IMPACT OF EXTRUDED SNACKS FROM AERIAL YAM (*D. Bulbifera*) AND AFRICAN BREADFRUIT SEED (*Treculia Africana*) ON BODY WEIGHT AND VITAL ORGANS OF ALBINO RATS

Kazeem Koledoye Olatoye*[1], GibsonLuckyArueya[2], Yetunde Grace Ogunremi[3]
[1]Department of Food Science and Technology, College of Agriculture and Veterinary Medicine, Kwara State University, Malete, P.M.B1530, Ilorin, Kwara State, Nigeria
[2]Department of Food Technology, Faculty of Technology, University of Ibadan, Nigeria
[3]Department of Clinical Pharmacy and Pharmacy Administration, Faculty of Pharmacy, University of Ibadan, Nigeria
**** E- mail: luckykaykay@yahoo.com***

Abstract
Aerial yam and Treculia africana are lesser-known food materials with high nutritive value and health benefit potential. Despite these, functional food production from them is rare. Effects of consuming extruded snack from these materials on body weight and some vital organs were investigated. Six groups, each consisting of five encaged albino rats were freely allowed to feed on weighted extruded snacks and distilled water for 28 days after acclimatization for 10 days. Snacks comprising aerial yam and Treculia africana in ratios (100:00, 00:100, 80:20, and 65:35) were served to groups I to IV. Commercial diet and casein-incorporated snack were given to groups V and VI, respectively, as controls. Daily, weekly and monthly consumption rates per animal in groups were estimated. Weekly, monthly and percentage weight difference were also determined. Daily inspection for possible signs of toxicity and deaths was carried out. Four rats per group were weighed and sacrificed for relative organ weights determination. The average feed consumption for experimental diets (8.06-10.82 g) was less than half that of commercial diet (24.62 g). Life weights of animals were significantly ($p \leq 0.5$) different among the groups. Weight reductions (%) for rats in groups I to IV were: -20.18, -23.98, -16.33 and -28.15, respectively. These contrasted with 17.16 and 23.39(%) weight gains in control groups. No significant differences ($P \leq 0.05$) in organs relative to body weight of rats fed with both experimental diets and controls. Rats appeared physically healthy with stools being consistent and no death of any rat recorded. The snack can be recommended for weight control.

Keywords: Aerial yam, *Treculia africana,* Functional food, Albino rats, Weight control.

Received: 11.10.2016 Received in revised form: 01.03.2017 Accepted: 03.03.2017

1. INTRODUCTION

Obesity (BMI ≥ 30 kg/m^2) is a serious food related public health problem with high prevalence level (0.2-4.2%) worldwide (Osundahunsi, 2016). With a global increase in the prevalence of obesity, both nutrition and exercise play key roles in its prevention and treatment (Monika and Kiran, 2012). As potential treatments, interventions of natural product (nutraceuticals) are currently being investigated. Flavonoid, among phytochemicals was singled-out for this purpose, with its ability to regulate gene expression and modulate enzymatic action (Pollastri *et al.,* 2011) coupled with possession of anti-obesity effect (Shabrova *et al.,* 2011). It increases energy expenditure for digestion and absorption of protein, inhibits fat absorption and promotes thermogenic fat burning (Aleksandra and Dorota, 2014). It has been demonstrated through supplementation with food that, flavonoid consumption can improve lipid profile, decrease insulin resistance and reduce visceral adipose tissue mass as well as levels of atherogenic cholesterol fractions (non-HDL cholesterol) (Shabrova *et al.,* 2011). However, replacing foods with supplements may lead to losses in beneficial food components or important interactions between food components (Karrie *et al.,* 2008). Therefore, inwardly looking-out for some under-exploited food materials with flavonoids, rather than replacing foods with supplements becomes imperative. This potential in Aerial yam and African breadfruit seed can be put into advantage, since both are rich sources of nutrients and phytochemicals, including the flavonoids (Mbaya *et al.,* 2013; Nwosu, 2014). Aerial yam is also a low-glycemic index carbohydrate which decreases appetite and thus can promote weight loss (Ahmed *et al.,* 2009; Adewole *et al.*, 2011). African breadfruit seed is a lesser-known protein-rich food material,(18-23%) (Akubor *et al.,* 2000; Appiah *et al*., 2012) and can increases energy expenditure for digestion. It is also known for increased satiety and quick sense of fullness, which encourages the individual to stop eating sooner, thereby reducing total energy intake. Reported food-based strategies for control of weight includes: high fibre or low calories snacks (Susan and Sylvia, 2010; Norah, 2012,), healthier oils (olive, sunflower oil) and fat replacers based snacks (Tarancón *et al.,* 2015), and those based on use of phytochemicals which includes: extruded snack from cassava and turmeric (Lavras, 2014); snack from Maize and Moringa seeds, (Aluko *et al.*2013); Apple pomace-brown rice based cracker snack, (Shabir *et al.* 2015); Purple wheat based functional biscuit (Antonella *et al.,* 2015); Grape marc extract-enriched biscuit (Antonella, 2014) and Novel snack crackers incorporated with Hibiscus sabdariffa by-product (Zahra, 2015).Development of such product from Aerial yam and *Treculia Africana* is seldom. The aim of this study was to examine the effect of eating such novel food on body weight and vital organs, using animal experimental model.

