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Performance characteristics of ungerminated and germinated fluted pumpkin (*Telferia occidentalis*) seed meal on albino rats

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ABSTRACT: The quality of proteins from ungerminated and germinated fluted pumpkin (*Telferia occidentalis*) seeds was investigated using male Wistar albino rats. The proteins were found to have high true digestibility (TD) and feed conversion ratio (FCR). There was no significant difference ($p<0.05$) between the net protein retention (NPR), protein efficiency ratio (PER), protein retention efficiency (PRE), Nitrogen efficiency ratio (NER), feed efficiency ratio (FER), net protein utilization (NPU) and relative NPR (RNPR) of the ungerminated and germinated seeds, while the Net protein value (NPV) of the ungerminated seeds was significantly lower ($p<0.05$) than that of the germinated seeds. Our results reveal the great potential of *Telferia occidentalis* seed protein as a source of dietary protein especially in the preparation of protein supplements and formulation of new diets. @ JASEM

Fluted pumpkin (*Telferia occidentalis*) belongs to the family Cucurbitaceae. The stem of this perennial vine can grow as long as 10m. The leaves of *Telferia occidentalis* is an important food vegetable for people especially in the Southern part of Nigeria (Elegbede, 1998; Oguntona, 1998). It is called "ugu" (Igbo) and "Iroko" (Yoruba). The seeds are called "Mkpuru ugu" by the Ibo people of South Eastern Nigeria. The seeds are boiled and eaten as snack, and can be used to thicken soup (Okeke *et al*., 2008). Earlier, Achinewhu (1998) reported the effect of fermentation on the quality of *Telferia occidentalis* seed protein. The present study was designed to investigate the effect of germination on the quality of *Telferia occidentalis* seed protein, with a view to unveiling any likelihood of improving the quality of the seed meal by germination.

MATERIALS AND METHODS

Collection of Samples, Animals and Reagents: Sixteen, 23-24-day old weanling litter male Wistar albino rats (50-60), were procured from the Animal House of the Department of Biochemistry, University of Port Harcourt, Port Harcourt, Nigeria. They were maintained on guinea growers mash (Bendel Feed and Flour Mills Ltd., Ewu, Nigeria), for one week, prior to the commencement of the experiment. All chemicals are of analytical grades from Sigma, BDH, May and Baker, etc. Fresh samples of fluted pumpkin seeds were purchased from markets in Port Harcourt. After due identification, they were rid of dirt and stored.

Preparation of ungerminated and germinated fluted pumpkin (*Telferia occidentalis*) meals (UTM and GTM): The first portion was briefly soaked in water, after which they were dehulled by hand rubbing and gentle heating. They were then dried in an oven at 100^{o}C for 12h, cooled and ground in a hand mill to pass an 80mm mesh screen. The resultant powder hereinafter referred to as ungerminated fluted pumpkin (*Telferia occidentalis*) meal (UTM), was stored and subsequently used in compounding the test diets.

The second portion was soaked in water, drained and spread on a tray lined with damp cotton wool and Whatman No. 1 filter paper. The tray was covered with another damp filter paper and kept in a cupboard for 5 days for the seeds to germinate. The sprouts were dehulled and cleansed, after which they were dried and ground into powder and stored. This powder is hereinafter referred to as germinated fluted pumpkin (*Telferia occidentalis*) meal (GTM), and was subsequently used in compounding the test diets.

Experimental Design: The animals were weighed, divided into four treatment groups (T_1, T_2, T_3 and T_4) of four rats each, and housed individually in metabolic cages with wire mesh flour (to prevent coprophagia), and appropriate compartments to enable the collection of faeces and urine, as well as determination of feed intake. Each treatment group was assigned one of four treatment diets, the composition of which is given in Table 1. T_1 received the reference diet consisting of 100% Nutrend^{TM} (from Nestle Foods Nigeria Plc.); T_2 received the test diet whose protein source was 100% UTM, T_3 received the test diet whose protein source was 100% GTM, while T_4 received the basal diet. All the diets were isoproteinic with protein contents of about 10% (Table 2). The animals were allowed feed and water *ad libitum* and were weighed weekly. The daily feed intake was recorded, while the faeces were collected daily, and dried for analysis. After a 3-day acclimatization period on their respective diets, they were weighed before commencing the collection of

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faeces and after another 7 days were again weighed and sacrificed. The feed, faecal and carcass nitrogen contents were analyzed according to standard methods [AOAC, 1980]. The absorbed nitrogen, feed conversion ratio (FCR), feed efficiency ratio (FER), protein efficiency ratio (PER), net protein retention (NPR), relative NPR (RNPR), protein retention efficiency (PRE), net protein utilization (NPU), true digestibility (TD), biological value (BV), nitrogen efficiency ratio (NER) and net protein value (NPV) were all calculated as described by Pellett and Young [1980]. The crude protein contents of the diets were determined according to standard methods [AOAC, 1980].

Statistical Analysis of Data: All values are quoted as the mean ± S.D. The values of the various parameters for the various groups were analyzed for statistical significant differences using student's t test, with the aid of SPSS 17.0 package.

Table 1: Crude protein contents of the diets

Component	Composition (%)
T_1	13.56±0.01
T_2	9.84±0.01
T_3	10.06±0.01
T_4	6.56±0.02

Values are means ± SD of three determinations.

