Effects of Wood Fibres of *Ficus exasperata* on PCV, Sugar Level and Live Weight of Albino Rats and Laboratory-Baked Breads

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ABSTRACT

Dietary fibre is one of the most cheaply talked about nutrients for health promotion and disease prevention. Therefore, the concept of dietary fibre consumption to improve food digestibility and bowel movement has generated some interests in medical circles. This work thus studied the structure of *Ficus exasperata* wood and the potentiality of its cellulosic materials as source of dietary fibre in foods. Effects of its cellulosic materials on the haematocrit, blood sugar levels and weight of albino rats by feeding the rats for a period of 28 days across four treatments (the control i.e. 0%, 10%, 15% and 20% wood fibres added to normal diet) were observed. The fibre caused a reduction in the live weight of the rats, stabilizes the blood sugar level and increases the blood PCV. Thus, there is possibility that the fibres reduce the plasma cholesterol level concentrations of the rats. Furthermore, incorporation of the wood fibres into the wheat flour did not adversely affect the physical, chemical and baking properties of baked bread. The study therefore recommends the wood of *Ficus exasperata* for further investigation as a cheap potential source of cellulose for human consumption.

Keywords: Dietary fibre, nutrition, *Ficus exasperata*, albino rat, bread, dietary diseases, blood sugar, haematocrit

1. INTRODUCTION

Nutrition is the science or practice of consuming and utilizing foods. In other words, nutritional science investigates the metabolic and physiological responses of the body to diet. The nutrients needed by the body are available only through food which is one of the most essential factors in maintaining and preserving health. For sustaining healthy and vigorous life, diet should be planned according to the principle of nutrition. The benefits of good nutrition are good health, happiness, efficiency and longevity. Optimum or adequate nutrition is required to maintain good health and is defined as a condition when all essential nutrients are present in a correct proportion as required by our body [1].

Modern food production has, however, deprived man the opportunity of having adequate dietary fibres as most food industries are of less concern about nutrients contents of the food produced rather their concerns are on taste and packaging. Since the advent of these kinds of foods, man has been faced with many nutritional problems particularly diseases such as dental decay, obesity, diabetes, cardiovascular diseases, stroke, cancer and hypertension. Obesity or over-nutrition is a condition in which there is excessive weight gain in the body and is a predisposing factor to cardiovascular diseases, diabetes, gout, liver and gall bladder diseases, osteoarthritis and usually, surgery is always a risk with obese people [1]. Since obesity is mainly caused by excessive calorie consumption, as such, foods with low calorific values and high dietary fibre contents should be consumed with the end result of maintenance and restoration of good health alongside gradual reduction in body weight.

Dietary fibres are highly complex substances that can be described as any nondigestible carbohydrates and lignins not degraded in the upper gut [2]. Dietary fibre can also be referred to as food materials particularly of plant origin that are not hydrolyzed by enzymes secreted by the human digestive tract but that may be digested by microflora in the gut [3]. Fibres have been found to considerably modulate hepatic, blood and intestinal lipids and lipoprotein profiles [4]. Dietary fibre is found in plants although in varying degrees. The recognition of the role of fibre in lowering the risk of cardiovascular disease reminds us of the importance of food-based strategies for maintaining health, there is therefore the increasing awareness in nutritional therapy towards avoiding the various diseases associated with overweight [5]. Since there is a hypothesis relating several diseases common in affluent societies to lack of dietary fibre, nutritional experts have come up with a number of new ideas for food recipe. One of these ideas that bear some relevance to wood anatomy is addition of wood fibres to wheat flour to produce or bake bread of low calorific value and high dietary fibre content, which is one of the cheapest means of dietary fibre administration i.e. to add processed fibres to regular foods [5].

Wood anatomy is a branch of Plant Biology that deals with the study of the internal structures of wood. It deals with the study of microscopic structures. It also examines and relates the relationship between different cells and their structures which can only be observed under microscope. Wood is usually defined as the secondary xylem of gymnosperms and dicotyledons. It is derived from the meristematic activities of the vascular cambium and form the bulk of the xylem in trees, shrubs, and some herbs [6]. The wood elements are tracheids, vessel members, different types of fibres, parenchyma cells, xylem, ray cells and sometimes, secretory cells [7].