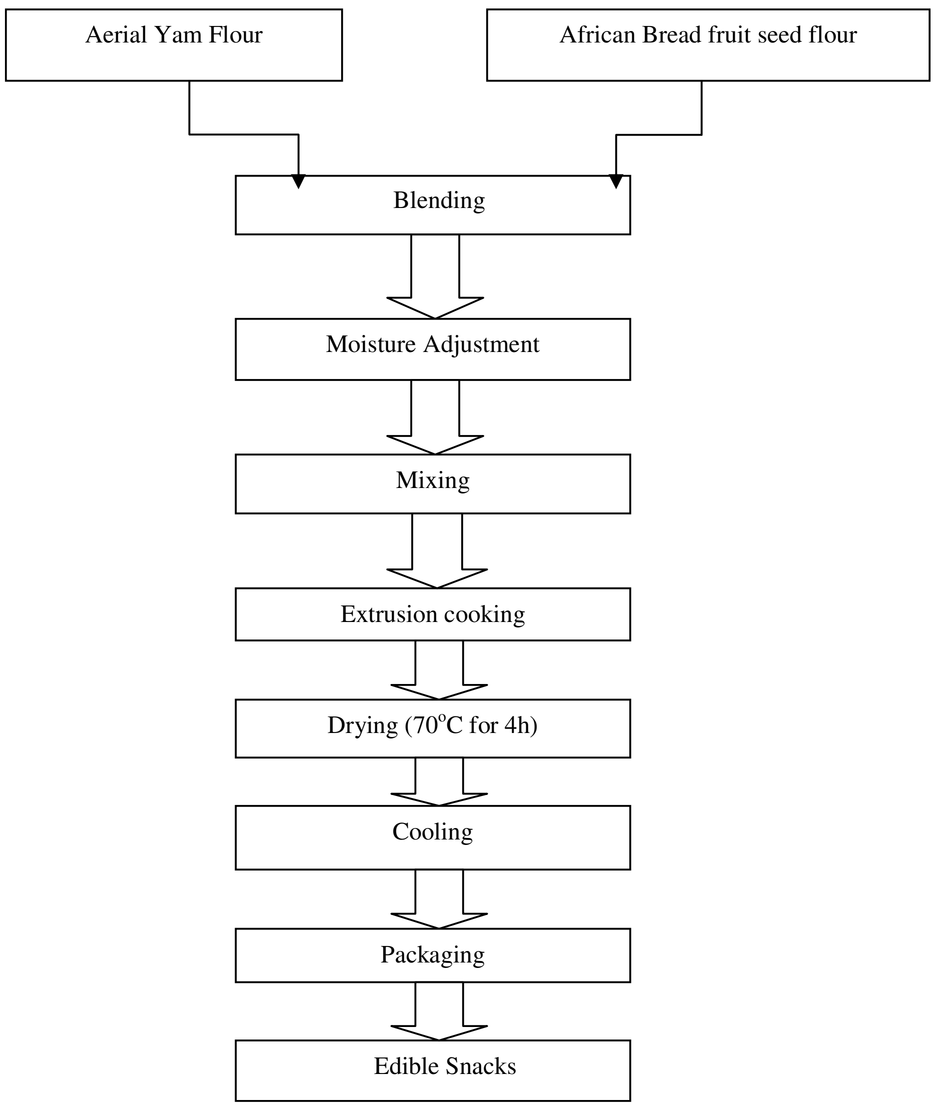

Figure 1. Flow chart for the production of extruded snacks from Aerial yam and African breadfruit seed.

