European Journal of Agriculture and Food Sciences
www.ejfood.org

Growth Performance of Wistar Rats Fed Graded Levels of *Piper umbellatum* Linn (Cow-Foot) Leaf Meal

Sor-Aniabari Ruth Baradum, Dikioye Emmanuel Peters, Reginald Chibueze Ohiri, and Charity Uchechi Ogunka-Nnoka

ABSTRACT

The growth performance of albino rats fed graded levels of *Piper umbellatum* Linn leaf meal (PULM) was evaluated. Twenty individually-housed albino weanling rats were divided into four groups of five rats each and fed with three graded levels of PULM inclusion diets (10%, 15% and 20%) labeled groups T_1, T_2, and T_3 respectively and T_0 for control. Growth performance was monitored for 21 days. Growth performance revealed total reduction in body weight of rats on day 7 in all groups. Mean weights of rats non significantly increased in groups T_1 and T_2 and decreased in group T_3 on days 14 and 21 while group T_0 increased significantly ($p \leq 0.05$) on day 21 when compared with initial weights. Feed intake in all groups decreased significantly ($p \leq 0.05$) while feed conversion ratio (FCR) decreased significantly ($p \leq 0.05$) only in group T_3 when compared with the control. Carcass weights (heart, liver and intestine) for groups T_1-T_3 and kidney for groups T_2 and T_3 significantly ($p \leq 0.05$) decreased when compared to control. The present study hence revealed that inclusion of *Piper umbellatum* Linn leaf meal in the rat's diet had reduction effects on body weight, feed intake, feed conversion ratio (FCR) and carcass weights of the rats. Hence, PULM could serve as a novel food source for body weight management.

Keywords: Growth Performance, Leaf Meal, *Piper Umbellatum* Leaves, *Wistar Rats.*

Submitted: June 4, 2022

Published: October 5, 2022

ISSN: 2684-1827

DOI: 10.24018/ejfood.2022.4.5.516

S. A. R. Baradum*
University of Port Harcourt, Nigeria.
(e-mail: baradumruth22@gmail.com)
D. E. Peters
University of Port Harcourt, Nigeria.
(e-mail: petersdikioye@ymail.com)
R. C. Ohiri
Biochemistry, Faculty of Science,
University of Port Harcourt, Nigeria.
(e-mail:
reginald.ohiri@uniport.edu.ng)
C. U. Ogunka-Nnoka
University of Port Harcourt, Nigeria.
(e-mail:
charity.ogunkannoka@uniport.edu.ng)

****Corresponding Author***

I. Introduction

Insufficient feed availability and nutrition has been discovered to be major constraints to livestock growing in Nigeria [1]. Animal and vegetable protein supplement are both used as a protein source in livestock rations which include fish meal, blood meal, groundnut cake, soybean meal, cotton seed meal, etc. Like other developing nations of the world, protein cost of animal origin in Nigeria is high and often not affordable by the local man. Therefore the necessity to alleviate the insufficiency in protein availability has been channeled towards the utility of easily accessible and inexpensive feed stuffs, which are plant proteins [2].

Piper umbellatum Linn is a perennial herb or scrambling shrub that is widely naturalized in tropical rain forest in Africa, Japan and the Indian Ocean Islands [3]. It belongs to the Piperaceae family and order: Piperales. The plant appears as the prevalent flora wherever they are discovered and tolerate light winter forest [4]. They become scanty in dry period. *P. umbellatum* are seen as undergrowth in evergreen rainforest and in river banks but few in moist or damp places [3]. According to [5], several common names are associated with this plant which is: cow-foot leaf, fula-pulaar, wild pepper, pepper plants, pepper vines. It is known as nyakorbadua in Ogoni, Khana Local Government Area of Rivers State where the plant sample was harvested. Although consumed uncooked, steamed, or cooked as a vegetable or condiment with fish or meat and rice in most tropical regions, the potential is yet untapped. The plant distinct parts are utilized customarily for either food or medicine. It is a favoured leafy vegetable and eaten either slightly cooked or minced with fish or meat in Sierra Leone. The basal stem part, which sometimes has a chunky and corky bark, is wont by Tamne people as seasoning for rice or palm oil sauce. In the Central African Republic, the stem-pith and the inflorescence are utilized in mucilaginous condiment preparation. The sweet, mature fruits are eaten as a delicacy in tropical Asia [6]. *P. umbellatum* leaves has being revealed to contain approximately 20% protein [5] and are rich in minerals especially potassium and calcium. The leaves also have appreciable phosphorus and iron contents [7]. Despite the above nutritional value of *Piper umbellatum* leaves, there is a dearth of information on the use of *Piper umbellatum* in animals feeding in Nigeria. Thus the study is designed to evaluate the growth performance of wistar rats fed graded levels of *Piper umbellatum* Linn leaf meal (PULM).

