International Journal of Basic, Applied and Innovative Research
IJBAIR, 2018, 7(1): 35 - 40
ISSN: 2315 - 5388
www.arpjournals.com; www.antrescentpub.com
E-ISSN: 2384 - 681X

RESEARCH PAPER

THE EFFECT OF PROCESSED CASSAVA PRODUCTS ("TAPIOCA" AND "GARRI") ON WEIGHT AND HAEMATOLOGICAL INDICES OF WISTAR RATS

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Published: 31st March, 2018

***Endorsed By**: Innovative Science Research Foundation (**ISREF**) and International Society of Science Researchers (**ISSCIR**).*
***Indexed By**: African Journal Online (AJOL); Texila American University; Genamics; Scholarsteer; EIJASR; CAS-American Chemical Society; and IRMS Informatics India (J-Gate)*

ABSTRACT

Weight control or weight management can be such a difficult task to achieve. People embark on different work out plan and adjust their dietary intake in order to maintain shape and weight. This study was designed to investigate the effect of tapioca and garri on weight and hematological indices of wistar rats. Eighteen wistar rats weighing between 118g-170g were divided into three groups; Control (A), Garri (B), and Tapioca(C). The control group (A) was fed with water and growers mash ad libitum, while the experimental groups were fed with garri (A) and tapioca (C) respectively with water twice daily for 28 days. Weight readings were taken on the 1st, 14th 28th day of the experiment. At the end of 28th day, animals were fasted overnight and sacrificed. Blood samples were withdrawn from the heart and abdominal aorta and were temporarily stored in EDTA bottles. Reduction in weight (body and organs) of the treated rats was observed. Changes were also observed in hematologic values when treated and controlled group were compared ($p>0.05$) although not statistically significant. Tapioca has more effect on body weight and hematological indices when compared with garri. Tapioca can thus be considered effective for weight reduction however, not over prolonged periods.

Key words: Tapioca, Garri, Weight, Haematological indices

INTRODUCTION

Cassava plant is a valuable source of carbohydrate, protein, and vitamins. However, its macro- and micro-nutrients are not well distributed. Cassava roots are rich in carbohydrates while cassava leaves are an excellent source of protein and vitamins (Julie Montagnac, *et al.*, 2009).

Cassava is the staple food for over one billion people around the world (FAO, 2011) especially in Asia, Africa and South America. It has high water content; it must therefore be transformed into various ready to eat form. Cassava products serve as food for both human and livestock (Wareing et al., 2001).

Cassava flakes, a local cheap snack commonly known as Tapioca, kpo-kpo garri, or Manihot is widely consumed as a staple food in some developing countries. Cassava flakes intake is believed in the southern part of Nigeria to induce weight loss. It is usually chewed dried but sometimes with meat or groundnut.

Garri, a gritty starchy staple food with high energy content derived from cassava is yellowish or whitish in colour. It's a convenient product, usually marketed in a ready to eat form. It can be prepared with hot or cold water depending on the type of meal (Nweke *et al.*, 2002; Adindu and Aprioku, 2006). Garri is the most common form in which cassava is sold in Nigeria and many other African countries (Ngoddy, 1977; Oluwole *et al*., 2004). It's often consumed with cold water in the south west region of Nigeria and consumed in a solid state in the eastern part of Nigeria.

Traditional methods of processing cassava into garri have been found to be deficient in reducing the amount of residual cyanide in the product (Achinewhu *et al.,* 1998; Achinewhu and Owuamanam, 2001). Several cases of acute and chronic conditions associated with consumption of cassava derived meals have been reported such as loss of vision, ataxia of gait, deafness and weakness (Osuntokun, 1994; Howlet, 1994; Onabolu, 2001)

Effects of Cassava mill effluent researched on haematological indices in Clarias gariepinus revealed significantly low ($p< 0.05$) Hb, PCV, RBC and MCV while WBC count was significantly higher (Adeyemo, 2005). Also hydrolysed cassava meal diet fed to broiler chickens had positive effects on haematological indices, PCV, Hb, RBC all increased significantly (Adeyemo and Sani, 2013).

Excessive weight gain often gives a feeling of dissatisfaction and loss of self-esteem especially among women. This makes them go all out to maintain their desired weight and shape in order to remain attractive. Overweight and obesity could also pose serious health challenges (Ogden et al, 2007). Overweight could increase the risk for obesity, high blood pressure, heart disease, diabetes mellitus, arthritis, gall stones, stroke, and back problems. Different weight management strategies are presently employed and variety of weight loss supplements sold as slimming aids are readily available. This study investigates the effects of tapioca and garri on weight and haemotological indices of wistar rats.

MATERIALS AND METHODS

Study Location: This research was conducted in the Department of Human Anatomy and Cell Biology, Delta State University, Abraka, Delta state, Nigeria over four weeks

Experimental animal and study design: Eighteen wistar rats were obtained from the animal house of the College of Health Sciences, Delta State University, Abraka and left to acclimatize for a period of two weeks. Tapioca and Garri were purchased from the local market; grower's mash was also purchased from vital feeds. Wistar rats of both sexes with weight ranging from 118-170g were randomly assigned into three groups (A, B and C). Each group was further subdivided into male and female groups: control (A); containing three males and three females, Garri (B); containing three males and females and Tapioca (C); containing three males and three females. Control group was fed with the water and growers feed marsh, while the experimental groups (B and C) were fed with garri and tapioca respectively with water twice daily for 28 days. Weight readings were taken on the 1^{st} 14^{th} and 28^{th} day of the experiment.

