Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Scholars Research Library

Annals of Biological Research, 2011, 2 (6) :9-15
(http://scholarsresearchlibrary.com/archive.html)

Annals of Biological Research
Scholars Research Library
ISSN 0976-1233
CODEN (USA): ABRNBW

The effect of acute and chronic oral ingestion of *Yaji* and *Yaji*-additives on PCV, WBC, and Differential WBC counts

[1,2]Akpamu U., [1,3] Nwaopara AO. and [4]Oyadonghan GP.

[1]Anthonio Research Center, Ekpoma, Nigeria
[2]Department of Physiology, Ambrose Alli University, Ekpoma, Edo State, Nigeria
[3]Department of Anatomy, Ambrose Alli University, Ekpoma, Edo State, Nigeria
[4]Department of Anatomy, Abia State University, Uturu, Abia State, Nigeria

---

ABSTRACT

This eight-week study was designed to determine the effects of Yaji and Yaji-additives on hematological parameters in adult Wister rats. The animal subjects were divided into five groups (A–E) and during the duration of study, group A (control) received 300g of growers mash (GM) only, while group B received 237g of GM plus 9g of each of the combined constituents of Yaji. Groups C, D and E received 291g of GM plus 9g of salt, monosodium glutamate (MSG) and groundnut powder respectively. At the end of each week, blood samples from 3 randomly selected rats were collected and analyzed. The first four weeks served as the acute treatment period (B1-E1), while both the first and second four-weeks (eight weeks) served as the chronic treatment period (B2-E2). The results showed that there was a significant reduction in the PCV of groups B1 and C2 ($p<0.05$) and in the WBC and monocyte counts of group C1 ($p<0.05$). However, no significant changes was observed in the PCV, WBC, and differentials of the other groups ($p>0.05$). It is our opinion therefore, that there is a need to control the quantities of the additives in Yaji considering the observed influence of salt in group C.

Key words: *Yaji*, additives, acute, chronic, Haematological parameters.

INTRODUCTION

Despite the controversies about the risks and benefits of additives [1-3], coupled with the known hazardous effects [4], food additives remain a major constituent of our diets. In Nigeria, one such diet is the meat product called *Suya*. This meat product is served with *Yaji*-a complex of spices

and additives including ginger, cloves, red pepper, black pepper, white-maggi (Ajinomoto), salt, and groundnut cake powder. The spices in *Yaji* contain gingerol [5], eugenol [6], capsaicin [7], and piperine [8] as active principle respectively, while the other three constituents - white maggi (or Ajinomoto), salt and groundnut cake powder, contain monosodium glutamate (MSG) [9], sodium chloride [10] and oil [11] as active principle respectively.

Specifically, the complexity and mass-consumption rate of *Yaji* have over the years, raised concerns about its indiscriminate, unregulated and 'non-standardized' production pattern [12-23], which, by implication, has associated health dangers. Indeed, these issues of concern have become the basis of several histological investigations that has exposed the inherent dangers in the indiscriminate, unregulated and excessive consumption of *Yaji*. And yet, several questions on the effect of *Yaji* are still being asked as new lines of thought develop.

Only recently, Akpamu et al [23] reported that an excessive consumption of *Yaji* has the capacity to induce PCV reduction, which in itself, indicates that the consumer's health and wellbeing are compromised considering the clinical significance of PCV. Along this line of thought however, only a few literatures have reported the impact of additives on haematological profile even though haematological parameters are known to be of clinical significance. This study therefore, investigates the effect of acute and chronic oral ingestion of *Yaji*- additives on basic haematological parameters.

MATERIALS AND METHODS

Location and duration of study: This study was conducted in Ekpoma, Edo State, Nigeria with rats that were allowed to acclimatize for three weeks. The preliminary studies, animal acclimatization, ingredients procurement/*Yaji* production, actual animal experiment, histological processing, microscopy/micrography and evaluation of results, lasted for a period of eleven months; while the actual administration of test samples to the test animals lasted eight weeks.

Materials of study: Clove, ginger, red pepper, black pepper, table salt, MSG (white magi or Ajinomoto) and groundnut, were purchased dried from Aduwawa market, Benin City; Nigeria. The constituents of *Yaji* and feed (growers mash from Bendel Feeds and Flour Mills, Ewu, Edo State) were crushed separately using an electric blender. Measurement of materials was carried out using Electric Balance (by Denver Company USA -200398. 1REV.CXP-3000) in the diagnostic Laboratory of the Department of Medical Laboratory Science, Ambrose Alli University, Ekpoma.

