth**.** The values obtained here are in close agreement with the findings of (Runde *et al*, 2020). The reason for the high content of fibre in feed 4 might be attributed to the fact that Tridax are generally known to be rich in fibre which is an important component of daily diet requirements of rabbits. Generally, moisture was higher in the control feed and lower in feed 4. The low moisture content observed in feed 4 indicates great resistance to microbial contamination as reported by (Oguntona, 1998).

The Lipid content in feed 1 and 2 which has 20% and 40% percentage of Tridax inclusion recorded values which are moderately fair and is good for diabetic patients as reported in the findings of (Hussein *et al*., 2017). The results of serum electrolytes as presented in table 2 showed a much higher value of calcium in feeds 1 and 2, this findings is in agreement with reports of (Ikewuchi *et al*., 2010) who also reported lower values of Calcium within the same range in their work. Calcium is also known to improve the quality of rabbit

meat which has good health benefits to humans when consumed. The values recorded for potassium in this work are in close agreement with the reports of (Garba and Mohammed, 2015), but that of chloride are not. Burnett *et al*. (2006) also reported similar values with respect to Ca, Cl and K in their findings. The results of the biochemical profile reported in this work is in close agreement with the findings of (Garba and Mohammed, 2015) who also reported similar results with respect to Albumin, Total cholesterol, Alkaline phosphatase, Alanine aminotransferase and Aspartate amino transferase. Jude, (2012) reported similar results of biochemical profile of Tridax leaves in his findings were he gave the range of total cholesterol at 1.63- 2.24. This value are in agreement with values of total cholesterol in this research work.

Conclusion: The prepared feed supplemented with 20% and 40% of Tridax residue is promising compared to others, hence, its inclusion could be used as a supplement in the feed of rabbit which will have important health benefits to humans especially the aged and diabetic patients when consumed in place of red meat. Also the low cholesterol in the feeds makes it idle for people with cardiovascular related problem. Thus, the cost of production can be reduced using Tridax plant as a substitute for Vitamin and mineral premix. It is recommended that further studies on the optimum level of inclusion of Tridax plant to be established.

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