II. Materials And Method

A. Plant Sample Collection and Identification

Piper umbellatum leaves were obtained from a garden both in Kaani and Boue; rural communities in Khana Local Government Area, Rivers State. The plant sample was identified and authenticated by Dr. Chimezie Ekeke of the Department of Plant Science and Biotechnology, University of Port Harcourt Herbarium with voucher number UPH/P/182. The leaves were detached from the stalk and washed carefully under running tap water and air-dried for 14 days at room temperature (20-25 ℃). The dried leaves were grinded using a grinding mill into fine *piper umbellatum* leaf meal (PULM).

B. Experimental Wistar Albino Rats and Design

Twenty Wistar albino weanling rats of about six weeks old were purchased from the Department of Biochemistry animal house, University of Port Harcourt for the experiment. The rats were individually caged and completely randomized into four groups of five rats per treatment. The treatment diets were prepared using the procedure stated by [8]. Four experimental diets containing *P. umbellatum* leaf meal of 0% (control), 10%, 15%, and 20% were allotted to the animals as replacement of maize. *P. umbellatum* leaf meal-based diets were supplemented with other ingredients which constitute treatments 0 (control), 1, 2 and 3 respectively.

C. Housing and Feeding

Manual metabolic cages were constructed using transparent plastic containers. The transparent plastic containers were used to house the animals individually. The plastic containers had its top made of welded mesh to enhance ventilation. Empty grand malt tins cut to the desired size were fixed at the corners of the cages to act as feed troughs. Uniport water bottles were used as drinkers. The bottles had its covers fixed with glass nipples which were fitted to the top of the plastic containers to aid drinking. Empty water bottles were also cut to the desired size and positioned in the plastic container with funnel fitted to it to serves as the urine collector. The animals had free access to feed and water throughout the experimental period and growth performance monitored for 21 days.

D. Parameters Measured

During the experimental period, weekly feed intake and weight gains were recorded, and feed conversion efficiency were calculated. At the expiration of the period of study, the animals were chloroformed for 5 minutes and dissected. The liver, spleen, kidneys, stomach, respiratory tract and full gastro-intestinal tract (GIT) were carefully removed and individually weighed after separation on an electronic weighing scale.

E. Chemical Analysis

The proximate compositions of the four experimental diets were conducted following the standard method of [9] while the Mineral contents (Heavy metal concentration) were determined using the Atomic Absorption Spectrophotometer (AAS; UNICAM 929 London) according to the descriptive method of [10].

F. Statistical Analysis

All data collected were subjected to statistical analysis and values were expressed as means ±SEM (standard error mean). One way Analysis of Variance was deployed to detect differences in experimental groups using statistical package for social sciences (SPSS) version 20. The results were represented significant at $p \leq 0.05$.

III. Results And Discussion

A. Proximate Compositions of Dried Piper Umbellatum L. Leaf Meal (PULM)

The proximate composition of graded levels of *Piper umbellatum* leaf meal (PULM) supplementation is revealed on Table II. Moisture content was higher in groups T_1 and T_2 and lower in group T_3 compared to group T_0. The moisture content in all groups (T_0-T_3) were lower than the value (12.67%) reported by [8] for baobab leaf meal (BLM) and higher than the value (6.4%) for *Moringa oleifera* leaf meal (MOLM) reported by [11]. However, the value for group T_3 was similar to those reported by [11]. The crude protein content was higher while crude fiber and crude fat contents were lower in groups T_1-T_3 compared to T_0. The crude protein and crude fiber contents in all groups (T_0-T_3) were higher compared with 18.47% and 7.69% respectively as reported by [8] for BLM and 22.6% and 10.1% as reported by [11] for MOLM. The PULM based diets were discovered to be rich in crude protein. The crude fat percent was lower compared with 7.67% reported by [8] and higher than 3.4% recorded by [11] for MOLM. The carbohydrate content was higher in groups T_1-T_2 while the ash content was higher in group T_3 and lower in groups T_1 and T_2 compared to T_0. The ash content was similar to the value (7.9%) reported by [11] for MOLM. The moderate ash content of PULM may be a good mineral source for farm animals.

