Haematological Parameters Of Albino Rats Fed On Tiger Nuts (Cyperus Esculentus) Tuber Oil Meal-Based Diet.

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Abstract

The effect of Cyperus esculentus (tiger nut) tuber oil meal-based diet on the haematological parameters of albino rats was studied. Cyperus esculentus tuber oil was extracted from the tuber using a soxhlet extractor. Twenty, 3 weeks-old albino rats (Rattus norvegicus) with an initial average weight of 51.67±5.29g were grouped into two groups of ten (10) animals each. The first group was fed with soybean oil-based (control) diet; the second group on esculentus tuber oil meal-based diet for six (6) weeks. There was no significant difference ($p>0.05$) in all the Haematological parameters which include Haemoglobin (Hb), Red blood cells (RBC), Packed cell volume (PCV), Mean cell volume (MCV), Mean cell haemoglobin (MCH), Mean cell haemoglobin concentration (MCHC), White Blood Cells (WBC) and platelets in the serum of Tiger nut oil based diet fed rats as compared to that of the soybean oil. We concluded that feeding rats with tiger nut oil based diets is safe, does not cause anemia and will not allow accumulation of toxic material in the body.

INTRODUCTION

Haematological parameters are those parameters that are related to the blood and blood-forming organs[1]. The haematological and lipid serum examination is among the methods which may contribute to the detection of some changes in health status, which may not be apparent during physical examination but which affect the fitness of the animals [2].

Tiger nuts (Cyperus esculentus), an unexploited and under-utilized food is a grass like plant of the family Cyperaceae (sedge family) and is widely distributed in many north temperature locations within South Europe as its probable origin[3]. Tiger nuts are cultivated in many countries of West Africa and a lot of people eat the tiger-nut without knowing the health benefits. They have been cultivated both as a livestock food and for human consumption of the tubers, eaten raw or baked. Tiger nuts tuber has been shown to have several effects in the body. It is believed that they help to prevent heart attacks, thrombosis and cancer especially of the colon[4,5], relieve indigestion especially when accompanied by halitosis, beneficial to diabetics and those seeking to reduce cholesterol or lose weight, hasten the inception of menstruation [6]. Along with a high-energy content (starch, fats, sugars and proteins), they are rich in minerals such as phosphorous and potassium and in vitamins E, C, soluble glucose and oleic acid. Typically, 100g Tiger nuts contain 386 kcal (1635 kj) as 7% proteins, 26% fats (oils), 31% starch, 21% glucose. They contain 26% fibre of which 14% is non-soluble and 12% soluble [7, 8]. They have excellent nutritional qualities with a fat composition similar to olives and a rich mineral content, especially phosphorus and potassium. The oil obtained from Cyperus esculentus is golden brown in colour and has a rich, nutty taste. The oil of the tuber was found to contain 18% saturated (palmitic acid and stearic acid) and 82% unsaturated (oleic acid and linoleic acid) fatty acids [8]. However, information and knowledge on the effect of the tuber oil meal-based diet on the haematological parameters of rats is still very scanty in literature and remains incomplete. The present study was therefore carried out to assess the effect of tiger nut oil meal-based diet on the haematological parameters of rats.

MATERIALS AND METHOD

COLLECTION AND PREPARATION OF SEED SAMPLE:

Dried tiger nut tubers used for this study was obtained from Hausa hawkers along Post Office in Ilorin, Kwara State, Nigeria and were identified as Cyperus esculentus (tiger nut) by a taxonomist in the Department of Crop Science, Faculty of Agriculture, University of Ilorin, Nigeria. The seeds were screened to remove bad ones. The seeds were then dried to

constant weight in an oven at 60 °C, milled using magic blender, SHB-515 model (made by Sorex company limited, seoul, Korea) put in air-tight containers and stored in desiccators for further analysis.