2. MATERIAL AND METHODS

2.1. Sources of Materials

Aerial yam used in this study was obtained from Genetic resource centre (GRC), International Institute of Tropical Agriculture (IITA), Ibadan, Oyo State, Nigeria. African breadfruit seed was purchased at Alaba international market, Lagos. Vanilla flavour, sucrose, pepper and vegetable oil and standard rat feed(control) were purchased from a local market in Ibadan.

2.2. Snacks production

Aerial yam and African breadfruit seed were processed into flour and combined at ratios (100:00, 00:100, 80:20 and 65:35) respectively. Blends were mixed with calculated amount of other ingredients as shown in Fig.1.

2.3. Experimental diet formulation

100% each of Aerial yam flour(AYF) and African bread fruit seeds flour (ABF) were used as bases for diets EE0 and EE1 respectively (Table 2.1) (Ani *et al.,* 2012; Akande *et al.,*2014 and Princewill *et al.,*2015). EE2 and EE3 were respectively formulated from (80:20) and (65:35) combinations of aerial yam and African breadfruit seeds. Diet EE4 was the standard (control) diet purchase from commercial producer (Ladokun feeds), while EE5serves as positive control to reflect the effect of casein substitution for ABF. Gross composition of the diets is shown in Table 1.

Table 1. Gross composition of the experimental diets

Ingredients	EE0	EE1	EE2	EE3
AYF (g)	100.00	-------	80.00	65.00
ABF (g)	-------	100.00	20.00	35.00
Water (ml)	108	93.40	78.10	122.90
Vegetable oil (ml),	20.00	20.00	20.00	20.00
Iodized salts (g)	2.50	2.50	2.50	2.50
Sucrose (g)	10.00	10.00	10.00	10.00
Ground pepper(g)	1.50	1.50	1.50	1.50
Vanilla Flavour(ml)	20.00	20.00	20.00	20.00

AYF: Aerial yam flour; ABF: African breadfruit seeds flour;

2.4 Feed consumption (FC) and rate determinations

Weighed diets were offered and left-over removed on daily basis, in order to determine the amount of meal consumed per 24h. Total meal consumed per group in (g) for every 7days and the entire 28days were determined by addition. Feed consumption rate per day for 5 rats and one rat were respectively determined according to equations 3.1 and 3.2.

FC/day = Total feed consumed/28 (g/day) Eq 3.1
FC/day/rat = FC/day/number of rats (g/day/rat) Eq 3.2

2.4 Handling of Animals

The study was conducted at the Department of veterinary medicine, university of Ibadan. Total number of thirty (30) mature male albino rats (*Rattus novergicus*) weighing between 100 – 200 g, obtained from the Animal House, Department of Clinical pharmacy, University of Ibadan were used. The animals were used after (10days) acclimatization period to well ventilated room with temperature 30±4^{0}C and relative humidity of 60%. They were housed in standard cages. They were fed at liberty with standard rat feed (Ladokun Feeds Ltd., Ibadan) and clean water. All animal experiments were conducted in compliance with NIH guidelines for care and use of laboratory animal (pub. No. 58-23, Revised 1985) as reported by Akah *et al.* (2009).The same level of hygiene was maintained throughout the 28days experimental period. All animals were inspected daily for signs of toxicity and possible deaths.

2.5 Animal experiment

Rats were randomly grouped into six (five each) and separately housed after adaptation period. Groups were provided with diets as shown in the Table 2. and water offered to them at liberty (Ani *et al.,* 2012; Akande *et al.,* 2014 and Princewill *et al.,* 2015). Weighted diets were offered and left-over removed on daily basis, in order to determine the amount of meal consumed. Life weights of each animal were also determined twice a week and hence total and percentage weight difference at the end of 28 days evaluated.