Experimental Rats: Adult rats of an average weight of 188g were procured from the animal farm house of the Department of Physiology, College of Medicine, Ambrose Alli University, Ekpoma, and moved to the site of the experiment at No. 5B Palmwell Street Ujemen, Ekpoma, were they were allowed to acclimatize for three weeks. The animals were separated into five groups (A – E) using 5 big cages (n = 24). Group A rats served as the control while group B – E served as the test groups. During the period of acclimatization, the rats were fed growers mash daily and water was given *ad libitum.*

Administration of test sample: After acclimatization, the rats in each of the groups received as follows: Group A (control) received 300g of feed only; B received 237g of feed plus 9g of each of the respective constituents of *Yaji*; C received 291g of feed plus 9g of salt (table salt); D received 291g of feed plus 9g of MSG; and E received 291g of feed plus 9g of groundnut daily. For the purpose of this study, pellets were produced by mixing respective *Yaji* constituents with the appropriate amount of feed (grower's mash) via sprinkling water onto the mixture until a semisolid paste is formed. The resultant paste was then split into bits and allowed to dry under the sun. The total feeding period was eight weeks but substance administration daily, lasted one hour (9:00am – 10:00am).

Samples Collection and Analysis: At the end of each week and before the commencement of the next feeding week, 3 randomly selected rats were picked for whole blood sample collection. This was done using the jugular vein. The collected blood samples were immediately stored in sterile bottles containing heparin (an anti-coagulant) pending when hematological analysis is done. The resultant mean values were then recorded. The first four weeks served as the acute treatment period (B1 – E1), while the first and second four weeks (eight weeks) served as the chronic treatment period (B2 – E2).

Packed cell volume (PCV) was estimated by the macrohaematocrit method, WBC counts by the visual means of the new improved Neubauer counting chamber using a diluting fluid (Turk's fluid) in a ratio of 1: 20, while differential white blood cell count was carried out using Leishman's stain as described by Dacie and Lewis [24, 25].

Data analysis: The mean ± S.D was generated using SPSS (version 17) soft ware package and the one way ANOVA (LSD) test determined at $p< 0.05$.

RESULTS

Table 1 summarizes the mean ± Standard deviation for PCV (%). Results for the acute treatment period show that except for group E that posted a non-significant increase in PCV ($P>0.05$), group C and D posted a non-significant reduction in PCV ($P>0.05$), while B posted a significant reduction in PCV ($P<0.05$). For the chronic treatment period, an increase in PCV was observed in group B, while groups C, D and E posted a reduction in PCV ($P<0.05$). Only the reduction in C however, was a significant.

Table 1: Effect of acute and chronic oral ingestion of Yaji and its additive on PCV of rats

PCV (%)	B	C	D	E
Control(A)	51.88±3.36	51.88±3.36	51.88±3.36	51.88±3.36
Acute	38.25±18.95*	50.50±3.42	48.00±6.68	54.00±2.83
Chronic	54.25±1.71	44.25±9.54*	46.75±2.99	47.75±7.85

*Values are mean ±Standard deviation; B=Yaji; C= Salt; D=MSG; E=G.nut; PCV=Pack Cell Volume; * represent $p < 0.05$ compared with control.*

Table 2 and 3 represents the results of WBC and differential WBC counts respectively. There were reductions in the WBC count for groups B1-E1, but only the reduction observed for group C1 was statistically significant ($P<0.5$). On the contrary, a non-significant increase in WBC

count (P>0.05) was posted for groups B2 – E2 as compared to those of C1–E1 and control (see Table 2).

Table 2: Effect of acute and chronic oral ingestion of Yaji and its additive on WBC of rats

WBC (x10^3/mm^3)	***B***	***C***	***D***	***E***
Control(A)	4.58±2.48	4.58±2.48	4.58±2.48	4.58±2.48
Short term	5.18±0.44	1.13±0.71*	4.40±0.94	3.81±0.89
Long term	4.78±.24	4.68±0.28	4.86±0.58	4.56±0.10

*Values are mean ±Standard deviation; * represent p < 0.05 compared with control.*

Table 3: Effect of acute and chronic oral ingestion of Yaji and its additive on differential count of rats

Neu (%)	B	C	D	E
Control(A)	42.50±6.14	42.50±6.14	42.50±6.14	42.50±6.14
Short term	45.50±4.20	44.755.32	38.50±12.92	45.25±10.99
Long term	48.00±1.63	48.75±1.50	47.50±3.11	47.00±2.58
Lym (%)	B	C	D	E
Control(A)	49.75±8.36	49.75±8.36	49.75±8.36	49.75±8.36
Short term	49.75±5.06	52.00±5.89	56.75±15.95	49.50±10.41
Long term	46.25±4.65	46.00±3.37	47.50±4.80	46.50±3.00
Mon (%)	B	C	D	E
Control(A)	7.50±3.59	7.50±3.59	7.50±3.59	7.50±3.59
Short term	4.50±3.79	3.00±1.83*	4.50±3.87	4.50±2.52
Long term	5.75±3.69	5.00±3.46	5.00±3.83	6.50±3.42

*Values are mean ±Standard deviation; Neu = Neutrophils; Lym = Lymphocytes; Mon = Monocytes; * represent p < 0.05 compared with control.*

As regards the differential WBC count, it was observed that groups B2-E2 posted an increase in neutrophil and monocyte counts, but a reduction in lymphocytes count when compared to those of C1–E1 and control. These changes were however, not statistically significant (P>0.05), except for the reduction in the monocyte count of group C1 (P<0.05) (see Table 3).

