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Production, Quality Evaluation and Postprandial Effects of High Fibre Fructose Sweetened Confectionery Snacks (Cookies) as a Functional Diet

Opega Justina Ladi[1*], Orishagbemi Cornelius, Ojo[1] and Samuel Faruna[2]

[1]Departments of Food, Nutrition and Home Sciences and Animal Production, Faculty of Agriculture, Kogi State University, Anyigba, Kogi State, Nigeria.
[2]Department of Animal Production, Faculty of Agriculture, Kogi State University, Anyigba, Kogi State, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Author OJL has been the Lead scientist and the principal investigator who was involved in experimental design, statistical analysis, drafting and typesetting of the manuscripts, production of the samples and chemical analysis procedures. Author OCO contributed to the sensory analysis procedures of the samples. Author FS done the feeding and maintenance, tagging and taking blood samples of the experimental animals. All authors read and approved the final.

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ABSTRACT

Production, quality evaluation and postprandial effect of high fibre fructose sweetened confectionery snacks (cookies) as functional diet was investigated. It was to establish the chemical, sensory evaluation and postprandial effects of the products, cookie ingredients were purchased from Ankpa Kogi state, date fruits (Dabino) was processed into powder both sweetener were weighed rations. A creaming method cookie production was used and standard methods were used for the analyses. Triplicate values were obtained in each case and expressed on dry weight basis. All data collected were analysed statistically using SPSS version 20.0 package. Means and standard deviation were calculated at significant level of $p \leq 0.01$. From the analyses, proximate composition (%) at (30, 40 and 50) in various ratios; showed that Moisture; (11.20 to 13.10) in sample C and B, [8.30 to 10.03] E and B (6.44 to 10.41) in B and C. Ash was (0.33 to 0.53) in C and D, (0.40 to 0.58) for C and B and (0.73 to1.0) E and B respectively, crude fibre were (0.17 to 0.41) in C and B (0.2 to 0.48) and

**Corresponding author: E-mail: opega.jl@ksu.edu.ng;*

(0.33 to 0.37) in C and A while crude fat included; (13.83 to 16.21), A and B, (8.23 to11.70) C and B and (7.83 to 13.43) in A and B, proteins was (12.98 to 17.16) for C and D, (11.17 to 12.90) E and D, (12.52 to 17.80) C and D and Carbohydrates included; (53.60 to 83.62), in B and E. (65.53 to 69.53) for D and C and (57.95 to 70.00) in E and A. Minerals in mg/100 included; sodium (52.50 to 70.33) B and A, (45.87 to 74.10) E and A and (41.23 to 76. 20) in B and D, Potassium (30.50 to 37.30%) in C and E, (30.60. to 56.0) in E and B (27.40 to 57.80) B and D, calcium (215.97 to 251.20) in C and D, (42.87 to 74.12) C and B (41.23 to 76. 20) B and D magnesium included (28.60 to 127.22) B and D, (112 to148.30) for C and B (115.50 to 142.20) phosphorus; (55.60 to 73.46) in A and B and (54.14 to 67.20) C and A. (56.18 to 71.36) for A and D. ferrous were (8.12 to 20.20) for B and E (11.71 to 30.07) C and B (17.04 to 29.42) in E and D Phytochemical contents at 30, 40 and 50% (mg / 100g) included; Tannic acid (1.8 to 2.9 mg), (2.20 to 3.44) and (2.76 to 5.00) flavonoid (2.27 to 3.74), (3.78 to 5.91) and (4.07 to6.96) phenolic acid (7.38 to 3.58), (8.71 to 16.43), (8.71 to16.43) Saponin (1.00 to 2.09), (1.05 to 2.47) and (1.05 to 2.46) Carotenoid included; (5.31 to 8.77), (1.05 to 2.56), (1.05 to 2.47) Alkaloid (0.08 to 0.40), (0.10 to 0.25) and (0.10 to 0.25) C and B for all the samples. The Sensory attributes in in ratios and at 30, 40 and 50% included; taste (7.00 to 8.30), (6.60 to 8.17) both samples were the same in 2:1 and 0:1 but 50% was (5.27 to 8.00) in 1:0 and, 1:1 the colour of the samples included (5.16 to 7.70),in 2:1 and 0:1 (6.17 to 7.67) in 1:0 and 1:1 and (5.37 to 8.37) 2:1 and, 0:1 Flavour included; (5.10 to 8.10), (5.77 to 8.67) and (6.27 to 7.67) in 1:0 and 1:2, crispness (5.77 to 7.27) 1:2 and 0:1 (5.77 to 8.70) 1:0 to, 1:2 (6.00 to 7.17) for 0:1 and 1:0 while the texture were in the range of (6.767 to 7.87) 1:0 and, 0:1 (5.67 to 7.50) for 2:1 and 1:1 and (6.00 to 7.07) in ratios 0:1 and 1:1. The postprandial effect of cookies in mmol / L showed (5.64 to 7.87) in ratio 1:0 and 1:2 and (6.20 to 6.8) for 1:1 and 1:2 at 30% and 40% respectively. The inhibitory effects of date fruits at 50% in ratio 1:0 (date palm) only can be modified optimized and use as potential pharmaceutical therapy in the treatment of type 2 diabetes, and other parameter tested moisture contents, phytochemical and postprandial effects were within the acceptable limit.

