REVIEW ARTICLE

Effect of Wild Beans on the Concentrations of Plasma Albumin, Proteins, Urea, and Uric Acid in Rats Fed with High-fat Diet

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ABSTRACT

It has been a big challenge to provide a healthy and nutritious source of food for the poor and undernourished population of the developing world such as Nigeria. Due to scarcity, high cost, and unreliable supply of healthy food, the developing and underdeveloped countries have resulted in finding out the cheap and alternative source of healthy and nutritious food as found in the underutilized wild edible plants. Hence, this study was to assess biochemical mitigated effects of underutilized wild beans on rats fed with high-fat diets (HFD). Based on the analysis carried out, rats fed with Feregede in the HFD diet compared to other wild beans had the lowest albumin and total protein in their plasma with a value of 35 ± 0.01 and 59 ± 0.04, respectively, thus having a less mitigated effect on these biochemical parameters. However, the uric acid and urea were found to be higher in rats having Feregede in their diet compared to other wild beans with the values 19 ± 0.09 and 0.29 ± 0.05, respectively. This present study shows the bioavailability of albumin, protein, urea, and uric acid as influenced by different wild beans in HFD. It is, therefore, recommended that wild beans, especially Otili and Pakala should be included in our diet as it would substantially aid in redressing the problems of malnutrition in our country.

Key words: Albumin, High fats diet, Protein, Urea, Uric acid

INTRODUCTION

High-fat diets (HFD) are known to lead to a positive fat balance and consequently to adipose mass accumulation[1]; furthermore, these diets do not seem to stimulate fat oxidation rate in the same way in obese and lean subjects.[2] The long-term intake of a HFD diet seriously affects human health and results in metabolic disorder and chronic diseases such as overweight, fatty liver, cardiovascular disease, hypertension, hypercholesteremia, insulin resistance, and leptin resistance.[3] The prevalence of these diseases is increasing in current society, and the pathogenesis is interrelated in a complex manner. Supplement of dietary fibers was regarded as one of the most effective ways to prevent and relieve chronic diseases caused by long-term intake of HFD in current society.[4] However, dietary fiber intake provides many health benefits. A generous intake of dietary fiber reduces the risk for developing the following diseases: Coronary heart disease, stroke, hypertension, diabetes, obesity, and certain gastrointestinal disorders.[5] Dietary fiber supplements have the potential to play an adjunctive role in offering the health benefits provided by high-fiber foods.[6,7]

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The wild type beans (*Sphenostylis stenocarpa* African yam bean; Otili, *Cajanus cajan* pigeon pea; Feregede, *Phaseolus lunatus* Lima bean; Pakala) are an underutilized tropical legume. The chemical composition of these grain legumes was shown to contain high quantities of proteins, amino acids, fiber, and minerals.[8,9] Their high intake has been associated with reducing the risk of developing diabetes, hypertension, animal's cancer, and hypercholesterolemia.[10] Moreover, the high level of the anti-nutrients present may be responsible for their low utilization most probable reason. In this respect, the edible bean types appear to be the most explored among the beans. The aim of this present study is to study the response of rats fed with a different wild underutilized local wild bean in a HFD. Our objective was to have an overview of alteration of clinical biochemistry.

MATERIALS AND METHODS

Collection of cultivar

The legumes (beans) used in this work are of two types; wild-type beans *S. stenocarpa* (Otili African yam bean), *C. cajan* (Feregede Pigeon pea), *P. lunatus* (Pakala lima beans), and Edible bean *Phaseolus vulgaris* (Oloyin kidney bean). They are gotten from the farmers in Ado-Ekiti.

Experimental design

Twenty four albino rats were obtained from the college of medicine Animal house, Ekiti State University, Ado Ekiti, Ekiti state. Their weight ranged between 50 g and 100 g. The animals were acclimatized to the environment for 7 days. As shown in Table 1, the rats were then randomly divided into 6 groups (4 rats per group) according to average body weight, the groups were fed with a normal chow diet (NCD), a high dietary (HD) fiber diet containing 8% fiber supplement in total, a HFD which provided 45% of its energy from fat, or a high-fat and dietary fiber diet (HFD). The main nutritional ingredients in the HD diets were adjusted to levels similar to those of the NCD, and the main nutritional ingredients in the HFD diet were adjusted levels similar to those of the HF diet. The rats were observed every day and weighed every week, and the food intakes were recorded for each group throughout the experiment.