Ficus species or the fig, the study material in this work, is native to Western Asia but many members have been cultivated for thousands of years in Mediterranean countries, Europe and North Africa. A number of Nigerian figs are evergreen and are commonly grow as shade trees since they reproduce very rapidly from cuttings. There are 59 species of *Ficus* in west tropical Africa [8]. Forty one of these have been identified in Nigeria [9]. Out of these only thirteen species are found in the savanna [10], the majority growing within the forest zone. The uses to which *Ficus* species are being put are many and varied. Some figs are eaten by livestock and wild animals. The leaves of some *Ficus* have long been recognized as browse or fodder within and outside Nigeria. [11] identified and characterized fourteen browse plants as supplement to cassava and plantain peels in Ashanti region of Ghana. The wood is also used for carving, while whole trees serve for ornamental, shade, soil conservation, soil improvement, bee hives and life fence in many parts of the world. The wood is light usually whitish to pale, soft and easy to work [12] and it has not been under any intense exploitation in Nigeria. The wood is medicinal and it is widely used in different areas of medicine. The wood fibres of *Ficus* species are potential dietary fibres and considering its wide distribution and the fact that it has not been under any intense exploitation in Nigeria, it will serves as a cheap source of dietary fibres.

[5] indicated that one of the possible cheapest means of dietary fibre administration is to add processed fibres to regular foods although it can to some extent alter the appearance, taste and feel of such foods. The more preferred media of processed fibre consumption would therefore be in form of baked foods such as bread, noodles etc. rather than table meals. This project work is thus acting as a preliminary study to determine the potentiality of a *Ficus* species wood as a source of dietary fibre by examining the blood and live weight responses of experimental animals fed on diets containing the wood fibres and assessing the physical parameters of laboratory-baked loaves of bread from fibre-supplemented wheat flour. These are with a view to determining the extent of acceptability of wood fibres in diets and establishing the possibility of adding processed wood fibres into baked foods.

2. MATERIALS AND METHODS

Study material

The plant material used was the wood of fig tree, *Ficus exasperata* of the family Moraceae. The choice of this species was because of its medicinal properties such as *in vivo* gastrointestinal protective effects, diuretic activity, analgesic, anti-ulcer, lipid lowering effects, anti-inflammatory activity, anti tumour activity and traditional uses for the treatment of gonorrhea, asthma, hemorrhoids, abnormal enlargement of spleen, malaria, dysentery, fungal infection, lowering of blood pressure, ringworm, cough, eye problems, tuberculosis etc. *Ficus exasperata* is widely used as local source of sandpaper.

Ficus exasperata was felled at Unilorin Zoo, University of Ilorin, Ilorin, Nigeria. A wood cylinder of about 30cm in height was then cut for investigation. From this cylinder, a shorter wood disc of about 4cm was cut by means of a hand saw and the circumference of the latter was divided into four equal sectors. Four Smaller blocks of wood each of about 4×2×2cm were then cut out from the sectors and immediately fixed in formal-acetic-alcohol (FAA) in a specimen bottle [13].

Thin free hand Transverse Sections (TS) and Tangential Longitudinal Sections (TLS) were cut out from the wood blocks. Staining was in Safranin and mounting was done using dilute glycerine. A total of eight slides (four for each of TS and TLS) were prepared for observation. Tissue maceration was done by boiling small blocks of wood for about five minutes in concentrated nitric acid (HNO_3) to which a few crystals of Potassium chlorate ($KClO_3$) had been added [14]. The resulting softened tissue was washed in several changes of water, transferred into a slide and teased out gently with a glass rod for some minutes. It was stained in Safranin and then mounted using glycerine.

All the prepared slides were examined under a microscope and pictures of the wood TS, TLS, and isolated fibre were taken. An ocular micrometer was used in determining the vessel diameter, vessel lumen width and the vessel wall thickness from the slides of the TLS. With regards to the slides of tissue maceration, attention was focused on such fibre properties as the type, shape and dimensions. Fibre length (L), diameter (D), lumen width (I) and wall thickness (C) were determined with the aid of ocular micrometer fitted to the microscope. From all the various cell dimensions, two derived ratio namely; coefficient of flexibility (I/D) and relative fibre length or fibre slenderness (L/D) were calculated.