Keywords: High fibre fructose; moisture content; carbohydrates; postprandial effects; phytochemicals.

1. INTRODUCTION

Nutrition is escalating from prominence on survival; hunger satisfaction and prevention of adverse effects of disease to drawing attention to the use of functional diets that promotes the well-being of human through reduction of risk factors of disease.

Functional diet: According to [1], Włodzimierz The term “functional foods” comprises of products of plant and animal origin containing physiologically active compounds beneficial for human health and reducing the risk of chronic diseases. [2] Production and consumption of functional foods has gained much importance as they provide a health benefit beyond the basic nutritional functions.

Sabate J, [3] Said functional foods must remain foods and that they are not pills or capsules but, components of diet or part of food that is beneficial for the consumer. They are designated to have health benefits that have advantages in reducing the risks factor of chronic diseases scientific investigations have moved from the primary role of food as the source of energy and body-forming substances to the more subtle action of biologically active food components on human health [1]. According to [4] they are defined as food and herbal products that are being tested in rigorous scientific studies, including clinical trials and have shown sufficient bioactive nutrients in preventing or curing nutritional related diseases.

Craig Stewart Patch [5] in analysis of the potential role of functional food in the primary prevention of coronary heart disease, reported that the use of functional foods can be an effective preventative health strategy for coronary heart disease (CHD) which was confirmed in the same study, that using plant sterol enriched margarine was an effective approach in the management of hypercholesterolemia where, 60 % of the subjects counselled on the inclusion of 25g per day of plant sterols achieved 15% reduction in total serum cholesterol, compared to none receiving standard dietary advice.

Date palm fruits (phoenix *dactylifera* L): Date palm fruit is a sweet edible fruit of date palm tree with a *parthenocarpic* (single long woody) seed. As evidenced and reported by E-Abed 2017 [6] in the study of extraction optimization and *in vitro*

and in vivo of anti-postprandial glycemic effect of an inhibitor from phoenix actylifera(date fruits) parthenocarpic fruits exhibited a potent inhabitation of enzyme related to type II diabetes with a specific inhibitor from α-glucosidase which decreased plasma glucose level.

Snacks: Confectionery snack is a light meal generally eaten in-between meals, they includes; chocolates cookies, peanuts, candy, crackers, and doughnuts, which often contain a substantial amount of sugar and other ingredients. snacks provides opportunity to increase the nutrient intake needed to meet the recommended allowance per day because, they are readily available, hence can prevent getting too hungry that will lead to eating heavy foods as only option.

Available records showed that Nigeria imported and consumed a total of $616.7 million of assorted snacks in 1st quarter of 2017 that is an indication that a lot of it, is consumed in Nigeria which increase taxation on imported goods.

Fructose: Fructose or fruit sugar is a simple ketone monosaccharide found in many plants; it is often bonded to glucose to form disaccharide; fructose is used commercially in foods and beverages, cheap and high in relative sweetness. It is the sweetest of all naturally occurring carbohydrates, because of this; less is needed to achieve the same sweetness that is low in calorie [7]. The relative sweetness of fructose has been reported in the range of 1:2–1:8 times than that of sucrose [8]. The sweetness of it is perceived earlier than that of sucrose or glucose and the taste sensation reaches a peak (higher than that of sucrose) but diminishes more quickly than that of sucrose. Fructose can also enhance other flavors in the system; it exhibits sweet synergy effect, when used in combination with other sweeteners [9]. Fructose has a low glycemic index and results in moderate release of insulin to the bloodstream relative to glucose and sucrose [9]. The demand for a greater variety of low calorie products as they strive to make healthier food choices is high; fructose sweetened products can meet this demand because of its unique sweetness and functionality [10]. The negative effect of refined sugar confectionery snacks was reported by [11] in the study of effect of social demographic factors of confectionery snack consumption on oral health of children living in London, that the prevalence of incidence of decayed, missing or re-filled teeth was identified and high among children who consumed sugar confectionery snacks.

According to [12] in the study of effect of an afternoon confectionary snack on cognitive processes critical to learning discovered that consumption of confectionery snacks in the afternoon improved spatial memory.