Table 2: Composition of the experimental diets

Component	Composition (%)			
	T_1	T_2	T_3	T_4
Nutrend™	100.00	-	-	-
UFM	-	16.78	-	-
GFM	-	-	10.94	-
Corn flour	-	68.22	74.06	85.00
Oil	-	10.00	10.00	10.00
Mineral/vitamin mix	-	5.00	5.00	5.00

Table 3: Performance characteristics of ungerminated and germinated fluted pumpkin (*Telferia occidentalis*) meal on albino rats

Parameter	Treatment		
	T_1^*	T_2^*	T_3^*
Food intake (g)	63.88±15.38^a	57.04±10.63^a	37.51±0.73^a
Weight gain (g)	23.64±5.87^a	7.25±1.98^b	3.69±0.22^b
Protein intake (g)	8.66±2.09^a	5.61±1.05^{a,b}	3.77±0.07^b
N intake (g)	1.39±0.33^a	0.90±0.17^{a,b}	0.60±0.01^b
Faecal N (g)	0.17±0.10^a	0.06±0.01^{a,b}	0.02±0.01^b
Carcass N (g)	1.93±0.34^a	1.21±0.51^{a,b}	0.86±0.51^b
Absorbed N (g)	1.22±0.25^a	0.83±0.13^{a,b}	0.58±0.02^b
Retained N (g)	1.12±0.37^a	0.40±0.05^{a,b}	0.05±0.01^b
Feed conversion ratio (FCR)	2.71±0.02^a	8.46±3.34^b	10.15±0.43^b
Feed efficiency ratio (FER)	0.37±0.00^a	0.14±0.05^b	0.10±0.00^b
Protein efficiency ratio (PER)	2.73±0.02^a	1.34±0.43^b	0.98±0.04^b
Net protein retention (NPR)	3.11±0.06^a	1.93±0.58^b	1.82±0.04^b
Net protein utilization (NPU, %)	61.79±5.02^a	47.95±7.08^b	61.33±12.44^{a,b}
Relative NPR (RNPR, %)	100.00±0.00^a	62.06±18.65^b	58.52±1.29^b
Protein retention efficiency (PRE)	49.76±0.96^a	30.88±9.28^b	29.12±0.64^b
True digestibility (TD, %)	86.18±1.82^a	99.01±0.58^b	99.54±0.54^b
Biological value (BV, %)	71.69±5.38^a	48.43±7.20^b	61.73±10.60^{a,b}
Nitrogen efficiency ratio (NER)	17.06±0.13^a	8.38±2.69^b	6.13±0.25^b
Net protein value (NPV)	837.87±0.62^a	471.83±0.48^b	616.98±0.61^c

*The relevant values are corrected and are means ± SD, n= four per group. Values in the same row with the different superscript are significantly different at p<0.05.

RESULTS AND DISCUSSION

The performance characteristics of ungerminated and germinated African yam bean (*Sphenostylis stenocarpa*) meal protein is given in Table 3. There was no significant difference in the food intake of the three groups. The FCR of the test proteins were significantly ($p<0.05$) higher than the reference protein. The FER, NPR, RNPR, PRE and NER of the test proteins were not significantly different, but were both significantly ($p<0.05$) lower than the reference protein. NPV of the test proteins are significantly ($p<0.05$) lower compared to the reference protein, with that of UTM being the least. The weight gain of the animals on GTM was significantly ($p<0.05$) the least, followed by those on UTM. This reduction in weight correlates with the food intake. The reduction in weight gain also implies that both USM and GSM can be used in weight reduction regimes. Studies have shown that weight reduction is one of the ways of reducing coronary risk incidence, as well as managing diabetes mellitus, dyslipidemia, hypertension and obesity (Trussell *et al.*, 2005; Bantle *et al.*, 2006; Krauss *et al.*, 2006), and is one of the strategies for improving low high density lipoprotein cholesterol (HDL-C) levels (Assmann and Gotto, 2004) and insulin resistance (Krauss *et al.*, 2006). Therefore, the significantly lower mean daily weight gain we observed in the test animals suggests the use of UTM and GTM in the management of hypertension, obesity and dyslipidemia.

The true digestibility of the test proteins were significantly ($p<0.05$) higher than that of the reference protein, as well as those reported for pigeon peas, lima beans, lentils, groundnuts, cowpeas, velvet

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beans, chick-peas, bambarra groundnuts, soybean cashew nut, coconut kernel meal and cotton seed meal (FAO, 1981). The biological value of the ungerminated seed protein was significantly ($p<0.05$) lower than that of the reference protein, but not different from that of the germinated seeds. The BV of the UTM is greater than that of velvet beans and lentils, but less than those of chick peas, bambarra groundnuts, cowpeas, soybean, pigeon peas, lima beans, groundnuts, coconut kernel meal and cotton seed meal; while that of the germinated seed protein is less than those of chick peas, lima beans, soybeans coconut kernel meal and cotton seed meal, but greater than those of velvet beans, lentils, groundnuts (54.5%), bambarra groundnuts, pigeon peas and cowpeas (FAO, 1981).

The NPU of the ungerminated seed protein was significantly ($p<0.05$) lower than that of the reference protein, but not different from that of the germinated seeds. The NPU of the ungerminated seed protein is less than those of lima beans, soybean, pigeon peas, cashew nut, coconut kernel meal and cotton seed meal, but greater than that of bambarra groundnuts, cowpeas, groundnuts, lentils and velvet beans (FAO, 1981); while that of the germinated seed protein is comparable to those of soybean, coconut kernel meal and cotton seed meal, and greater than those of bambarra groundnuts, cowpeas, groundnuts, lentils, velvet beans, lima beans cashew nut, and pigeon peas (FAO, 1981). The PER of the test proteins are not significantly different, but were significantly lower ($p<0.05$) than that of the reference protein. They were both significantly lower ($p<0.05$) than the reported value greater than lentils, and those for soybean, pigeon peas, lima beans, chick-peas and groundnuts (FAO, 1981).

Therefore, the present results suggest the use of *Telferia occidentalis* seed meal in weight management and as a source of high quality protein.

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