Preparation of wood fibres for feeding laboratory rats

Fine wood dust was obtained from the wood of the tree, heartwood/sapwood being indistinct [7]. The wood dust was soaked in preboiled distilled water maintained at 100°c for 24hours in the oven. The wood dust was then air dried for about a week and pulverized mechanically. The pulverized wood dust was allowed to pass through a fine sieve and stored in a plastic bag.

Feeding trials of laboratory rats

Sixteen (16) albino rats of about eight weeks old along with their normal feed were purchased. The rats were marked for the purpose of identification and were acclimatized in a cage with access to their normal diet and water for two weeks. After the period of acclimatization, the rats were divided into four diet groups. The initial live weights of all the rats were determined in grams using a weighing balance. The first group which was fed on normal diet served as the control, the second group was placed on 10% wood fibre mixed with 90% normal feed; the third group on 15% wood fibre mixed with 85% normal feed and the fourth group on 20% wood fibre mixed 80% normal feed. Each of the groups was supplied with the same quantity of feed in powdered form and water for a period of four weeks.

The percentage feed intake per week of each of the four treatment levels was taken as the diet's preference index (PI). This was determined as a percentage using the formula

$$PI = \frac{T_c - T_i}{T_c} \times 100$$

Where PI= preference index

Tc = cumulative weight of rat meal supplied to a group in one week

Ti = left over of the meal at the end of the week

Blood Packed Cell Volume (PCV) and blood sugar level

The percentage blood Packed Cell Volume (PCV) of each rat was determined using haematocrit centrifuge and their blood sugar level was also determined using glucometer at University of Ilorin Teaching Hospital (UITH), Ilorin, Nigeria. Their percentage blood PCV and blood sugar level were observed at the beginning of the first week and at the end of the fourth week of feeding them with diets containing wood fibres.

Baking and assessment of loaves of bread

Four different kinds of dough were prepared, one control and three experimental doughs. To each of the experimental liquid ingredients, 0.5g, 1.0g and 2.0g of the processed wood fibres was respectively mixed thoroughly with 100g 0f wheat flour before dough preparation. Each of the four set-ups was prepared in two replicates and placed in the oven at 120°C for about 1hour.

All the loaves of bread were assessed for acceptability of colour, texture and flavor. The opinions of 25 randomly selected individuals at the University of Ilorin were sought. All the respondents were made to score the parameters over a two-point scale; acceptable or unacceptable. Also, some mean dimensional characteristics of the loaves of bread such as mean weight (g), height (cm), area (cm^2) and volume or size (cm^3) were determined. The weight of each loaf was determined using weighing balance; the height of a loaf was measured by inserting a long needle through the thickest portion of it, marking off the height and determining the extent in cm on a meter rule; the area occupied by a loaf was calculated in cm^2 using the graphical method; and the data on the height and the area of loaves were used to compute their volume in cm^3.

The shelf lives of the four categories of bread were determined by exposing the loaves to the open laboratory conditions and observing them closely by means of a hand lens for one week. The number of days that passed before any noticeable infestation by fungus was taken as the shelf life of a loaf of bread.

Wood structure of *Ficus exasperata*

The wood is whitish, soft and diffuse porous, as such the different seasonal growth rings are not distinguishable from one another. The Transverse Section (TS) of the wood is shown in Figure 1a, the Tangential Longitudinal Section (TLS) in Figure 1b and the isolated fibre in Figure 1c. The vessels occur in solitary units and ranges from round to oval. The fibres have open lumina, are elongated and have simple pit with pointed ends. There are more fibres present compare to vessels. Axial parenchyma is of the paratracheal type and densely packed. The rays are multiseriate.