Fructose is preferable over sucrose and glucose in sugar-sweetened foods and beverages because, of its lower effect on postprandial blood sugar levels [13]. [14] Reported that the relative sweetness of fructose is in the range of 1:2–1:8 and that because of this sweetness, less is needed to achieve the same sweetness that is low in calorie. [15] Reported that dietary fibre consists of cellulose and lignin and that diets that are high in dietary fibre decreases the re-absorption of bile acid thus, reducing circulating cholesterol. According to, [16], consumption of dietary and functional fibres has lowering incidence of constipation. [17] Reported that fibre have reduction effect on irritable bowel syndrome. It provides physiological benefit in the diet, primarily by the lowering of cholesterol in the blood and the decrease in the intestinal absorption of glucose [18].

1.1 General Objectives

To produce and compare the chemical composition, examine postprandial effect and evaluate the sensory attributes of cookies sweetened with date fruits and table sugar;

1.2 Specific Objectives

To produce and determine the chemical composition (proximate composition, mineral and selected Phytochemicals and evaluate the effect of substituting fructose with sucrose on the sensory attributes. To study the postprandial effects of date fruit powder and table sugar sweetened cookies.

1.3 Statement of the Problems

From unpublished observations, the prevalence of nutrient related diseases is increasing while the cost of health care products continue to increase in prices leaving the burden for the afflicted and also consumers are more conscious of diet consume and diet restriction due to the use of refined table sugar and synthetic ingredients which may have negative side effects from confectionery snacks that could

complement the day's recommended dietary allowance which has caused underutilization of confectionery snacks.

1.4 Justifications of the Study

The desire to search for natural sources of nutrients and non-nutrients that contains functional diets became a necessity, the study of production, quality evaluation and postprandial effect of high fibre fructose sweetened confectionery cookies as a functional diet will create value addition that could bring to the limelight the worth in substituting sucrose with date palm fruit in production of cookies that may combat, prevent risk factors of diseases and contribute positively to the health status of the consumer through provision of enough nutrients that meets metabolic requirements while giving the consumer a feeling of satisfaction and well-being, increase the nutrient intake and improve the quality of the diet needed to meet the recommended dietary intake level per day and thereby, increase high utilization of the products by adults.

1.5 The Significance of Study

This research work may definitely not be the first study on alternative sweeteners but, there seems to be no evidence of any of the studies that has been previously reported. Findings on this study will be a veritable tool for nutritionists, dieticians, medical personals for counselling, researchers, lecturers, laboratory personnel and students of related field of study for references.

1.6 The Scope of the Study

The study was limited to cookies produced using sucrose substituted with date fruits sweeteners, postprandial examination, sensory evaluation and chemical analyses procedures which included; (approximate composition; Moisture, Ash, Crude- fibre, Crude fat, Crude protein and Carbohydrates) (mineral; Sodium Potassium, Calcium, Magnesium, Phosphorous and Ferrous.), (phytochemicals; Tannic acid, Flavonoids Phenolic acid, Saponin, Carotenoid and Alkaloid)

3. MATERIALS AND METHODS

3.1 Work Plan for 8 Months

3.1.1 Activities/time

Survey and acquisition of equipment and raw material was carried out within a period of nine months; from May to December 2019.

3.2 Survey

3.2.1 Survey of equipment

Survey of equipment and acquisition was carried out within two months.

3.2.2 Survey of raw material / acquisition

Raw material / acquisition were within two months.

3.3 Sample Collection

The sweetener (date palm fruits) (Dabino) was purchased from Ankpa local government area of Kogi state Nigeria; other items (table sugar, butter, Flour, Milk, Eggs, Baking soda, Nutmeg, Strawberry Sodium M. were bought from Anyigba market, Dekina local government area of Kogi state Nigeria.

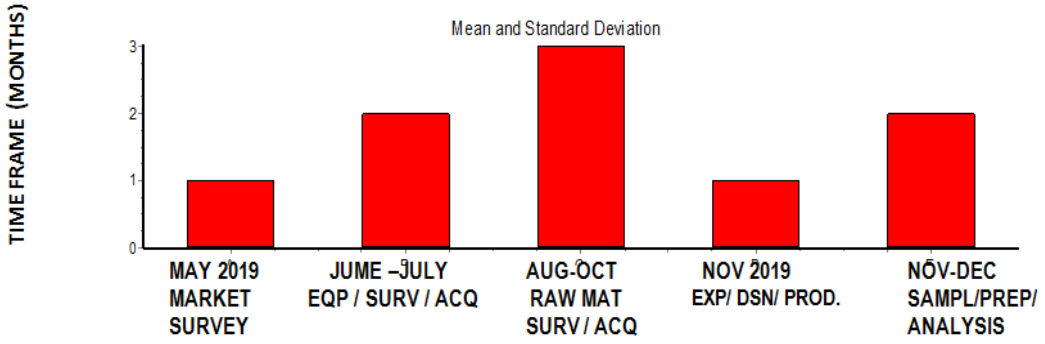

Fig. 1. Graphical representation of the study time in months from May to December 2019