DISSECTION AND TISSUE COLLECTION

All of the rats were anesthetized with chloroform, and venous blood was collected from the orbital vein for hematology and blood biochemical analyses.

Blood biochemical analyses

For the biochemical analyses, the blood samples were maintained 4°C for 2 h and then centrifuged at 3000 r/min for 20 min at 4 °C. The supernatant was stored at −80° C albumin, total protein, urea, and uric acid levels were measured following the commercial Random Kit (USA).

Albumin determination

The classical Plummer (1971) procedure for albumin determination was adopted. A 0.02 ml of sample and 5 ml of reagent (bromocresol green dye) of Random kit were pipetted into the standard test tube, and the blank test tube contained only 5 ml of the reagent. The resulting solutions were mixed well and allowed to stand for 5 min at room temperature (23°C±2°C) before absorbance was read at 600 nm against blank. The color change on the binding of albumin to bromocresol green was almost instantaneous.

Total protein determination

Protein determination of plasma and all fractions was estimated by the method of[11] using bovine serum albumin as standard.

Urea and uric level determinations

The collected blood samples were dispensed into lithium heparin bottles and were centrifuged at 10,000 rpm (10,000 rpm) for 10 min and separated to obtain plasma. The separated plasma was stored at −10°C for further analysis. Urea and uric levels in plasma were estimated using the commercially available Random Kit (USA).

RESULTS AND DISCUSSION

After 5 weeks, the rats fed with HFD plus chow (negative control) showed a significantly higher weight than that of rats fed with only chow diet (Positive control). In the course of the study, the food intake [Figure 1] of Otili group was higher than that of the control groups, and food intake. The feeding pattern of each group shows that Otili group had more appetite for the feed [Figure 1]. The resulting effect can be clearly seen in the recorded weekly average weight by the

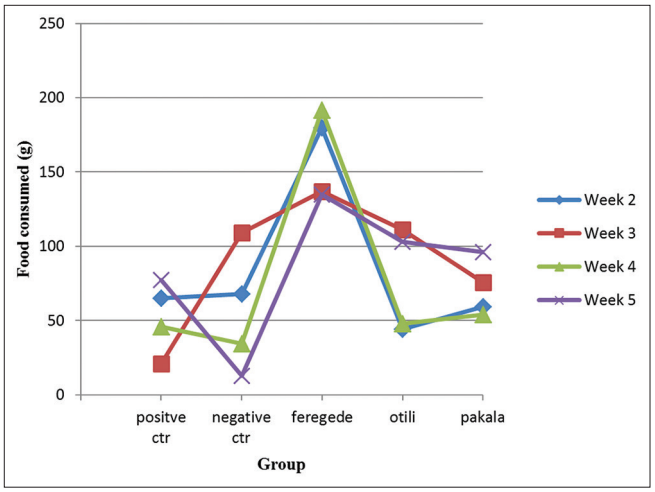

Figure 1: Curves showing food consumption of rats

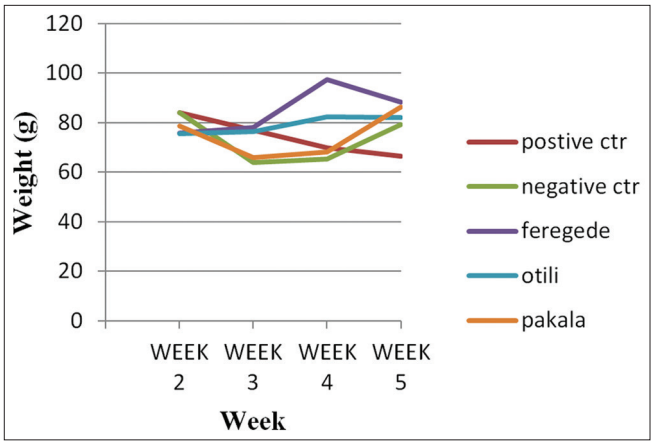

Figure 2: Standard curves showing the weekly weight of rats

Wister albino rats for 4 weeks as shown in Figure 2. There was a general similarity in the behavior of the rats which have the wild beans in their feed. Unlike the controls and Otili other groups did not huddle together but lay separately, often on their backs with their limbs fully extended.