TABLE I: Percentage Composition Of Experimental Diets

Ingredients	← Dietary treatments →			
	$T_0$0%	**$T_1$10%**	**$T_2$15%**	**$T_3$20%**
Maize	60	50	45	40
P. umbellatum leaf meal	-	10	15	20
Crayfish	10	10	10	10
Soya bean meal	15	15	15	15
Groundnut shell	13.5	13.5	13.5	13.5
Periwinkle shell	0.5	0.5	0.5	0.5
Common salt	0.50	0.50	0.50	0.50
Vitamin-traced mineral premix**	0.50	0.50	0.50	0.50
Total	100	100	100	100

** Vitamin Trace Mineral Premix: Inclusion rate is 2.5g/kg to supply Vit. A = 8000 IU, D = 500 IU, Vit. E = 2.5mg, Vit. K_3 = 1mg, Vit. B_2 = 0.005mg, Folic Acid = 0.5mg, Nicotinic Acid = 8mg, Calcium Panthotenate = 2mg, Choline Chloride = 50mg, Manganese = 50mg, Zinc = 4mg, Copper = 4.5mg, Cobalt = 0.1mg, Iodine = 0.1mg.

B. Mineral Compositions of Dried Piper Umbellatum L. Leaf Meal (PULM)

The result of the mineral constituents of PULM is shown on Table III. Selenium content was lower in groups T_1-T_3 compared to group T_0. Sodium, potassium, calcium and manganese contents were higher in group T_3 and lower in groups T_1 and T_2 compared to T_0. However, magnesium, iron and zinc contents were lower in groups T_1-T_3 compared to T_0. The calcium, iron, potassium and zinc contents in all groups were higher compared with 6.98 mg/100 g, 2.98 mg/100 g, 7.09 mg/100 g and 5.89 mg/100 g respectively reported by [11] for MOLM. The mineral content of PULM revealed a considerable amount of beneficial minerals including calcium, potassium, magnesium, sodium and iron implying that PULM is a source of mineral for livestock.

C. General Growth Performance Of Rats Fed Dried Piper Umbellatum Leaf Meal (PULM).

The growth performances of the rats in terms of weight gain, feed intake and carcass characteristics after treatment with graded levels of *Piper umbellatum* L. (cow-foot) leaf meal (PULM) for 21 days are presented in Table IV, Table V, Table VI, Table VII, Table VIII and Table IX.

Table IV showed decrease in the body weights of rats in all groups after 1 week (7 days) of feeding with treatment diets when compared with the initial weights (day 0) but was not statistically significant ($p \geq 0.05$) when compared with group T_0 (control).

Table V showed an increase in the mean body weights of rats in groups T_0 and T_1 respectively and a decrease in groups T_2 and T_3 respectively after 2 weeks (14 days) of feeding when compared with the initial weights. There was no statistical significant difference ($p \geq 0.05$) in the mean weight of rats in all groups when compared to group T_0.

Table VI showed non significant ($p \geq 0.05$) increase in the body weights of rats in groups T_0, T_1 and T_2 and a nonsignificant ($p \geq 0.05$) decrease in group T_3 after 3 weeks (21 days) when compared with initial weights.

TABLE II: PROXIMATE COMPOSITION OF DRIED *PIPER UMBELLATUM* L. LEAF MEAL (PULM)

Proximate compositions ←	Concentration (%) →			
	T_0 0%	**T_1 10%**	**T_2 15%**	**T_3 20%**
Moisture	7.80	8,10	8.65	6.42
Crude protein	23.10	24.50	25.20	25.98
Crude fat	6.00	5.84	5.45	5.55
Crude fibre	27.00	25.16	24.50	15.30
Ash	7.50	7.10	6.30	8.95
Carbohydrate	28.60	29.30	29.90	37.80

TABLE III: *MINERAL COMPOSITION OF DRIED PIPER UMBELLATUM L. LEAF MEAL (PULM)*

Minerals composition ←	Concentration (mg/100g) →			
	$T_0$0%	**$T_1$10%**	**T_2 15%**	**T_3 20%**
Selenium	0.048	0.045	0.043	0.042
Sodium	146.85	126.46	116.87	218.04
Potassium	384.22	362.51	345.20	452.78
Calcium	674.38	635.74	602.09	852.32
Magnesium	391.32	368.32	349.21	235.33
Iron	58.18	51.95	48.64	41.07
Zinc	3.98	3.68	2.97	2.38
Manganese	4.53	4.19	3.98	5.14