3.4 Sample Preparation

3.4.1 Date fruit processing into powder

Date fruits were trimmed and washed, it was drained, deseeded and oven dried at 60°C for 35 minutes, to prevent caramelization, crushed and milled into fine powder using a harmer-mill grinding engine and sieved using mesh muslin cloth of 33 mm, packed and sealed to prevent moisture absorption, contamination and alterations, and labelled (date fruit powder) then table sugar was also bought, both were labelled as (date fruit powder) and table sugar for easy identification and kept at an ambient temperature of 32±34°C.

3.5 Experimental Design

Romero, AL et al. [19] Factorial type of analyses of experimental design was used to produce 15 samples involving treatments of 30%, 40% and 50% respectively.

Tables 1, 2 and 3: included; a total of 30% 40% and 50% (0.3, 0.4 and 0.5) of both sweeteners in other ingredients (465 g) was used; of which ratio 1:1 contains equal amount of each sweetener of 50: 50% each, 1:0 was 100% fructose only while 0:1 was 100% sucrose, 2:1 and 1:2 were 75:25 % and 25:75% fructose and sucrose respectively in each case of treatment.

3.6 Procedures for Cookie Production

Both sweeteners were weighed and labelled according to the following ratios (1:1, 1:0, 0:1 2:1 and 1:2) and were indicated to F^1:S^1, F^1:S°, F°:S^1, F^2:S^1 and F^1:S^2 to produce 15 samples. Each of the sweeteners (gate palm fruit powder and table sugar) were creamed with butter separately using creaming method as described by [20]. baking powder was weighed, sieved into flour and mixed, while milk and eggs were whisked and homogenized with the batter then, flour was mixed with baking powder, folded-in and labeled as (date batter) (table sugar batter) it was refrigerated in a deep freezer at 10±2°C for 2 hours, sized out by using cookie cutter and transferred onto cookie sheets and baked at a preheated constant and high temperature of 200°C for 8 minutes to prevent spreading. They were cooled, packed and stored at an ambient temperature of 34 to 37°C for further analyses.

3.7 Postprandial Examination Procedures

Thirty (30) albino rabbits of one year old with weights between 3.1 to 3.5 kg were purchased and stabilized for a week in the livestock unit of department of animal production, faculty of agriculture, Kogi state university Anyigba, prior to investigations, they were grouped into 16 of two each in a cage and tagged with '' F^1:S^1, F^1:S°, F°:S^1, F^2:S^1 and F^1:S^2. F°: S° then, restrained from feeding from 9.00 pm to 7.00 am the following day, a disposable latex free hand gloves were worn and the first blood sample was taken using the following procedures**;** the ear lobe of the animals were cleaned with 95% alcohol and anesthetic cream was applied on the collection site for 5 minutes prior to blood sampling, this was carried out to make the animal insensitive to pain during blood extraction. A total of 15 lancet devices were used to puncture the marginal ear vein and the blood

Table 1. Experimental design for cookie formulation at 30% sweeteners in 465 g ingredients

Sample Code	Samples	% of STNR	OINGR(g)	T^1	T^2	T^3
1:1	(f^1/s^1)	30%	465	33.8:33.8	67.5	533
1:0	(f^1/s^0)	30%	465	67.5:0	67.5	533
0:1	(f^0/s^1)	30%	465	0: 67.5	67.5	533
2:1	(f^2/s^1)	30%	465	45:22.5	67.5	533
1:2	(f^1/s^2)	30%	465	22.5 :45	67.5	533

Table 2. Experimental design for cookie formulation at 40% sweeteners in 465 g ingredients

Sample Code	SAMPLES	% of STNR	OINGR(g)	T^1	T^2	T^3
1:1	(f^1/s^1)	40%	465	45:45	90	555
1:0	(f^1/s^0)	40%	465	90:0	90	555
0:1	(f^0/s^1)	40%	465	0 :90	90	555
2:1	(f^2/s^1)	40%	465	60:30	90	555
1:2	(f^1/s^2)	40%	465	30:60	90	555

Table 3. Experimental design for cookie formulation 50% sweeteners in 465 g ingredients

Sample Code	SAMPLES	% of STNR	OINGR (g)	T^1	T^2	T^3
1:1	(f^1/s^1)	50%	465	56:56	112	577
1:0	($f^1/s°$)	50%	465	112:0	112	577
0:1	($f°/s^1$)	50%	465	0:112	112	577
2:1	(f^2/s^1)	50%	465	75: 37	112	577
1:2	(f^1/s^2)	50%	465	37:75	112	577