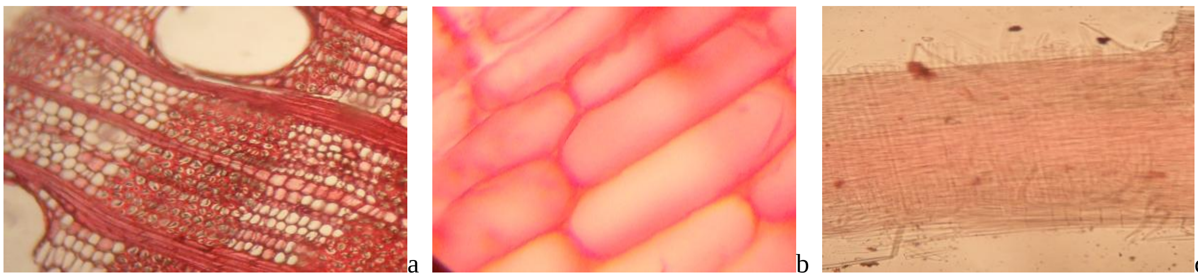

Figure 1: Tranverse Section (a), transverse longitudinal section (b) and isolated fibres (c) of *Ficus exsperata* wood

Table 1: Some dimensional characteristics of *Ficus exasperata* wood

MEAN VALUES	FIBRE DIMENSIONS	VESSEL DIMENSIONS
LENGTH (µm)	1242.11 ± 97.42	
DIAMETER (µm)	21.25 ± 1.08	178.62 ± 6.70
LUMEN WIDTH (µm)	14.85 ± 1.07	164.09 ± 6.83
WALL THICKNESS (µm)	2.94 ± 0.38	7.26 ± 0.84
RELATIVE FIBRE LENGTH	58.76 ± 3.65	
COEFFICIENT OF FLEXIBILITY	0.72 ± 0.02	

- Relative Fibre Length = Fibre Length/ Fibre Diameter
- Coefficient of Flexibility = Fibre Lumen Width/ Fibre Diameter

Responses of albino rats to cellulose fibre supplemented diets

The summary of the behavioural and biological responses of albino rats to the four feeding trials is shown in the Table 2 below.

Table 2: Blood and live weight responses of albino rats to four feeding trial over a period of four weeks

Feeding trial	Parameter	Initial value	First week	Second week	Third week	Fourth week	Mean
Control (100% normal diet)	Preference index (%)		66.70	73.90	80.00	73.00	73.40
	Weight (g)	193.00	217.75	204.00	218.00	243.50	
	%weight increase					26.16	
	PCV (%)	45.25				50.50	
	Blood sugar(mmol/L)	4.85				3.53	
10% wood fibre	Preference index (%)		86.30	74.60	81.60	75.50	79.50
	Weight (g)	189.25	201.00	219.00	222.50	223.75	
	%weight increase					18.23	
	%weight reduction					69.69	
	PCV (%)	47.00				59.00	
	Blood sugar(mmol/L)	3.70				3.00	
15% wood	Preference index (%)		63.30	68.30	87.30	83.63	75.63
	Weight (g)	189.00	198.25	205.00	208.00	194.00	

fibre	%weight increase					2.65	
	%weight reduction					10.13	
	PCV (%)	44.50				58.00	
	Blood sugar(mmol/L)	3.55				2.65	
20% wood fibre	Preference index (%)		76.40	63.70	79.70	88.63	77.11
	Weight (g)	183.25	181.50	191.75	187.50	198.00	
	%weight increase					8.05	
	%weight reduction					30.77	
	PCV (%)	45.75				54.25	
	Blood sugar(mmol/L)	4.03				3.05	

- Preference index or diet preference is the % feed intake per week
- % Body weight reduction for each experimental level

$$= \frac{\%\ \text{weight increase for the level}}{\%\ \text{weight increase for the control}} \times 100$$

Table 3: Result of ANOVA conducted on the live weights of the rats

Sources of variation	Degrees of freedom	Sums of squares	Mean squares	F	P-values
Treatment	3	8908.300	2969.433	4.683	0.005
Replicate	3	40769.500	13589.833	21.433	0.000
Week	4	6344.325	1586.081	2.501	0.047
Error	69	43751.075	634.074		
Total	80	3409498.000			