TABLE IV: GROWTH PERFORMANCE OF RATS FED TREATMENT DIETS FOR 1WEEK

Group	Initial weight (g)	Weight after 7 days (g)	Feed Administration(g)	Feed intake (g)
T_0 0% (Control)	88.20±7.53	83.40±9.54	100.00±0.00	$60.34±8.35^{a}$
T_1 10% diet inclusion	87.40±8.57	86.20±8.10	100.00±0.00	$54.46±5.04^{b}$
T_2 15% diet inclusion	80.60±10.03	66.60±9.56	100.00±0.00	$32.01±3.49^{a,b}$
T_3 20% diet inclusion	81.40±10.84	72.20±9.44	100.00±0.00	$25.09±2.12^{a,b}$

Values are reported as Mean± Standard Error of Mean (M±SEM) (n =5). Values with similar superscripts indicate statistical significance difference ($p \leq 0.05$) down the column while those without superscripts shows non-significance difference ($p \geq 0.05$) down the column when compared with the control and between groups.

TABLE V: GROWTH PERFORMANCE RATS FED TREATMENT DIETS FOR 2 WEEKS

Group	Initial weight (g)	Weight after 14 days (g)	Feed Administration (g)	Feed intake (g)
T_0 0% (Control)	88.20±7.53	101.20±5.96	$117.10±12.52^{a}$	$57.38±5.34^{a,c}$
T_1 10% diet inclusion	87.40±8.57	91.00±8.68	$60.75±1.50^{a,b,c}$	$27.33±7.14^{a,c}$
T_2 15% diet inclusion	80.60±10.03	75.80±9.01	$112.70±3.50^{b,c}$	$42.75±5.98^{b,c}$
T_3 20% diet inclusion	81.40±10.84	68.40±8.47	$77.60±0.00^{a,c}$	$9.29±0.30^{a,b,c}$

Values are reported as Mean± Standard Error of Mean (M±SEM) (n =5). Values with similar superscripts indicate statistical significance difference ($p \leq 0.05$) down the column while those without superscripts shows non-significance difference ($p \geq 0.05$) down the column when compared with the control and between groups.

TABLE VI: GROWTH PERFORMANCE RATS FED TREATMENT DIETS FOR 3 WEEKS

Group	Initial weight (g)	Weight after 21 days (g)	Feed Administration (g)	Feed intake (g)
T_0 0% (Control)	88.20±7.53	112.80±7.26	110.71±3.08[a]	76.12±3.59[a]
T_1 10% diet inclusion	87.40±8.57	102.80±8.14	52.62±1.34[a,b,c]	47.98±5.11[a,b,d]
T_2 15% diet inclusion	80.60±10.03	83.60±8.69	74.41±7.19[a,b,c]	55.79±6.93[a,c,d]
T_3 20% diet inclusion	81.40±10.84	74.80±9.21	31.92±1.42[a,b,c]	28.78±0.33[a,b,c,d]

Values are reported as Mean± Standard Error of Mean (M±SEM) (n =5). Values with similar superscripts indicate statistical significance difference ($p \leq 0.05$) down the column while those without superscripts show non-significance difference ($p \geq 0.05$) down the column when compared with the control and between groups.

TABLE VII: BODY WEIGHT OF RATS FED TREATMENT DIETS FOR 7, 14, AND 21 DAYS

Group	Initial weight (g)	Weight after 7 days (g)	Weight after 14 days (g)	Weight after 21 days (g)
T_0 0% (Control)	88.20±7.53[a]	83.40±9.54[b]	101.20±5.96	112.80±7.26[a,b]
T_1 10% diet inclusion	87.40±8.57	86.20±8.10	91.00±8.68	102.80±8.14
T_2 15% diet inclusion	80.60±10.03	66.60±9.56	75.80±9.01	83.60±8.69
T_3 20% diet inclusion	81.40±10.84	72.20±9.44	68.40±8.47	74.80±9.21

Values are reported as Mean± Standard Error of Mean (M±SEM) (n =5). Values with similar superscripts indicate statistical significance difference ($p \leq 0.05$) across the row while those without superscripts shows non-significance difference ($p \geq 0.05$) across the column when compared with the control and between groups.