Tables 1 - 3 KEY: F (Fructose); S (sucrose); T1 (Treatment 1) =Total ratio of sweeteners
T2 (Treatment 2) = Ingredients + Sweeteners
T3 (Treatment 3) = Total ratio + Ingredients
%STNR (percentage of the sweeteners

samples were collected and labeled as F1:S1, F1:S0, F0:S1, F2:S1 and F1:S2 and recorded accordingly the collection site was cleaned with sterile cotton and finger pressure applied to stop the bleeding. The blood was dropped on the reagent strips and tested immediately to avoid blood clotting for blood glucose level assessment and documented as (Test result 1) this was applied to the rest of the group consecutively using anesthetized marginal ear vein blood withdrawal method as described by [21].

3.7.1 Administration of samples to animals

A total of 50 g of the cookies at ratios F^1:S^1, F^1:S°, F°:S^1, F^2:S^1 and F^1:S^2 in the percentage of (30%, 40% and 50%), were mixed with 50 g of animal feed each, labeled and fed to the experimental animals accordingly, the starting point was noted and waited for 30 minutes and the blood samples were recollected read and recorded.

3.7.2 Sensory evaluation

Sensory evaluation of the cookies was carried out by 12 panelist using [22] 9 points hedonic scale where, 9 (like extremely) 1 (dislike extremely). Scores were based on the intensity of the taste, color, crispness, texture, flavor and overall acceptability.

3.7.3 Chemical analysis procedures

The chemical analyses procedures were performed using various standard methods.

3.7.4 Proximate composition determination

3.7.4.1 Determination of moisture content

The contents of the samples were determined [23] oven dried methods; a cleaned container was weighed as w^1 then a total of 2 g was weighed into the weighed container and the weight was taken in grams and recorded together with container (w^2). The container and the samples were placed in the oven and dried in a thermostatically controlled drying oven heat which was maintained at a temperature of 105±5°C for 5 hours and dried at a constant heat, the container was removed from the oven and placed in a desiccator then allowed to cool both container and the dried samples were weighed in grams.

3.7.4.1.1 Calculation of moisture %:

Where: W1 = weight of empty crucible
W2 = weight of crucible + sample before drying
W3 = weight of crucible + sample after drying to constant mass

The difference in mass (weight of % moisture lost) was calculated as % moisture content

3.7.4.1.2 Ash contented were estimated

Ash contented of the samples were estimated using muffle furnace a method described by [24]. A total of 5 grams of the sample was Weighed in duplicate into a tare crucible and placed in a muffle furnace, it was burn for 18 hours at 550°C and the muffle furnace was turn off and allow to cool at 250° C, the door was open gently to avoid losing ash that may be fluffy, tongs were used for safety to transfer crucibles to a desiccator, covered and desiccators were closed, it was cooled to a room temperature and weighed and the ash content were calculated and recorded.

$$\frac{Wet\ after\ aching - tare\ wt.of\ crucible}{Original\ wt.of\ sample} X\ 100$$

3.7.4.2 Determination of crude fibre content

A total of 3 g of the sample was weighed (w^1) out and defatted, and placed in the flask, 200 ml of

boiling sulphuric acid solution concentration of (1.25%) was added, an acid concentration of 5% was added and taken to 50 mL of acid then 150 mL of distilled water was added until the concentration reduces and then attached to the condenser and bring to boiling point in a minute and antifoaming agent was added to prevent boiling over and it was boiled for 30 minutes, the volume of the solution was constantly maintained by adding heated distilled water and the flask was swirled periodically to remove particles adhering to the sides. The lining and the Buchner funnel with the filter paper and boiling water at the same time and at the end of the boiling period, was removed and the flask was let to rest for one minute then the contents was carefully filtered using, suction methods. The filtration was carried out in less than 10 minutes and the filter paper washed with boiling water. The residue was transferred to the flask using a retort containing 200 ml of boiling NaOH solution and re-boiled for 30 min. The filtration crucible with boiling water were preheated, carefully filtered and hydrolysed, the mixture was let to rest for 1 minute and residue washed with boiling water that contain HCl solution and then with boiling water and finished with three washes with petroleum ether. It was placed in the crucible in an oven and set at 105°C for 12 hours then cool in dryer it was quickly weighed (w^2) and placed in the crucible in a furnace at 550°C for 3 hours and leave to cool in a dryer and weighed (w^3)

3.7.4.2.1 Calculations

Where: A = weight of crucible with dry sample (g) w1
B = weight of crucible with ash (w^2)
C = weight of sample (w^3) [25]