H_0: The effects of the Treatments/Replicate/Week are the same
H_1: The effects of the Treatments/Replicate/Week are not the same
Decision rule: Reject H_o if P-value is less than α, α=0.005

Table 4: Result of Paired T-test conducted on the final and initial values of the PCV and blood sugar level of the rats

		Paired Differences					T	Degrees of freedom	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Standard Deviation	Standard Error Mean	Lower	Upper			
Pair 1	initial PCV – final PCV	-9.75000	3.64577	1.82289	-15.55124	-3.94876	-5.349	3	0.013
Pair 2	initial sugar level – final sugar level	1.02500	0.39476	0.19738	0.39685	1.65315	5.193	3	0.014

H_0: The initial and final mean values of PCV and blood sugar level are the same
H_1: The initial and final mean values of PCV and blood sugar level are the same
Decision rule: Reject H_o if P-value is less than α, α=0.005

Table 5: Result of paired T-test conducted on the mean Preference Indices (P.I.) of the four feeding groups

		Paired Differences					T	Df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	group1 – group2	-6.10000	9.02995	4.51498	-20.46867	8.26867	-1.351	3	0.270
Pair 2	group1 – group3	-2.23250	7.94294	3.97147	-14.87148	10.40648	-.562	3	0.613
Pair 3	group1 – group4	-3.75750	11.34257	5.67128	-21.80606	14.29106	-.663	3	0.555
Pair 4	group2 – group3	3.86750	14.22962	7.11481	-18.77501	26.51001	0.544	3	0.625
Pair 5	group2 – group4	2.34250	11.10792	5.55396	-15.33268	20.01768	0.422	3	0.702
Pair 6	group3 – group4	-1.52500	9.36710	4.68355	-16.43014	13.38014	-.326	3	0.766

H_0: The means of the P.I. for the groups are equal
H_1: The means of the P.I. for the groups are not equal
Decision rule: Reject H_o if P-value is less than α, α=0.005
Where groups 1, 2, 3 and 4 represent the control, 10% fibre level, 15% fibre level and 20% fibre level respectively.

Characteristics of laboratory-baked bread

Table 6 shows some characteristics of the laboratory-baked bread. The flavours of both the control and the experimental loaves of bread was 100% acceptable to all respondents. The colour ranges from light brown tint with cream to pale chocolate brown in the 1.0g fibred loaves.

Table 6: Some qualitative and quantitative characteristics of the baked bread

Type of loaf	Colour	Flavour	Fibre spot	Mean weight (g)	Mean height (cm)	Mean area (cm^2)	Mean volume (cm^3)	Shelf life (days)
0g fibre content (control)	Light brown tint with cream	Acceptable	Absent	152.50	6.20	123.84	767.94	3
0.5g fibre content	Light brown tint with cream	Acceptable	Less frequent	148.00	6.70	120.78	811.08	5
1.0g fibre content	Light brown	Acceptable	Frequent	148.00	6.15	121.88	749.47	5
2.0g fibre content	Pale chocolate brown	Acceptable	More (uniformly) frequent	147.50	6.90	116.73	806.29	4

Table 7: Result of ANOVA conducted on the weight of the baked bread

Sources of variation	Degrees of freedom	Sum of squares	Mean squares	F	P-values
Treatment	3	33.00	11.00	2.933	0.163
Error	4	15.00	3.75		
Total	7	48.00			

H_0: The effects of the Treatments on the weight of the bread are the same
H_1: The effects of the Treatments on the weight of the bread are not the same
Decision rule: Reject H_o if P-value is less than α, α=0.005

Table 8: Result of ANOVA conducted on the volume of the baked bread

Sources of variation	Degrees of freedom	Sum of squares	Mean squares	F	P-values
Treatment	3	162715.087	54238.362	1.100	0.446

Error	4	197281.862	49320.466		
Total	7	359996.949			

H_0: The effects of the Treatments on the volume of the bread are the same
H_1: The effects of the Treatments on the volume of the bread are not the same
Decision rule: Reject H_o if P-value is less than α, α=0.005
The results of ANOVA conducted on the live weights responses of the rats show a significance difference at the three factors namely; treatments, weekly responses and replication ($P<0.05$).
From Table 3,
H_0: The effects of the Treatments/Replicate/Week are the same
H_1: The effects of the Treatments/Replicate/Week are not the same
Decision rule: Reject H_o if P-value is less than α, α=0.005
Decision: The effects of the Treatments/Replicate/Week are not the same
Since the F-test above is significant, we proceed to do post-ANOVA test to determine which of the treatments are different. The Duncan Multiple Range test was used for this purpose.