Table VII showed the body weights of rats before and after treatment with graded levels of *P. umbellatum* leaf meal for 21 days. The result showed a non significant ($p \geq 0.05$) decrease in the mean body weight of rats in all groups on day 7 when compared with the initial weights. Mean weights of rats non significantly ($p \geq 0.05$) increased in groups T_1 and T_2 and decreased in group T_3 on days 14 and 21 but not significant ($p \geq 0.05$) while group T_0 increased significantly ($p \leq 0.05$) on day 21 of treatment when compared with the initial weights.

D. Overall performance of rats fed treatment diets

Table VIII showed the mean final weight gains/loss in all groups with T_0, T_1 and T_2 recording weight gains and group T_3 recording weight loss. Final mean weight values were 112.80±7.26, 102.80±8.14, 83.60±8.69 and 74.80±9.21g with their corresponding mean weight gains/losses as 24.60±2.89, 15.40±2.73, 3.00±3.54 and -6.60±6.53g for T_0, T_1, T_2 and T_3 respectively. It was observed that mean weight of rats in group T_0 diet was higher than the other groups and mean weight of rats in group T_1were higher than the other PULM based diets. The low weight gain in groups T_1-T_3 compared to group T_0 may be due to the poor nutrients utilization by the rats. It is worthy of note that there was a corresponding decrease in weight gain as the level of *Piper umbellatum* leaf meal (PULM) increased in the diets which agreed with the report of [12] in their "Determination of nutritive value of tropical biomass products as dietary ingredients for monogastrics using rats" as the animal model. They discovered a corresponding reduction in the weight gains of the rats in all the plant species investigated when the inclusion was increased from 25-50 percent. The report of [13] clearly stated that at lower inclusion of 0.15% and 0.30%, there were improvements in weight gains in rabbits but decreased when 0.45% of *Moringa oleifera* (moringa) leaf meal (MOLM) was added. The reduction in the mean body weight of rats with increase in the inclusion level of PULM could be because of the high level of PULM inclusion in the diet, decrease in feed intake resulting from unacceptability of the feed by rats and possibly some intrinsic anti-nutritional factors (tannins) which are present in *Piper umbellatum* leaves. These anti-nutritional factors are well-known to decrease the nutrients availability by forming indigestible complexes with them [14]–[16], thereby resulting to reduction of intestinal nutrients absorption, suppression of growth, decreased animal feed intake, final weight gain and reproductive performance [17]. Contrary to the result of this study, [18] recorded increase in body weight gains of 954.98, 1274.52, 1373.34 and 1107.46g of broilers fed with *Moringa oleifera* leaf meal (MOLM) on 0, 1, 2 and 3% inclusion levels respectively. The increase noticed maybe attributed to the low MOLM inclusion levels and improved quality of protein in the diets. In different studies by [19] with 5% inclusion of *Icacina oliviformis* (false yam) leaf meal fed to rabbits and [20] with 5% inclusion of *Leucaena leucocephala* (leucaena) leaf meal fed to broilers, there was no adverse effect recorded on the growth performance of the experimental animals. Therefore they concluded that at 5% inclusion level of feed; feed intake, digestibility and weight gain improved.

The value of the mean total feed intake ranged between 63.16±1.83 -193.84±12.31g with T_0, T_1 and T_2 recording higher values (Table VIII). Feed intake in all groups decreased significantly ($p \leq 0.05$) when compared to T_0. It was detected that feed intake decreased with increasing inclusion levels of PULM. These outcomes is in conformity with the results of [20], [21] who also showed inverse relationship between feed intake and increasing levels of leaf/seed meal inclusion in diets. However, [19], [22] discovered improved feed intake with increasing test material. So, the observed variations could be accredited to the type of plant, inclusion level and experimental animal used.

Feed conversion ratio (FCR) decreased significantly ($p \leq 0.05$) in group T_3 and increased in groups T_1 and T_2 but were non significant ($p \geq 0.05$) when compared to T_0. T_2 recorded the highest mean value of FCR follow by T_1 (Table VIII). Rats in group T_0 had a better FCR which is possibly due to the absence of PULM. These outcomes were consistent with the result of [18], [19]. Increasing the inclusion level of PULM could have led to increase in anti-nutritional factors present in the diet which could impair the diet digestibility.