3.7.4.3 Determination of crude fat contents

Estimation of crude fat was carried out using Soxhlet Extraction Method according to method described by [26] where, all the glass apparatus were rinse with petroleum ether and dry in the dry air oven at 102°c, it was removed and kept in the desiccator and a total of 5 gram of grounded and dried sample was placed in the thimble in the soxhlet extractor of 150 ml round bottom flask it was cleaned and the flask was fill with 90 ml petroleum ether and covered with tightened lid to prevent boiling over and the setting was placed on a heating mantle allowed to boil continuously for 6 hours for the extraction process. The condensing unit from extraction unit was removed and samples were allowed to cool down and the entire lipid finally removed. All the solvent were collect after distillation and the sample was placed in the oven and after removing it, it was placed in the desiccator and the weight of the sample was taken.

3.7.4.3.1 Calculation

Empty thimble= w1
Thimble with sample= w2
Weight of sample= p
Crude fat in percentage = $(w^2\text{-}w^1)/p \times 10$

3.7.4.3.2 Estimation of crude protein

Crude protein was estimated where; Kjeldahl method was carried out according to method of 981.10 of [27]. A g of the sample was hydrolyzed with 15 mL concentrated sulfuric acid (H_2SO_4) containing two copper catalyst tablets in a heat block at 420°C for 2 h, it was cooled and water was added to the hydro lysates before neutralization and titration, the amount of total nitrogen in the raw materials were multiplied with both the traditional conversion factor of 6.25 and species-specific conversion factors in order to determine total protein content.

3.7.4.4 Determination of Carbohydrate Content

The available carbohydrates content was determined using nitrogen free method as described by [28] was used; the carbohydrate content was calculated as weight by difference between 100 and the summation of other proximate parameters as Nitrogen free extract (NFE) percentage carbohydrate. % Carbohydrate (NFE) = 100 - (M + P + F + A + F2) Where M = Moisture P = Protein F = Fat A = Ash F2 = Crude fibre.

3.7.5 Mineral contents estimation

Samples were analysed for minerals (C_a, Fe, Zn, K and Mg) through wet digestion. Iron, calcium, magnesium and zinc content were calculated by using atomic absorption spectrophotometer, while potassium was estimated through flame photometer according to the recommended method of [29]. Ferrous, Zinc, Calcium and magnesium) in samples were calculated. A total of 1 gm. of grinded sample was kept in digestion tube and 10 ml of concentrated nitric acid was added and kept at ambient temperature and left to stand overnight. Then the mixture was treated with 4 ml concentrated perchloric acid and the

sample was kept on magnetic hot plate for digestion. The processes were completed for 2 hours and were allowed to cool down to a room temperature and shifted into a 200ml volume flask and filtered by using filter paper. The volumes of the samples in the flask were prepared up to 100 ml with distilled water and absorbance was estimated through atomic absorption spectrophotometer (Model GBC 932 PLUS, UK). For determination of K (Potassium) content in cookies same procedure was applied but it was calculated by using flame photometer (Model PEP, JENWAY, UK)

3.7.6 Phytochemical analysis procedures

3.7.6.1 Methods determination of tannic acid content

Tannin contents were determined using Folin Denis Reagent as described by [30]. In that method, a standard calibration curve was prepared and the Absorbance (A) against concentration of tannins at specific wave length was estimated as follows: Suitable aliquots of the tannin-containing extract (initially: 0.05, 0.2 and 0.5 mL) were pipetted in test tubes, the volume was made up to 1.00 mL with distilled water, then 2.5 mL of sodium carbonate reagent were added. Then the tubes were shaken and the absorbance was recorded at 725 nm after 40 min. The amount of total phenols was calculated as tannic acid equivalent from the standard curve.

3.7.6.1.1 Carotenoid

Samples were finely ground and stirred with acetone for 1–2 minutes in a nitrogen atmosphere. The homogenate is filtered and the residue was extracted further with acetone until it becomes colourless. Both were combined and concentrated to a small volume by rotary evaporation. Over the acetone extract was added to an equal volume of freshly distilled diethyl ether, and the mixture was homogenized and it was washed with solution of *sodium chloride* (for diethyl ether to remove easily and to avoid emulsification of the mixture) to complete removal of the acetone [31].

3.7.6.1.2 Determination of total Alkaloids

A total of 15 samples at 100 g of cookies sweetened with fructose and sucrose were ground and estimated using spectrophotometric methods as defined by [32]. Samples were filtered and evaporated at a temperature of 45o C to dryness. The residue was dissolved in 2 NHCl and then filtered and a ml of the solution was transferred to a separator funnel and washed with 10 ml chloroform and the pH of the solution was adjusted to neutral with 0.1 N NaOH. A total of 5 ml of BCG solution and 5 ml of phosphate buffer were added to the solution. The mixture was shaken and the complex formed was separated with 4 ml of chloroform by vigorous shaking. It was collected in a 10-ml volumetric flask and diluted to volume with chloroform.