Table 9: Result of Duncan Multiple Range Test conducted on the mean live weight of rat.

Groups	N	Subset 1 (Mean)	Subset 2 (Mean)
Group 4	20	188.4000	
Group 3	20	198.8500	198.8500
Group 2	20		211.1000
Group 1	20		215.2500
Significance		0.194	0.054

The error term is Mean Square (Error) = 6340.74

Based on the analysis, groups 4 and 3 and groups 3, 2 and 1 are not significantly different from each other. Groups 1, 2, 3 and 4 represent the control, 10% fibre level, 15% fibre level and 20% fibre level respectively. This implies that there is no significant difference between the control and 10% or 15% fibre levels of treatment while the mean difference in the weight of rats of the control and the 20% fibre level treatments is significant.
These statistical results would probably elicit an immediate suggestion that the 10% and 15% treatment levels would be more appropriate for the body weight regulation in albino rats. Such a suggestion would however be erroneous. This is because the statistical results were based only on the mean live weight differences which incidentally were consistently low for all the rats under 20% fibre treatment right from the pre-experimental week (Table 2). These weights were however relatively high and consistently so in the other three treatments prior to and throughout the period of the experiment.

3. DISCUSSION

Structure of *Ficus exasperata* wood

The fibres are of libriform type with relative length of 58.76µm. The mean fibre length is 1.24mm, this value is short within the context of wood anatomy ([15], and is sufficiently thin-walled (Table 1). The fibres are also flexible as indicated by the high coefficient of flexibility or measure of fibre slenderness. Furthermore, the vessels are fairly thicked-wall with wide lumina, so these vessels would not collapse readily and blend with the fibre during mechanical processing.

Responses of rats to fibre supplements

Although the preference indices of the fibre supplemented diets are higher than that of the control, the statistics between their means did not show any significance difference between them, P-value for each pair being >0.05 (Table 5). This implies that the fibre supplemented diets were sufficiently available to the rats.
The mean live weights of all the albino rats used increased throughout the four weeks of experimentation (Table 2). At the end of the first week, the lowest mean weight of 181.50g was recorded in the rats fed at 20% fibre level while the highest, 217.75g was in those fed with normal diet (control). But at the end of the fourth week, the lowest mean weight of 194.00g was recorded in those fed at 15% fibre level and the highest mean weight of 243.50g was recorded also in the control group.
The more reliable body weight data would probably be the relative percentage body weight increase within the period of the experiment. By calculating the percentage live weight increase for the four treatments, one obtains

26.16% (the highest) for the control and 18.23%, 2.65% and 8.05% for the other three treatments respectively. This shows that the 10% fibre level treatment might have caused a body weight reduction by 69.69%, the 15% level by 10.13% and the 20% level by 30.77% relative to the control. [16] observed that cellulose (an insoluble fibre) did not lower plasma cholesterol nor did it bind bile acids *in vitro* or *in vivo*. Findings from this research work however contradict this observation.

The mean initial and final haematocrit (PCV) values for the experimental rats are shown in Table 2. In all, the percentage blood PCV increased by between 10% and 30% within the four weeks of experimentation. A paired sample statistical T-test conducted on the two sets of data indicated a significant difference ($P<0.05$) in the mean difference between them (Table 4). [17] at 95% confidence limits gave the normal PCV of adult rats as 37-53% for males and 35-49% for females. Since only the final mean haematocrit value of the control fell within the acceptable standard, the wood fibre supplemented rat diet could have caused increased in the PCV (percentage of blood volume occupied by red blood cells). In cases of dengue fever, a high haematocrit value is a danger sign of an increased risk of dengue shock syndrome. The factors that cause elevated levels of PCV include; *Polycythemia vera* (PV), chronic obstructive pulmonary disease and other pulmonary conditions associated with hypoxia, Anabolic Androgenic Steroid (AAS) use, dehydration and capillary leak syndrome [18]. Therefore, the elevated values of PCV in the experimental rats may be as a result of dehydration as dietary fibres require the taking in of increased amount of water.