TABLE VIII: OVERALL PERFORMANCE OF RATS FED TREATMENT DIETS

Group	Initial weight (g)	Final weight (g)	Weight gain/loss (g)	Total feed intake (g)	Feed conversion ratio
T_0 0% (Control)	88.20±7.53	112.80±7.26	24.60±2.89	193.84±12.31^{a}	8.34±1.13^{a}
T_1 10% diet inclusion	87.40±8.57	102.80±8.14	15.40±2.73	131.65±10.18^{a,b,c}	10.08±2.38^{b,d}
T_2 15% diet inclusion	80.60±10.03	83.60±8.69	3.00±3.54	130.55±13.21^{a,c}	11.81±6.90^{c,d}
T_3 20% diet inclusion	81.40±10.84	74.80±9.21	-6.60±6.53	63.16±1.83^{a,b,c}	-9.36±3.37^{a,b,c,d}

Values are reported as Mean± Standard Error of Mean (M±SEM) (n =5). Values with similar superscripts indicate statistical significance difference ($p \leq 0.05$) down the column while those without superscripts shows non-significance difference ($p \geq 0.05$) down the column when compared with the control and between groups.

TABLE IX: CARCASS WEIGHT OF RATS FED TREATMENT DIETS

Group	Respiratory tract (g)	Full stomach (`g)	Heart (g)	Kidney (g)	Liver (g)	Full GIT (g)	Spleen (g)
T0 0% (Control)	1.11±0.13	2.67±0.17a	0.47±0.50a	0.38±0.02a	6.30±0.56a	14.76±0.91a	0.58±0.13a
T1 10% diet inclusion	0.96±0.17	1.66±0.60	0.32±0.47a,b,d	0.33±0.03b,c	3.63±0.51a	3.63±0.51a,b	0.32±0.07a
T2 15% diet inclusion	0.95±0.12	0.72±0.29a,b	0.32±0.01a,c,d	0.31±0.02a,c	3.48±0.52a	11.79±1.34a,b	0.39±0.06
T3 20% diet inclusion	0.94±0.26	2.00±0.20b	0.20±0.03a,b,c,d	0.22±0.01a,b,c	2.46±0.27a	10.52±0.37a,b	0.21±0.02a

Values are reported as Mean± Standard Error of Mean (M±SEM) (n =5). Values with similar superscripts indicate statistical significance difference ($p \leq 0.05$) down the column while those without superscripts shows non-significance difference ($p \geq 0.05$) down the column when compared with the control and between groups.

E. Carcass Weight Of Rats Fed Treatment Diets

The organs consideration for carcass weight were the respiratory tract, full stomach, heart, kidney, spleen, liver and intestine (GIT). These are organs targeted by toxins when ingested particularly the kidney and liver. From the outcome of this study (Table IX), carcass weights of rats in groups T_1-T_3 for heart, liver and Intestinal (GIT) and in groups T_2 and T_3 for kidney significantly decreased ($p \leq 0.05$) when compared to T_0. There was no observable significant difference ($p \geq 0.05$) in the mean values of carcass weight in the respiratory tract and T_1 of full stomach although they were lower than T_0. This result is in accordance with the report of [23] who observed that the inclusion of mulberry (morus) leaf meal at 10, 20 and 30% progressively decreased the weight of the carcass, breast, thigh leg and abdominal fat in broilers [23]. Conclusion

The present study revealed that inclusion of *Piper umbellatum* Linn leaf meal in the rat's diet at 10, 15 and 20% inclusion rates had reduction effects on body weight, feed intake, feed conversion ratio (FCR) and carcass weights of the rats. Hence, PULM could serve as a novel food source for body weight management.

IV. CONCLUSION

The present study revealed that inclusion of *Piper umbellatum* Linn leaf meal in the rat's diet at 10, 15 and 20% inclusion rates had reduction effects on body weight, feed intake, feed conversion ratio (FCR) and carcass weights of the rats. Hence, PULM could serve as a novel food source for body weight management.