The result of biochemical analysis on the blood is shown in Table 2. As a marker of kidney disease micro-albuminuria predates urinary albumin levels by approximately 5–10 years. Measurement of higher total urinary albumin levels is important for conditions associated with an increased risk of renal failure such as diabetes, essential hypertension, non-diabetic renal disease, cardiac decomposition, pregnancy, and in pharmaceutical clinical trials. Rats fed with Pakala had the highest albumin with the value of 41 ± 0.01 while the lowest value was found in the positive control group with the value 31 ± 0.08. Perhaps, the low albumin in urine levels especially in rats fed exclusively with chow may lead to the renal damage.

Proteins are important building blocks of all cells and tissues. They are necessary for the body's growth, development, and health.[12] Blood contains albumin and globulin. Albumin proteins keep fluid from leaking out of your blood vessels. Globulin proteins play an important role in the immune system. The total protein test measures the total amount of protein in blood and specifically looks for the amount of albumin and globulin. The total protein in Group 1 had the highest rate with a value of 77 ± 0.15 while rats with Feregede had the lowest with a value of 59 ± 0.04.

Urea is synthesized in the liver from ammonia produced as a result of deamination of amino acids. A urea nitrogen test can also assess how well the kidneys are functioning, determine if you have kidney disease, monitor your kidney disease and help diagnose a number of diseases and disorders that may affect how your kidneys function. Rats fed with only chow had the highest urea concentration with a value of 27 ± 0.05 while the lowest value was found in rats fed with Otili with

Table 1: Experimental design

S/N	Experimental group	Composition
1	Positive control	Chow
2	Negative control	Chow+High Fat Diet
3	Feregede	Chow+HFD+Feregede
4	Otili	Chow+HFD+Otili
5	Pakala	Chow+HFD+Pakala

HFD: High-fat diet

Table 2: Results of biochemical analysis of the blood

Groups	Albumin	Total protein	Urea	Uric acid
1	31±0.08	77±0.15	27±0.05	0.43±0.01
2	37±0.05	75±0.10	17±0.10	0.27±0.04
3	35±0.01	59±0.04	19±0.09	0.29±0.05
4	40±0.01	70±0.01	10±0.02	0.20±0.02
5	41±0.01	69±0.01	11±0.01	0.26±0.04
6	36±0.02	70±0.03	12±0.05	0.30±0.09

the value 10 ± 0.02. Negative control groups fed with HFD and HFD complemented with the bean samples had lower urea concentration compared to the positive control. Perhaps, the low urea levels, especially in Group 4, may lead to the occurrence of cancer, especially colon cancer.[13,14]

Also uric acid was found to be higher in Group 1 with a value of 0.43 ± 0.01 and low in rats fed with Otili with the value of 0.2 ± 0.02. This indicates that rats fed with HFD complemented with Otili had a normal concentration of uric acid. Uric acid is a metabolite of purines, nucleic acids, and nucleoproteins. Consequently, abnormal levels may be indicative of a disorder in the metabolism of these substances.[15] Hyperuricemia may be observed in renal dysfunction, gout, leukemia, polycythemia, diabetes, hypothyroidism, or in some genetic diseases. A 24-h urine-uric-acid test is often suggested for collection to measure and interpret the urinary analysis. The acid is produced during the digestion of some foods that affect the natural breakdown of cells in the body. The test is recommended when the doctor finds symptoms that could be the reason for high uric acid levels. Elevation in uric acid concentration suggests numerous renal and metabolic disorders, including renal failure, gout, leukemia, and starvation.[15,16-18]

CONCLUSION

From the result of the biochemical analysis of blood collected from the experimental animals. The indication from the present study further corroborates our earlier works that dry beans especially, Otili (*S. stenocarpa*) played an important clinical role in the human nutrition with reduced risk of

chronic disease and could be an exceptionally cost effectual approach for improving health.

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