DISCUSSION

The findings of this study on the effect of Yaji are in line with earlier reports by Akpamu et al. [23] that *Yaji* has the potential to alter the values of PCV. The observed acute response to oral ingestion of *Yaji* is suggestive of the fact that the constituents of *Yaji* in combination can induce anemia since PCV is an important diagnostic tool used in determining blood loss, health status and anemia. On the other hand, the observed chronic response to *Yaji* ingestion are indicative of the fact that the body might have responded to the prolonged effect of *Yaji* on PCV with the appropriate defensive physiological mechanisms.

Furthermore, judging by the observations in group C (group fed salt), one cannot but agree with the assertion that high salt (sodium chloride) diets might have adverse effects on the kidneys [26] and by implication, distorts its physiological activities. This may explain the observed effect of salt intake on PCV as there is evidence that 90% of erythropoietin –the hormone responsible for RBC production, is produced by the kidney [27].

Similarly, the observed changes in groups D1 and D2 (group fed MSG), draws attention to the controversies associated with MSG consumption [28]. In fact, it has shown that neonatal MSG

can induce a decrease in blood lymphocytes percentage [29], and that prolonged intake of MSG administration can induce renal damage [30]. It has also been shown that MSG can significantly induce the formation of micro-nucleated polychromatic erythrocytes [31]. Our findings on MSG therefore, suggest that MSG has the capability to induce a dosage/duration-dependent haematological alteration.

Moreover, the report that MSG induces renal cortical necrosis [32] may explain our finding on PCV considering the endocrine role of the kidney in erythropoisis. In addition, the reported effect of MSG on the gastro-intestinal tract lining [33], which, by implication, may cause distortions in the regulated absorption of minerals and vitamins, might also explain our observations on PCV since minerals and vitamins are important for erythropoisis [27, 34]. More so, the well known neurotoxic effects of MSG [19-22, 35], may have as well influenced the observed changes on PCV, judging by the role of the nervous system on endocrine functions.

Indeed, the observed differences in the PCV, WBC and differential count for group E1 and E2 suggests that acute ingestion of groundnut suppresses immunity, while chronic ingestion induces anemia. Our result however, contradicts those of Ironkwe and Oruwari [36] on the effect of peanut oil on hematological parameters, but the probable reason might be the difference in the substance of study. Nevertheless, studies on fish have shown that groundnut oil (dietary oil) ingestion can induce reductions in haematological parameters [33, 38] and interestingly, there is evidence that dietary oils affect vascular wall integrity, which might lead to atherosclerosis as well as cardiac complications [39].

In conclusion, the findings of this study suggest that *Yaji*-additives have the potential to induce anemia in a dosage/duration dependent fashion. Agreed there were variations in the effect of *Yaji*-additives on PCV, the effect of salt however, was more obvious. It is our opinion therefore, that there is a need to control the quantities of additives in *Yaji* particularly the salt content.

REFERENCES

[1] I Milner; **1989**. Environmental Nutrition. HighBeam advertising network. HighBeam Research.
[2] AR Gaby; **2005**. *Alternative Medicine Review*; 10: 294-306.
[3] D McCann; A Barrett; A Cooper, D Crumpler, L Dalen, K Grimshaw, E Kitchin, K Lok, L Porteous, E Prince, E Sonuga-Barke, OJ Warner, J Stevenson; **2007**. *Lancet*. 5.
[4] LK Moore; **2003**. Developing Human. 2nd. Philadelphia. W.B. Saunders co. Ltd. 173- 183.
[5] M Witchtl; **2004**. Herbal Drugs and Phytopharmaceuticals. 3rd Edn., CRC Press, Boca Raton FL, pp: 653-656.
[6] K Krishnaswamy; N Raghuramulu; **1998**. *Ind. J. Med. Res*, 108: 167-81.
[7] OH Collier; W.J. McDonald-Gibson; S.A. Saeed; **1965**. *J. Physiol*. (Lond), 179(2): 248-262.
[8] H McGee; **2004**. On Food and Cooking. Revised Edn, Scribner, pp: 427-429.
[9] BA Omojola; **2008**. *African J. Biotech*. 7(13): 2254-2257.
[10] HS Carson; WJ Osborn; MJ Wyss; **1998**. *Hypertension* 32: 46-51.
[11] KN Fageria; CV Balgar; C Jones; **1997**. Growth and mineral nutrition of field crop. 2nd Ed. Marcel Dekker, Inc, New York 1001K p. 494.