APPENDIX

A. Proximate Composition of Dried Piper Umbellatum L. Leaf Meal (PULM)

MULTI ENVIRONMENTAL MANAGEMENT CONSULTANTS LIMITED
Consultants in Upstream & Downstream Field Operations (Oil & Gas), EIA/PIA/ EER/EIS, Finger Printing, R & D, Solid Mineral, Food/Drug & Water, Bioremediation of Contaminated Sites, Waste Mgt/Treatment Plant Installation, Pollution Monitoring, Corrosion Control, Safety/Marine Services, Laboratory Equipment Supply/Installation/ Training /Calibration /Establishment of Analytical Methods, Supply of Analytical Chemicals/Standards

Administrative Office
20 Daniel Makinde Street,
Ketu. Lagos State. Nigeria
01-8169027, 08053404983
e-mail: dewalelab2@gmail.com

Laboratory Address
MEMAC Building
Olujonwo Avenue
Laura-Igbe. Ikorodu. Lagos
08033273508

10/12/2020

CERTIFICATE OF ANALYSIS

S/N	PARAMETER	T_0	T_1	T_2	T_3
1	MOISTURE (%)	7.80	8.10	8.65	6.42
2	PROTEIN (%)	23.10	24.50	25.20	25.98
3	FAT (%)	6.00	5.84	5.45	5.55
4	D.FIBRE (%)	27.00	25.16	24.5	15.30
5	ASH (%)	7.50	7.10	6.30	8.95
6	CHO (%)	28.6	29.30	29.90	37.80

The samples submitted for the study were analysed as received in our laboratory. The results are as stated in the above Table.

11/12/2020

BELLO, A. A
FOR: MULTI ENVIRONMENTAL MANAGEMENT CONSULTANTS LIMITED
IKORODU, LAGOS

B. Mineral composition of dried Piper umbellatum L. leaf meal (PULM)

UNIPORT RUTH RESULTS 15/12/2020

S/N	PARAMETER	T_0	T_1	T_2	T_3
1	Selenium (mg/100g)	0.0483	0.0451	0.0428	0.0421
2	Sodium (mg/100g)	146.8503	126.4632	116.8664	218.0357
3	Potassium (mg/100g)	384.2218	362.5119	345.1964	452.7753
4	Calcium (mg/100g)	674.3751	635.7412	602.0873	852.3185
5	Magnesium (mg/100g)	391.3158	368.3194	349.2081	235.3327
6	Iron (mg/100g)	58.1763	51.9536	48.6421	41.0684
7	Zinc (mg/100g)	3.9835	3.6841	2.9742	2.3824
8	Manganese (mg/100g)	4.5261	4.1857	3.9826	5.1428

16 Dec 2020

REFERENCES

[1] Fagbohun AO. "Performing carcass, Haematological and histological studies of broilers fed full fat Mucuna diet" An M.Sc desertation, University of Ibadan, Nigeria; 1988.

[2] Yusuf KO, Bamgbose AM, Oso AO, Fafiolu AO, Oni AO. Nutritional Evaluation of Baobab (*adansonia digitata*) seed meal with rats. *Asset Journal Series A*, 2008; 8(2): 226-231.

[3] Nunez V, Castro V, Nurillo R, Ponce-soto LA, Merfoot I, Lomonte B. Inhibitory effects of *Piper umbellatum* and *Piper peltatum* extracts towards myotoxic phospholipase A2 from Bothrops snake venoms: isolation of 4-nerolidylcatchol as active principle. *Phytochemistry,* 2005; 66(9):1017-1025.

[4] Dyer LA, Palmer AN, *Piper: A model genus for studies of evolution, clinical ecology and trophic interactions*, Boston, Kluwer Academic Publishers; 2004.

[5] Nwauzoma AB, Dawari SL. Study on the phytochemical properties and proximate analysis of *Piper Umbellatum* (linn) from Nigeria. *Am. J. of Res. Commun.* 2013; 1(7): 164-177.

[6] Domis M, Oyen LPA, "*Piper umbellatum* L." *PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale,* Medicinal plants, vol. 11, G. H. Schmelzer, and A. Gurib-Fakim, A. Eds. Wageningen, Netherlands: Earth print limited; 2008.

[7] Isikhuemen EM, Ogbomwan BO, Efenudu IU. Evaluation of Phytochemical and Mineral Constituents Piper guineense Schum. & Thonn. And Pier umbellatum Linn: Implications for Ethomedicine. *European J. Med. Plants*, 2020; 31(1): 84-97.

[8] Salifu AS, Abonuusum A, Laary JK. Growth Performance of Albino Rats Fed Graded Levels of Baobab (*Adansonia digitata*) Leaf Meal. *Arch. Curr. Res. Int.* 2016; 6(1): 1-7.