Table 2 shows the mean initial and final blood sugar level for the rats. There is a decrease of between 18% and 27% in the blood sugar level of the rats within the period of experiment. A paired sample statistical T-test conducted on the two sets of data indicated a significant difference ($P<0.05$) in the mean difference between them (Table 4). Since the normal blood sugar level of rats is 2.5-5mmol/L, and the final mean values fell within this, the wood fibre supplemented rat diet could not have had any deleterious effects on the quantity of sugar in the blood. [19] observed that cellulose (an insoluble fibre) stabilize blood glucose levels by acting on pancreatic insulin release and liver control of glycogen breakdown, findings from this research work corroborate this assertion .

Laboratory-baked loaves of bread assessment

The colour of the loaves of bread ranged from light brown with cream tint in the control to pale chocolate brown in the 2.0g fibred loaves (Table 6). Of all the 25 respondents whose opinion on assessment was sought, 15 (i.e. 60%) preferred the cream-tinted light brown colour of the control and 0.5g fibred loaves, 6 (i.e. 24%) preferred the light brown colour of the 1.0g fibred loaves while the remaining 4 (i.e. 16%) preferred the pale chocolate brown of the 2.0g fibred loaves. This result may be due to the variation in the presence of fibre spots in the cellulose-supplemented bread. The flavour of both the control and experimental loaves was however 100% acceptable to all the respondents. These results indicate that the colour and flavor of wood fibre supplemented bread were equally acceptable to the potential consumers as those commercially available loaves in the market.

The control loaves have the shortest shelf life of 3 days, this shelf life of 3 days for the control loaves of bread was reported earlier by [15] and [20], and the 2.0g fibred loaves, of 4 days. A shelf life of 5 days was however recorded for both the 0.5g and 1.0g fibred loaves. Again this result shows that fibred loaves can adequately, compare with those commercially available.

From the dimensional characteristics if the laboratory-baked bread shown in Table 6, it can be seen that the control loaf is the heaviest (152.50g) and occupy the widest area (123.84cm^2) while the lightest mean weight of (147.50g) and highest height of (6.90cm) were recorded in the 2.0g fibred loaf. The 0.5g and 1.0g fibred loaves have the lowest area (120.78cm^2) and lowest height (6.15cm) respectively. The statistics shows that there was no significant difference ($P>0.05$) in the mean weight of the four categories of bread (Table 7). This implies that addition of wood fibres at the stated concentrations did not have a noticeable effect on bread weight.

The mean volume of the bread loaves ranged between 749.47cm^3 in the 1.0g fibred loaf to 811.08cm^3 in the o.5g fibred loaf. Experimental loaves were generally of larger sizes than the control except the 1.0g fibred loaf (Table 6). From the ANOVA carried out on the loaves of bread with respect to their volume showed no significant difference ($P>0.05$) across the four treatment levels (Table 8). These results show that addition of cellulose fibres to wheat flour dough does not adversely affect its baking properties. Instead, it enhances bread quality and size. With wood fibres as additives therefore, reduced amounts of wheat flour would be required for bread baking.

The wood fibres of *Ficus exasperata* are potential soluble dietary fibres with the prospect for human consumption. This cellulosic material incorporated into normal diet of albino rats caused a reduction of the live weight of these experimental animals by between 10% and 70% as compare to the control. There is therefore the possibility that cellulose fibres might have caused a reduction in the hepatic and/or plasma cholesterol concentrations. Furthermore, addition of cellulose fibres does not negatively affect the physical, chemical and the baking properties of bread, bakery products can therefore be looked upon as potential means of wood fibre consumption for nutritional therapy against excessive body weight and its resultant health hazards. However, empirical data and information on the safety of *Ficus exasperata* wood consumption and metabolism from extensive works on experimental animal models are essential ingredients to support the result of this study.

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