OIL EXTRACTION

Lipid was extracted from the grounded Tiger nut using the soxhlet extractor as described by Folch et al. (1957). Chloroform: methanol (2:1 v/v) mixtures was employed for the extraction in order to extract an appreciable quantity of both the polar and non polar in the sample, this implies that all lipids are extracted with impurities and needs to be purified.

PURIFICATION OF THE EXTRACTED OIL

The purification was done by employing the method of Folch et al. (1957).

FEED FORMULATION:

The purified tiger nut oil and soybean oil were used as a source of fat in the formulation of animal feed. The diet for each group was formulated by mixing known quantities of sources of each food class (Table 1). The food items were mixed together and manually made into pellets to feed albino rats.

Figure 1

Table 1: composition of diets

Table 1:	composition of diets	g/kg
	Soybean oil	Tiger nut oil
Corn starch	476	476
Soybean	250	250
Rice bran	40	40
D-L methionine	4	4
Sucrose	100	100
Vitamin mix	50	50
Tiger nut oil	-	80
Soybean oil	80	-

Vitamin mix(per kg of diet): thiamin hydrochloride, 6mg; pyridoxine hydrochloride 7mg; nicotinic acid 30mg; calcium pantothenate 16mg; folic acid 2mg; biotin 0.02mg; cyanocobalamin 0.01mg, retinol palmitate 4,000u, cholecalciferol 1000u; tocopherol acetate 50u, menadione 0.05mg; choline chloride 2g.

ANIMAL MANAGEMENT:

Twenty (20) 3 weeks-old albino rats of both sexes with an initial average weight 51.67±5.29 g were randomly assigned into two (2) dietary treatment groups . Each treatment had two replicates with five animals per replicate. The first group was fed with soybean oil-based (control) diet; the second group on C. esculentus tuber oil meal-based diet. The animals were weighed prior and were allowed to acclimatize to the laboratory environment for one week before the commencement of the feeding trial. The animals were supplied feed and water ad libitum and weighed (on weekly basis) for six (6) weeks. Group feeding was done to ensure animals in all group were subjected to the same conditions. Each group of rats was housed in a metal cage at room temperature.

The rats were all fed their respective feeds daily, weighed weekly and sacrificed at the end of the 6th week by anaesthesing them in a jar containing cotton wool soaked in diethyiether and disserting them quickly.

COLLECTION AND TREATMENT OF BLOOD SAMPLES:

Blood was collected from the animals by simply incising the jugular vein and evacuating the blood into heparinised bottle.

Determination of haematological parameters

The Automated Haematologic Analyzer (Sysmex KX – 21) was used to analyze the haematological parameters like PCV, WBC, RBC, MCH, MCHC, HGB and PLT. The analyses were carried out based on standard methods [10], [11].

STATISTICAL ANALYSIS

All data were analyzed statistically using Analysis of Variance (ANOVA) test [12]. Significant difference between the treatment means was determined at 5% confidence limit using Duncan's Multiple Range Test [13].

RESULT

Table 2 shows the proximate analysis of the formulated diets (test and control) on which the rats were maintained. There was no significant difference ($p>0.05$) in the various components of the diets.

Figure 2

Table 2: Proximate composition of compounded

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	Soybean oil	Tiger nut oil
Moisture content	6.75±0.03 [a]	6.38±0.22 [a]
Total ash	5.21±0.12 [a]	4.75±0.14 [a]
Crude fat	9.32±0.18 [a]	10.33±0.18 [a]
Crude protein	15.73±0.29 [a]	15.22±0.15 [a]
Crude fiber	5.70±0.12 [a]	5.54±0.18 [a]
Dry matter	93.23±0.02 [a]	93.67±0.17 [a]

Each value is a mean of three determinations ±SEM

Values carrying the same superscripts across the same row for each parameter are not significantly different. (P>0.05).

The haematological parameter of rats fed with soybean oil and Tiger nut tuber oil based diets are shown in Table 3. There was no significant difference in all the Haematological parameters in the serum of Tiger nut oil based diet fed rats as compared to that of the soybean oil.