3.7.6.1.3 Determination of Total Flavonoid Content

The total of flavonoid content was determined following the method described by Berk et al [33]. briefly; 1 mL of aluminium tri-chloride of 2% solution in methanol was added to 1mL of the samples. The absorbance of the mixture was read at 415nm after 10 minutes incubation at room temperature. The total flavonoid content was expressed as mg routine equivalents (RE) per g using a routine standard according to the method

3.7.6.1.4 Phenolic acid determination

Phenolic acid extraction procedures for samples was carried out according to the method described by [34]. a total of (20 g) was mixed with 100 mL of deionized water that was adjusted to pH 2 with HCl, it was stirred in a magnetic stirrer for 15 minutes and the samples were then filtered through cotton wool to remove the solid particles. The extraction was performed with the vacuum station from Varian and the filtrate was passed through an appropriate cartridge which was then washed with 50 mL of acidified water to remove all other polar constituents of the samples. The adsorbed compounds were eluted with methanol (50 mL). The extract was concentrated to 5 mL under reduced pressure in a rotary evaporator at 40°C and filtered through a 0.45-m membrane filter and injected into HPLC system. The entire extraction procedure was repeated simultaneously at l for each of tested material.

3.7.6.1.5 Saponin

Determination of Saponin content of the samples were carried out using hydrothermal, microwave and Bain-Marie water bath heating methods as defined by [35]. samples were added to distilled water then methanol and ethanol of three different solvents with ratio 1:20 g/ml, and the mixed solutions were exposed to three different

extraction methods; microwave, autoclave and Bain-Marie. The microwave extraction method and the mixed solutions were exposed and heated using a microwave oven of (MG-2312W, LG Co.) at a constant power of 800 W for 1.00 hour with an interval of heating. The autoclave-accelerated extraction method and the mixed solutions were placed into a laboratory autoclave which was set at a pressure of 15 psi and at the temperature of 121°C for 15 min. In the water extraction method, the prepared solutions were put into a laboratory Bain-Marie water bath in which temperature was adjusted in 50°C for 24 h. After that, the heated mixture solutions were filtered using No. 1 What-man filter paper and the filtrates were put in the laboratory oven at 60°C for 48 h to remove the solvents. Finally, a total of 20 ml of distilled water was added into the solvent-free samples and shaken for 30 seconds. The solution was heated at 90°c. Samples were dried in an oven at 100°c until a constant weight was obtained and Saponin content was calculated in percentage.

3.7.6.1.6 Phytic acid determination

The phytate content of the samples were carried using a [36]. A total of 1-Methylpiperazine (99%), D-Myo-inositol hexaphosphate di-potassium salt (95%), 5-sulfosalicylic acid dehydrate, FeCl3, and NaNO3 were used and all reagents and buffers were filtered through 0.2-µm membranes and samples were defatted and the procedures were carried at room temperature of 340 C, and grounded using grinding machines with a 24-tooth rotor and 1.0 mm sieve with a motor speed set at 15,000 rpm was used and it was sieving into a fine homogenized uniform particle size of less than 0.5 mm. the extraction was completed in 1 h in a 20-mL vial with 0.5 HCl in a ratio of 1:20 (wt/vol) and was constantly stirred. An aliquot of 1 mL of supernatant containing phytate was filtered with 1mL tuberculin syringe and 13-mm/0.45-m syringe filtered and stored at 4°C.

3.7.6.1.7 Oxalate determination

Total oxalate content was measured using the enzyme method as described by [37]. Each sample of 2.0 g was homogenized with 1.6 mL 0f 0.5 mol/L of HCl acid and diluted with 1 mL distilled of water. The homogenate was transferred into 10 mL graduated tubes and heated in a boiling water bath for 20 min. After cooling, distilled water was added to each tube to bring the volume of the homogenate up to 10 mL The next day, 1 mL of the homogenate was clarified by centrifugation (12,000 g, 10 min) at 4 8°C. After this, 0.016 mL NaOH (2mmol/L) was added accurately to 0.5 mL supernatant. This mixture was called an oxalate extract. For determination of oxalate content in 10 the oxalate extracts, about 20 mg oxalate oxidase in dry powder were first placed in a 2-mL test tube and 0.06 mL distilled water, 0.8 mL reagent 10 mg), 25 mL N, N-dimethyl per 100 mL of 125 mmol/L NaOH buffer with 75% alcohol (V/V), pH 4.0) and 0.04 mL (150 U/mL) horseradish peroxidase were added 0.05 mL oxalate extract was added to initiate the reaction. After incubation at room temperature for 90 min, the absorbance at 555 nm of the reaction mixture was read in a spectrophotometer UV/VIS 2802PCS, and oxalate content was determined, data were presented as mean mg oxalate / 100 g of the cookie.