Sample Collection: At the end of the experimental period, all the rats were fasted overnight and sacrificed on the twenty-eight days by cervical dislocation. Organs (liver, left and right kidney) were removed and weighed, blood samples was collected from the heart and abdominal aorta using a 5ml syringe and stored in EDTA bottles containing heparin for anticoagulation. Blood samples obtained from all experimental animals was taken to the laboratory for hematology analysis. (Pack cell volume, White blood cell count, Hgb, Neutrophil Lymphocyte Monocyte Eosinophil Basophil Platelet)

Statistical Analysis: SPSS version 20.0 software was employed for data analysis. Statistical analysis was carried out between treated groups and control using student t-test. $P \leq 0.05$ was considered statistically significant.

RESULT

Table 1: shows weekly body weight differences in animal models treated with garri and tapioca as compared with control. A gradual decrease in weight was observed in the treated groups. Comparatively, there was no significant statistical difference between the values obtained from the control and treated groups ($p>0.05$). However, There was a significant gender difference ($p<0.05$) as shown in figure 1

Table 2: shows organ weight differences in animal models treated with garri and tapioca compared with control. A gradual decrease in organ weight was observed in the treated groups although no significant statistically difference between the values obtained from the control and garri treated group was observed ($p>0.05$) however, there was a Signiant difference in organ weights of tapioca treated group as compared with control ($p<0.05$).

Table 3 & 4 shows no statistical differences in the PCV, WBC, Hgb, neutrophil, lymphocyte, monocyte, eosinophil, basophil and platelet between control and garri however there was a significant difference in lymphocyte between control and garri and control and tapioca ($p<0.05$).

Table 1: Total body weight differences in animal models

GROUPS	WEEK 0	WEEK 2	WEEK 4
CONTROL	118.0 ± 0.0	140.0 ± 5.6	152.0 ±16.9
GARRI (A)	135.0 ± 12.7	114.0 ± 14.1	88.0 ± 0.0
GARRI (B)	141.0 ± 12.7	131.0 ± 21.2	89.0 ± 15.6
TAPIOCA (A)	148.0 ± 33.9	114.0 ± 25.5	87.0 ± 18.3
TAPIOCA (B)	144.0 ± 25.4	113.0 ± 18.3	80.0 ± 22.6

Values were expressed as mean ± SD; $p>0.05$

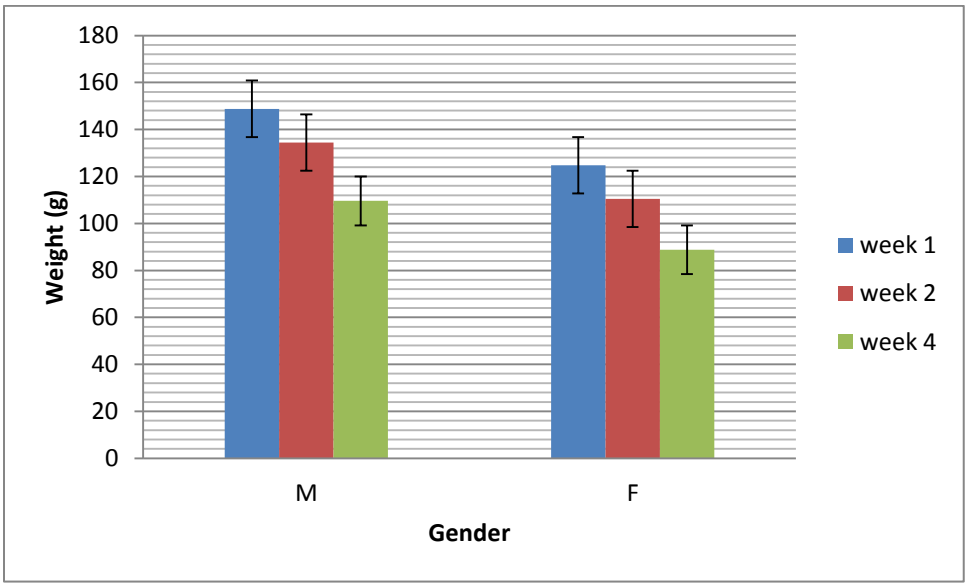

FIG 1: graph showing gender difference

There was a significant gender difference in week 1 and 2 ($p<0.05$). However, there was no significant gender difference in week 4 ($p>0.05$).