Table 2. Grouping of Animals and diets offered.

Group	I(EE0)	II(EE1)	III(EE2)	IV(EE3)	V(EE4)	VI(EE5)
AYF:ABF	100:00	00:100	80: 20	65:35	Normal diet	AYF/Casein

AYF: Aerial yam Flour; ABF: African Breadfruit seed flour.

Table 3. Feed consumption rate (FCR)

(AYF:ABF)/Basal	Wk1(g)	Wk2(g)	Wk3(g)	Wk4(g)	Total(g)	FC/day(g)	FC/day/rat (g)
EE0(100:00)	470	358	409	192	1429	51.04	10.21
EE1(00:100)	412	266	278	172	1128	40.29	8.06
EE2(80:20)	419	293	315	259	1286	45.93	9.19
EE3(65:35)	436	335	317	195	1283	45.82	9.16
EE4(Normal)	723	1015	830	879	3447	123.11	24.62
EE5(Casein diet)	412	364	369	370	1515	54.11	10.82

AYF: Aerial yam flour, ABF: African Breadfruit seed flour, FC=feed consumed

Table 4. Effects of snacks consumption on life weight of rats

GRP	WK1	WK2	WK3	WK4	TWD	%WD
EE0	-12.80 ± 1.32^{bc}	-12.20 ± 1.77^{d}	-3.80 ± 1.77^{b}	-5.40 ± 1.36^{c}	-34.20 ± 3.96^{cd}	-20.18 ± 2.01^{bc}
EE1	-18.20 ± 3.18^{c}	-4.00 ± 1.52^{c}	-8.40 ± 2.11^{bc}	-10.20 ± 1.83^{d}	-40.80 ± 4.93^{de}	-23.98 ± 3.02^{cd}
EE2	-11.40 ± 2.77^{bc}	-6.60 ± 1.75^{c}	-5.80 ± 1.77^{bc}	-3.80 ± 1.28^{c}	-27.60 ± 3.89^{c}	-16.33 ± 1.62^{b}
EE3	-14.40 ± 4.49^{bc}	-13.20 ± 0.97^{d}	-11.00 ± 2.59^{c}	-10.20 ± 1.07^{d}	-48.80 ± 3.34^{e}	-28.15 ± 1.68^{d}
EE4	5.4 ± 1.63^{b}	26.80 ± 2.01^{a}	9.60 ± 1.99^{a}	10.40 ± 1.69^{a}	41.40 ± 3.63^{a}	23.39 ± 2.23^{a}
EE5	14.40 ± 2.66^{a}	2.80 ± 2.80^{b}	7.40 ± 1.03^{a}	3.40 ± 1.81^{b}	28.00 ± 4.54^{b}	17.16 ± 2.70^{a}

Means with the same superscript in the same column are not significantly different ($P\leq0.05$)

2.6 Organ Evaluation

At the end of the experiment, four rats from each group were sacrificed, thereafter quickly dissected and the organs harvested and used for the determination of relative organ weights. The liver, kidney, spleen and heart were collected, weighed and each expressed as a percentage of the live weight.

2.7 Data analysis

All tests were replicated and data obtained were statistically analyzed using a one-way analysis of variance (ANOVA) and means were separated by Duncan's Multiple Range Test (DMRT) using the Statistical package for social science (SPSS) IBM VERSION 21.0 package. Significance was accepted at 0.05 probability level.

3. RESULTS AND DISCUSSION

3.1 Feed consumption rate (FCR)

Rate at which each diet was freely consumed by albino rats during the study period is presented in Table 3. The average feed consumed per day for a rat fed with each experimental diet was less than half of consumed diet in control (EE4) group. 24.62 g of commercial diet was consumed per day by a rat, while 10.21, 8.06, 9.19, 9.16 and 10.82 g were consumed in groups EE0, EE1, EE2, EE3 and EE5 respectively. This could be attributed to feeling of satiety as both Aerial yam and African breadfruit seeds were known for bulkiness and provision of quick sense of fullness (Appiah *et al.,* 2012). It can also be as a result of the effect of residual phytochemicals in the product. However, both conditions are commonly targeted for weight reduction.