[9] AOAC. Official Methods of Analysis, Association of Analytical Chemists, 16th edition, Washington D.C., U. S. A;1995

[10] Sanyaolu VT, Eleyowo OO, Ogundare CO. Metal Residues in Hair Sample of Residents around Metal Recycling Factories in Ikorodu, Lagos State, Nigeria. *Ife J. Sci.* 2018; 20(3): 569-575.

[11] Tijani LA, Akanji AM, Agbalaya K, Onigemo M. Effects of *Moringa oleifera* Leaf Meal on performance, Nutrient Digestibility and Carcass Quality of Broiler Chickens. *Applied tropical Agriculture*, 2016; 21(1): 46-53.

[12] Phuc BNN, Lindberg JE, Ogle B, Thomke S. Determination of nutritive value of tropical biomass products as dietary ingredients for monogastrics using rats: 1. Comparison of eight forage species at two levels of inclusion in relation to a casein diet. *Asian-Australasian J. Anim Sci.* 2001; 14(7): 989-993.

[13] El-Badawi AY, Omer HAA, Abedo AA, Yacout MHM. Response of growing New Zealand white rabbits to rations supplemented with different levels of *Moringa oleifera* dry leaves. *Glob. Vet.* 2014; 12(4): 573-582.

[14] Maynard DN, Elmstrom GW, Wessel-Beaver L. Improvement of tropical pumpkin, *Cucurbita moschata* (Lam) poir: In Cucurbitaceae 94, *Evaluation and Enhancement of Cucurbita germplasm*. Created by Wehner TC and TN, South Padre Island: 1994, pp 1-4.

[15] Groff J, Gropper S, Hunt S. *Advanced Nutritional and Human Metabolism*. 2nd Edition. New York: 1995, pp 221-362.

[16] Oboh G, Akindahunsi AA, Oshodi AA. Dynamics of phytate-Zn balance of fungi fermented cassava products (flour and garri). *Plant Foods Hum. Nutr.* 2003; 58: 1-7.

[17] Setyawati I, Oka IGL, Putra S, Mahardika IG. Calliandra Leaf decreased reproduction of wistar rats during gestation and lactation. *Int. J. Pure Appl. Biosci.* 2014; 2(6): 209-214.

[18] Banjo OS. Growth and performance as affected by inclusion of *Moringa oleifera* leaf meal in broiler chicks diet. *J. Biol. Agric. Healthc.* 2012; 2(9): 35-38.

[19] Ansah T, Emelia AA, Deku G, Karikari PK. Evaluation of false yam (*Icacina oliviformis*) leaves on the gowth performance of weaner rabbits (*Oryctolagus cuniculus*). *Online J. Anim. Feed Res.* 2012; 2(1): 76-79.

[20] Zanu HK, Mustapha M, Addo Nartey M. Response of broiler chickens to diets containing varying levels of Leucaena (*leucaena leucocephala*) leaf meal. *Online J. Anim. Feed Res.2012;* 2(2): 108-112.

[21] Saulawa LL, Ukachukwu SN, Onwudike OC, Garba MG, Aruwayo A. Quantitative substitution of raw baobab (*Adansonia digitata*) seed meal for soyabean meal in broiler started diet. *Int. J. Poult. Sci.* 2014; 13(6):335- 339.

[22] Umoren UE, Isika MA, Asanga EP, Ezeigwe PN. Effects of replacement of maize with earth ball (*Icacina manni*) meal on the performance of broiler chickens. *Pak. J. Biol. Sci.* 2007; 10(14): 2368-2373.

[23] Tilahun M, Urge M, Yirga M. Effect of Substituting Commercial Feed with Mulberry Leaf Meal on Performance of Broiler Chickens. *J. Biol. Agric. Healthc.*2018; 8(14): 58-63.

Baradum, Sor-Aniabari Ruth is a young scholar from Kabangha Town, Khana Local Government Area, Rivers State, Nigeria. She obtained her B.Sc Degree in Biochemistry from University of Port Harcourt, River State, Nigeria in 2015. She is currently doing her Master's Degree (M.Sc) in Nutritional and Toxicological Biochemistry, University of Port Harcourt, Rivers State, Nigeria.. She has the ability to work in any Environment, bringing her strong, analytical, problem-solving and technical skills to bear in order to contribute positively to the growth and development of any organization and its work force. She has worked with Divic Specialist Medical Laboratory as a laboratory scientist. Miss Baradum is a member of ISROSET-International Journal Of scientific Research in Biological Sciences.