[12] AO Nwaopara, LC Anyanwu; CA Oyinbo; IC Anaikot; **2004**: *Journal of Experimental and Clinical Anatomy*; 3(2): 44 – 47.
[13] AO Nwaopara; MAC Odike; U Inegbenebor; MA Adoye; **2007a**. *Pakistan Journal of Nutrition;* 6(6): 524-527.
[14] AO Nwaopara; MAC Odike; TA Ikhuoriah. LC Anyanwu; **2007b**. *Medilink Journal*. 8(74): 34-38.
[15] AO Nwaopara; MAC Odike; U Inegbenebor; SO Nwaopara; EI Ekhoye; **2008a**. *Electronic Journal of Biomedicine; 3: 61-64.*
[16] AO Nwaopara, MAC Odike; U Inegbenebor, SO Nwaopara, GI Ewere; **2008b**. *Pakistan Journal of Nutrition;* 7(2): 287 – 291.
[17] AO Nwaopara; C Anibeze; F Akpuaka; SO Nwaopara; **2009a**. *The Internet Journal of Alternative Medicine*. 6 (2). ISSN 1540 – 2584.
[18] AO Nwaopara; CIP Anibeze; FC Akpuaka; **2009b**. *Journal of Clinical Review and Opinions;* 1(2): 021 - 025.
[19] AO Nwaopara; CIP Anibeze; FC Akpuaka; E Uhumuavbi; **2009c**. *Internet Journal of Biological Anthropology*; 3(2).
[20] AO Nwaopara; CIP Anibeze; FC Akpuaka; **2010a**: *Asian Journal of Medical Sciences* 2(1): 16 -21.
[21] AO Nwaopara; CIP Anibeze; FC Akpuaka; **2010b**. *Research Journal of Applied Sciences, Engineering and Technology;* 2(1): 67 – 72.
[22] AO Nwaopara, U Akpamu; MA Izunya; AG Oaikhena; O Okhiai; CL Anyanwu; OB Idonije; PG Oyadonghon; **2011**. *Current Research Journal of Biological Sciences* 3(4): 308-312.
[23] U Akpamu; AO Nwaopara, MA Izunya, AG Oaikhena, O Okhiai, OB Idonije, UC Osifo; **2011**. *British Journal of Pharmacology and Toxicology* 3(2): 108-112.
[24] JV Dacie; SM Lewis; **1991**. Practical hematology, Churchill Living Stone, Edinburgh Pp. 41-57.
[25] JV Dacie; SM Lewis; **2001**. Practical Haematology. 11th ed, Longman Group.Ltd. Hong Kong. Pp 11-17.
[26] CA Kirk, DE Jewell; SR Lowry; **2006**. *Vet Ther*; **7**: 333–46.
[27] AC Guyton; JE Hall. **2006**. Textbook of Medical Physiology. 11th Edition. Elsevier Saunders. Philadelphia. Ch 32. Pp. 422.
[28] D Biodum; AA Biodun; **1993**. Spice or Poison? Is monosodium glutamate safe for human consumption? National concord. 4th Jan, 5.
[29] M Hriscu; G Saulea; N Vidrascu; I Baciu; **1997**. *Rom. J. Physiol*. 34 (1- 4). 95 – 101.
[30] NA Vinodini; AK Nayanatara; C Ramaswamy; VR Anu; DK Rekha, GKM Damadara, B Ahamed; Shabarinath; B Ramesh; **2010**. *Journal of Chinese Clinical Medicine.* 5 (3). 144- 147.
[31] Farombi et al., 2006.
[32] AO Eweka; **2007**. *Internet J. Health;* 6(2).
[33] AO Eweka; FAE Om'Iniabohs; **2007**. *Electronic Journal of Biomedicine;* 2: 14-18.
[34] K Sembulingham; P Sembulingham; **2010**. Essentials of medical Physiology. 5th ed.Jaypee brothers medical publisher. Pp. 73.
[35] AO Eweka; FAE Om'Iniabohs; **2007**. *Internet J. Neurol;* 8(2).
[36] MO Ironkwe; BM Oruwari; **2011**. *Pakistan Journal of Nutrition*; 10 (10): 974-977
[37] AZ Aderolu; OA Akinremi; **2009**. *Turkish Journal of Fish. and Aqua. Sciences*; 9: 105-110
[38] AO Satolu; **2010**. *World Journal of Fish and Marine Sciences*; 2 (2): 93-98.

[39] B Sekalska; A Ciechanowicz; B Dolegowska; M Naruszewicz; **2007**. *J. Exper. Anim. Sci;* 43 (4): 283-299.