Figure 3

Table 3: Comparism of the Hematological Indices In Control And Tiger nut oil Fed Rats.

Parameter	Soybean oil	Tiger nut oil
Hb (%)	13.13±0.09 [a]	13.23±0.23 [a]
PCV (%)	38.67±0.26 [a]	39.00±0.63 [a]
RBC (x 10^{12}/L)	05.91±0.09 [a]	05.94±0.07 [a]
MCV (μm^3)	66.33±0.93 [a]	66.00±1.18 [a]
MCH(pg)	22.25±0.43 [a]	21.75±0.67 [a]
WBC(x10^9/L	05.95±2.66 [a]	05.53±0.36 [a]
PLAT	100.00±0.45 [a]	99.00±1.18 [a]
Neut	8.00±1.26 [a]	9.25±0.43 [a]
Lymph	92.00±1.26	88.25±0.76

Each value is a mean of three determinations ± SEM

Values with the same superscripts across the same row are not significantly different (P>0.05).

Hb – Haemoglobin concentration

PCV – Packed cell volume

RBC – Red blood cell

WBC – White blood cell

MCHC – Mean cell haemoglobin concentration

MCH – Mean cell haemoglobin

MCV – Mean cell volume.

DISCUSSIONS

Nutritional status of an individual is dependent on dietary intake and effectiveness of metabolic processes. These can be determined by either or combinations of clinical, anthropometric, biochemical or dietary methods. The first worthy statement about the study is that none of the animals specimen died either naturally or due to feed ingestion The values obtained from proximate analysis of the formulated diets (Table 2) compared favourably with each other, indicating that the rats in both groups were placed on the same amount of nutrients quantitatively and therefore whatever differences that are noticed might be due to the differences in the quality of the nutrients in these diets or their bioavailability when consumed.

The absence of significant difference as shown in Table 3 among treatment groups for the hematological parameters added to the absence of mortality suggested tiger nut tuber oil is not toxic. It has been reported that the measurement of anaemia gives an indication of the severity of the disease [14]. Packed cell volume is the volume by percentage of red cells in whole blood. The non significant reductions in the haematological parameters contents of the blood of rats reared on the oil based meal of tiger nut and soybean based meal is an indication that the oxygen carrying capacity of the animals' blood is not reduced. The major function of the red blood cells is to transport haemoglobin, which in turn carries oxygen from the lungs to the tissues [15]. The Hb concentrations and haematocrit are values revealing the degree of anemia while the MCHC is a useful index of the average Hb concentration of the red cells [16]. Generally, low readings for RBC, Hb and hematocrit can indicate anaemia. Leucocytes are known to increase sharply when infection occurs, as one of the first line of defense of the body [17] .The increase in total while blood cell count, neutrophils, lymphocytes and monocytes counts following tiger nut oil feeding for 6-weeks confirms the anti-infection properties of tiger nut. According to Robins (1974), in a toxic environment, RBC count significantly decreased while WBC increased but such is not experienced in this study. The hemoglobin and packed cell volume of the rats were within acceptable range suggesting adequate iron status. This could be associated with the iron content of tiger nut oil which is a good source of non-heme iron [19]. Non-heme iron from plant sources has been reported not to be as readily available to the body as heme iron from animal sources which are well absorbed [20]. A non-significant difference in platelet number of control and test serves as an absence of marker disease such as microangiopathy and macroangiopathy [21]. Thus, confirming Tigernut trader (2005) that tiger nut tuber oil may not contribute to the risk for cardiovascular diseases.

CONCLUSION

In conclusion, the various dietary treatments did not significantly affect the serum components meaning that the oil might be toxicological free. These findings, in effect

show that this plant oil if adequately processed could substitute for expensive animal sources which are out of the reach of the poor. This confirms that the test diets are adequate for maintaining healthy nutrition status in weanling rats. Further work needs to be conducted on the effect of tiger nut oil on some selected organs in rats.

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