Table 2: Organ weight differences in animal models

GROUPS	LIVER (g)	LEFT KIDNEY (g)	RIGHT KIDNEY (g)
CONTROL	6.00 ± 0.56	0.50 ± 0.00	0.45 ± 0.07
GARRI (A)	3.30 ± 0.28	0.30 ± 0.00	0.40 ± 0.00
GARRI (B)	3.30 ± 0.42	0.35 ± 0.07	0.35 ± 0.07
TAPIOCA (A)	3.20 ± 0.00	0.50 ± 0.14	0.30 ± 0.14
TAPIOCA (B)	2.45 ± 0.56	0.25 ± 0.07	0.25 ± 0.07

Table 3: Hematology Indices in animal models

GROUPS	PCV (%)	WBC (Per mm^3)	Hgb (g/dl)	NEUTRO-PHIL (%)	LYMPH-OCYTE (%)
CONTROL	34.00± 7.07	$6.52\times10^3\pm 1.66\times10^3$	10.20 ± 2.12	54.0 ± .00	43.0 ± 4.24
GARRI (A)	36.00 ± 1.41	$5.32\times10^3\pm 3.78\times10^3$	10.80 ± 0.42	45.0 ± 21.21	59.0 ± 1.41
GARRI (B)	38.00 ± 2.82	$7.00\times10^3\pm 2.12\times10^3$	11.40 ± 0.84	40.0 ± 0.00	56.0 ± 1.41
TAPIOCA (A)	38.00 ± 9.89	$4.35\times10^3\pm 6.36\times10^3$	11.40 ± 2.90	68.0 ± 11.31	30.0 ± 11.31
TAPIOCA (B)	39.00 ± 8.48	$4.72\times10^3\pm 4.20\times10^3$	11.70 ± 2.54	73.0 ± 18.38	27.0 ± 18.38

Table 4: Hematology Indices in animal models

GROUPS	MONO-CYTE (%)	EOSIN-OPHIL (%)	BASO-PHIL (%)	PLATELET (mm^3)
CONTROL	1.00 ± 1.41	2.00 ± 2.82	0.00 ± 0.00	$480\times10^3\pm 42\times10^3$
GARRI (A)	5.00 ± 4.24	1.00 ± 1.41	0.00 ± 0.00	$570\times10^3\pm 42\times10^3$
GARRI (B)	2.00 ± 1.41	0.50 ± 0.70	1.50 ± 0.70	$560\times10^3\pm 42\times10^3$
TAPIOCA (A)	1-00 ± 1.41	0.00 ± 0.00	0.00 ± 0.00	$680\times10^3\pm 22\times10^3$
TAPIOCA (B)	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	$565\times10^3\pm 10\times10^3$

DISCUSSION

This study showed that consumption of Garri and Tapioca led to reduction in body weight in both male and female albino wistar rats, while the animals in the control group gained weight as shown in tables 1. It was however observed that females lost more weight than males in both experimental groups, higher weight loss was also observed in the Tapioca experimental group when compares to Garri experimental group. This may be due to the high cyanide content in Tapioca

as compared to Garri. This is consistent with the work of Tewe and Maner (1981) which showed that the ingestion of fresh or processed cassava based diets led to reduced growth rates in rats, pigs, African giant rats, sheep and goats. Also, the work of Maduagwu and Umoh (1988) showed that cyanide caused a consistent reduction in weight gain in the experimental rats. Cyanide toxicity reduced food and water intake which ultimately led to reduced average body weight of rats significantly. Aletor (1993) also carried out similar study using forty-eight albino rats to investigate the dietary implications of the residual cyanide levels of garri using performance, nitrogen balance, relative organ weights, serum and urinary thiocynate and some hematological variables. The experimental rats showed no outward signs of toxicity. However, rats fed cyanide-containing garri diets had significantly ($P \leq 0.05$) slower rates of growth than the controls and lower weights.

This study showed that there was reduction in organ weight of the liver and both kidneys, in both the Garri and Tapioca experimental group for both sexes as shown in the tables 2. However, the Tapioca group showed significant ($P \leq 0.05$) reduction in organ weight as compared to those fed with Garri, this may also be due to high cyanide content and low protein in diet. Tewe and Maner (1977) fed fetuses of sows 277 or 521 mg cyanide/kg diet throughout gestation and lactation and the fetuses exhibited decreased organ to body weight ratios.

Changes in some of the hematological parameters of the experimental rats were observed as shown in tables 3 and 4. In the Tapioca treated wister rat, there was reduction of white blood count (WBC), lymphocytes, and eosinophil. However, there was increase in neutrophil and platelets and packed cell volume (PCV), while basophil and monocyte were normal. In Garri treated wister rats, there was increase in PCV, white blood cell count (WBC), haemoglobin, neutrophil, platelets, monocyte and lymphocyte, while basophil was normal. All these were not statistically significant except the increase in lymphocyte for both experimental group ($p<0.05$). It is suggestive of chronic infection. These maybe associated with toxins associated with processing conditions and probably preservation methods (Bankole and Adebanjo, 2003). This might also be due to high cyanide content and low protein in tapioca.

CONCLUSION

Tapioca and garri can be considered a cheap and effective ready to eat snack beneficial in losing weight and maintaining shape as against the very expensively sold slimming aids available for sale. Proper processing and adequate preservation is necessary. However, its chronic consumption can be toxic to the body and can lead to serious health challenges.

ACKNOWLEDGEMENT: I wish to appreciate Bernard Abel for his support during this research work.

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