3.2 Effects of snacks consumption on weight of rats

There were significant ($p\leq0.5$) differences in weight between the groups fed experimental diets and those fed commercial and casein incorporated diets (Table 4). Weight reductions were consistently observed in all the groups fed with experimental diets, progressive weight gains were observed for the control groups. Weight reduction (%) range from -28.15 to -

16.33, for EE3 and EE2 respectively. The percentage weight loss in EE0 and EE1 were -20.18 and -23.98. Weight gain (%) ranged between 17.16 and 23.39 for casein and commercial diet respectively. The differences can be attributed to chemical and phytochemical compositions of each diet. Impact of phytochemicals in weight management has been well researched, especially flavonoids (Pollastri *et al.,* 2011; Shabrova *et al.,* 2011).
Its ability to regulate gene expression and modulate enzymatic action as well as its anti-obesity effect was documented (Shabrova *et al.,* 2011). However casein has been able to suppress its effect in EE5. Rate of feed consumption can also play significant role since, it may affect energy intake. It may be as a result of quick sense of fullness and satiety experienced by the groups fed with experimental diet. Increased satiety in functional foods was regarded as a promising avenue to reducing energy intake (Monika and Kiran, 2012). The energy density of the diet is the energy content per unit of weight or volume, and seems to be correlated with total energy intake.

3.3 Organs relative to body weight of rats fed with different blends of AYF and ABF

Organs relative to body weight of rats fed with EE0 (100%AYF) and controls (EE4 and EE5) were not significantly P≤0.05 different (Table 5). Also, liver, kidney and spleen of rats in groups fed with EE3 (65%AYF and 35%ABF) were not significantly varied. However, those of groups EE1 and EE2 were slightly higher than the rest of the groups and with EEI being the highest for all the selected organs. This might be as a result of residual anti nutritional factors, which if consumed in excess are characterized by adverse effect on the heart and lungs. Though, absence of liver and kidney enlargement especially had been attributed to adequate processing and perhaps freedom from anti nutritional factors (Ani *et al.,* 2012). It's an indication of freedom from infiltration of fluid into the organ cells (Iyayi and Taiwo, 2003) and liver and kidney toxicity, since these two organs play important roles in the detoxification and excretion of most toxic materials from the body. Moreover, studies on health benefit of most of these anti nutritional factors are endemic (Parekh *et al.,* 2005; Shabrova *et al.,* 2011; Aleksandra and Dorota, 2014). It follows that possible medicinal properties of these foods cannot be ruled out. The fact that all the selected organs relative to body weight of rats fed with EE3 was not markedly varied with those of controls (EE4 and EE5) is possibly an indication of maximum supplementation level for the two food materials. It could be opined that, food formulation EE3 holds the highest potential to safely reducing weight in Laboratory animals and can be recommended for human.

3.4 Mortality Rate and physical activities of rat fed with AYF/ABF based snack

Animals in all groups showed had normal disposition throughout the experiment (28days). They all appeared physically normal and very healthy as they were gallivanting within the cages. Stools were consistent, no watery stool or any symptom of diarrhea and no death of any rat were recorded. Diets could therefore be regarded as medicinal and safe from the foregoing.

Table 5. Organs relative to body weight of rats fed with different blends of AYF and ABF

Groups	Liver/body wt X100	Kidney/body wt X100	Spleen/bodywt X100	Heart/bodywt X100
EE0	3.97 ± 0.43^{c}	0.45 ± 0.04^{bc}	0.53 ± 0.01^{a}	0.48 ± 0.04^{ab}
EE1	5.90 ± 0.72^{a}	0.55 ± 0.03^{a}	0.53 ± 0.04^{a}	0.59 ± 0.06^{a}
EE2	5.59 ± 0.19^{a}	0.51 ± 0.01^{ab}	0.37 ± 0.01^{b}	0.52 ± 0.01^{ab}
EE3	5.33 ± 0.48^{ab}	0.49 ± 0.02^{ab}	0.51 ± 0.06^{a}	0.57 ± 0.03^{a}
EE4	4.10 ± 0.17^{bc}	0.38 ± 0.01^{c}	0.46 ± 0.03^{ab}	0.41 ± 0.01^{b}
EE5	3.94 ± 0.21^{c}	0.44 ± 0.02^{bc}	0.41 ± 0.04^{ab}	0.44 ± 0.02^{b}

Means with the same superscript in the same column are not significantly different (P≤0.05)

4. CONCLUSIONS

Weight reducing potential of the snack was established from animal study. Following free consumption of the snack by albino rats for 28days trial period, weight loss (%) range from 16 to 28 for 80:20 and 65:35 (AYF:ABF) respectively. 100% each of AYF and ABF resulted into 20% and 23% weight reduction respectively. They were in sharp contrasts to weight gained (%), ranged between 17.16 and 23.39 in control animals. Safety evidence was also obtained as there were no significant differences$P\leq0.05$ in organs relative to body weight of rats fed with experimental diets and controls. The selected organs relative to body weight of rats fed with EE3 was especially not markedly varied with those of controls (EE4 and EE5) and is possibly an indication of maximum supplementation level for the two food materials. It could be opined that food formulation from (65:35) of (AYF:ABF) respectively can best be use in this application. However, further toxicological studies are recommended for this product before its utilization for weight control. Such studies should include specifically, biochemical, heamatological and histological parameters of rat fed with this snack.

5. ACKNOWLEDGEMENT

Authors appreciate the kind gesture of GRC (Genetic resource centre) of the IITA (International institute of tropical Agriculture, Ibadan), coordinated by Professor Michael Aberton, for the free provision of Aerial yam used in this study.

6. REFERENCES

[1] Osundahunsi,(2016). Food: The fuel and Vehicle for life; Inaugural Lecture series 75; Federal university of Technology, Akure, Ondo State Nigeria.pg9

[2] Monika and Kiran,(2012). Development of functional food products in relation to obesity; Functional Foods in Health and Disease 2(6):188- 197.

[3] Pollastri S., Tattini M. 2011Flavonols: old compounds for old roles. Ann Bot 2011;108:1225-1233.

[4] Shabrova E.V., Tarnopolsky O., Singh A.P., Singh A.P., Plutzky J., Vorsa N., Quadro L. 2011 Insights into the molecular mechanism of the anti-atherogenic actions of flavonoids in normal and obese mice. Plos One 2011; 6:24634

[5] Aleksandra kozłowska1 and dorota szostak-węgierek (2014) Flavonoids - food sources and health benefits; National Institute of Public health; Rocz Panstw Zakl Hig; 65(2):79-85

[6] Karrie H. and Sheri Z.(2008) Some Facts about phytochemicals;UC cooperative Extension Centre for Health and Nutrition Research, Department of nutrition, University of Califonia Davis, CA 95616-8669

[7] Mbaya Y.P, Hussaini A ,Santuraki and Shehu A. Jauro 2013 Acceptance of Aerial Yam (Dioscorea bulbifera L.) for Food in Biu Emirate Council, Borno State, Nigeria. Journal of Biology, Agriculture and Healthcare 3(10) www.iiste.org ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)

[8] Nwosu. J. N, (2014) Evaluation of proximate and sensory properties of biscuits produced from aerial yam flour (Dioscorea bulbifera) American Journal of Research Communication 2(3). 123-129.

[9] Ahmed Z, Mohd Z.C, Rakesh, K.J, Asha B, Kuldeep K.G and Gandhi Ram (2009) Antihyperglycemic and Antidyslipidemic activity of aqueous extract of Dioscorea bulbifera tubers; Dabetologia croatica 38-3.

[10] Adewole E, Ogunmodede O.T1 , Adeniran O.A1 and Lajide (2011) Rheological properties of Wild yam(Discorea villosa) and Aerial yam (Discorea bulbifera) The Pacific Journal of Science and Technology ;3 (5): 324-328.

[11] P.I. Akubor, P.C. Isolukwu, O. Ugbabe and I.A. Onimawo, Proximate composition and functional properties of African breadfruitkernel and wheat flour blends. Food Research International Journal 33: 707-712, 2000

[12] Appiah.F, Oduro.I, Ellis, W.O and Adu, G. 2012 Comparative assessment of the performance of Parkia biglobosa, Glycine max and Treculia africana in the production of a local condiment (dawadawa) in Ghana; African Journal of Food Science Vol. 6(5), pp. 111-116

[13] Susan M., and Sylvia Y., (2010)Dietary fibres in pulse seeds and fractions: Characterization, functional attributes, and applications;Food Research International; 43 (2010) 450–460.

[14] Norah O'Shea, Elke K. Arendt and Eimear Gallagher(2012).Dietary fibre and phytochemical characteristics of fruit and vegetable by-products and their recent applications as novel ingredients in food products;Innovative Food Science and Emerging Technologies 16 (2012) 1–10

[15] Tarancón. P., Salvador .A., Sanz .T., Fiszman.S., and Tárrega. A., (2015) Use of Healthier fats in biscuits (olive and sunflower oil): changing

sensory features and their Relation with consumers' liking;Food Research International 69 (2015) 91–96
[16] Lavras, 2014: Cassava and turmeric flour blends as new raw materials to extruded snacks; Ciênc.agrotec. vol.38 no.1 Jan./Feb. 2014http://dx.doi.org/10.1590/S1413705420140001000008
[17] Aluko.O., Brai. M.R., and Adelore O., (2013). Evaluation of Sensory Attributes of Snack from Maize-Moringa Seed Flour Blends; World Academy of Science, Engineering and Technology; International Journal of Biological, Biomolecular, Agricultural, Food and Biotechnological Engineering 7(10): 944-946
[18] Shabir. A.M., Sowriappan J.D.B., ManZoor A.S., Swaminathan S and Mohammad. M.M., (2015) Effect of apple pomace on quality characteristicsof brown rice based cracker; Article in press Journal of the Saudi Society of Agricultural Sciences (2015)
[19] Antonella P., Anna M B., Vito M.P., Carmine S., Giuseppe G., Francesco C., and Antonio B., (2015) Production and characterization of functional biscuits obtained from purple wheat; Food Chemistry 180 (2015) 64–70
[20] Antonella P., Anna M.B., Vito M. P., Carmine S., Giuseppe G., and Francesco C., (2014) Physico-chemical, sensory and volatile profiles of biscuits enriched with grape marc extract; Food Research International 65 (2014) 385–393
[21] Zahra S.Ahmed and Safaa S. Abozed(2015). Functional and antioxidant properties of novel snack crackers incorporated with Hibiscus sabdariffa by-product; Journal of Advanced Research (2015) 6, 79–87
[22] Omeire G.C (2013). Physico-chemical properties of composite Flours from blends of Acha (Digitaria exilis) and compea 9Vigna unguculata) flour.agri. Eng. Int. CIGR Journal 14(3): 210-217
[23] Ani A.O. , Onweluzo J.C and Asogwa I.S(2012). Growth Performance and Haematological Indices of rats fed mucuna seed meal-based diets; 1(11): 1625-1636
[24] Akande T. O., Odunsi A. A., Emiola A. O. and Adedeji O. S (2014)Evaluation of Growth Performance and Hepatic Histological Changes in Albino Rats Fed Varying Levels of Differently Treated Castor Bean Cake Based Diets; J Anim Sci Adv 2014, 4(1): 641-647
[25] Princewill-Ogbonna.I.L, Abagha O.J, Ijioma S.N 2015. Haematological and Histopathological parameters of rats fed with Aerial yam (Dioscorea bulbifera) Comprehensive Journal of Food Science and Technology Research, 2(2), 09 – 16
[26] Akah J, Alemji J.A,Salawu O.A,Okoye T.C, Offiah N.V (2009). Effects of vernonia amydalic on biochemical and Haematological parameter in diabetic rats. Asian J. Med. Sci. 3(3); 108-113.
[27] Iyayi E.A and Taiwo.V.O,(2003).The effects of diets incorporating Mucuna (M.pruriens) moinmoin on the performance of laying hens and chickens, Tropical J. Animal Science, 7(1), 2003,57-63.
[28] Parekh H, Jadeja, Chanda.S (2005). Efficacy of aqueous and methanol extracts of some medicinal plants for potential antibacterial activity. Turk. J. Biol. 29: 205-210.