3.8 Statistical Analysis

All data obtained were subjected to statistical analyses including arithmetic mean, standard deviation and multiple comparison tests using SPSS version 17.0 package. Differences between means were considered significant at $P \leq 0.05$ as defined by [38] methods.

3.9 Result Presentation

Results of the research work were presented in form of tables, graphs with sufficient statistical analyses

4. RESULTS AND DISCUSSION

4.1 Results

Results of pproximate composition of cookies sweetened with fructose and sucrose at 30, 40 and 50% showed that moisture contents included; (11.20 to 13.10%) C and B, [8.30 to 10.03%] samples E and B (6.44 to 10.41%) in B and C. Ash ranged from (0.33 to 0.53%) for C and D, (0.40 to 0.58%) for C and B and (0.73 to1.0%) E and B respectively, crude fibre were (0.17 to 0.41 %) in C and B (0.2 to 0.48%) and (0.33 to 0.37%) C and A while crude fat included; (13.83 to 16.21%), A and B, (8.23 to11.70%) C and B and (7.83 to 13.43%) in A and B, proteins was (12.98 to 17.16%) for C and D, (11.17 to 12.90%) for E and D and (12.52 to 17.80%) in samples C and

Table 4. Proximate: Composition of samples from date fruits powder and table sugar at 30%

Sample codes	Moisture	Ash	Crude Fibre	Crude Fat	Crude protein	Carbohydrates
A	12.83±0.03^{a}	0.40±0.00^{a}	0.23±0.01^{a}	13.83±0.01^{a}	16.42±0.01^{a}	56.30±0.02^{b}
B	13.10±6.13^{a}	0.53±0.02^{a}	0.41±0.01^{a}	16.21±0.03^{a}	16.20±0.01^{a}	53.60±0.04^{b}
C	11.20±0.07^{a}	0.33±0.02^{b}	0.17±0.007^{b}	14.22±0.02^{b}	12.98±0.03^{a}	61.20±0.08^{b}
D	12.18±0.02^{b}	0.43±0.02^{b}	0.22±9.60^{c}	15.20±0.08^{a}	17.16±0.03^{a}	54.83±0.03^{b}
E	12.03±0.03^{b}	0.40±0.02^{b}	0.19±0.007^{b}	16.20±0.33^{a}	15.91±0.03^{a}	83.62±3.15^{a}

Values represent means of triplicate values ± sð (standard deviation) sample means with the same superscripts in a Column are significantly the same p≥0.05

Table 5. proximate composition of samples from date fruits powder and table sugar at 40%

Sample code	Moisture	Ash	Crude fibre	Crude fats	Crude proteins	Carbohydrates
A	9.82±0.02^{a}	0.45±1.92^{a}	0.29±0.01^{a}	11.70±0.02^{a}	11.41±0.03^{a}	66.40±0.03^{b}
B	10.03±0.03^{a}	0.58±0.02^{a}	0.46±0.00^{b}	10.83±0.10^{c}	12.19±0.03^{a}	65.60±0.30^{b}
C	9.13±0.03^{a}	0.40±0.02^{a}	0.21±0.007^{a}	8.23±0.03^{a}	12.50±0.01^{a}	69.53±0.08^{c}
D	8.50±0.00^{a}	0.40±0.00^{b}	0.48±0.003^{a}	11.40±6.13^{a}	12.90±0.003^{a}	65.00±1.70^{b}
E	8.30±0.02^{a}	0.48±0.02^{a}	0.30±0.02^{c}	11.20±0.20^{b}	11.17±0.03^{a}	68.40±0.00^{b}

Values represent means of triplicate values ± sð (standard deviation) sample means with the same superscripts in a Column are significantly the same p≥0.05

Table 6. proximate composition of the samples from date fruits powder and table sugar at 50%

Sample codes	Moisture	Ash	Crude-Fibre	Crude fat	Crude protein	Carbohydrates
A	7.03±0.03^{a}	0.80±0.00^{b}	0.37±0.007^{b}	7.83±0.03^{a}	13.05±0.03^{b}	70.00±0.03^{a}
B	6.44±0.10^{a}	1.0 ± 0.02^{a}	0.34±0.007^{a}	1.06±0.06^{a}	13.24±0.33^{b}	68.60±0.12^{a}
C	8.80±0.0^{a}	0.44±0.02^{c}	0.33±0.000^{a}	7.40±0.00^{a}	12.52±0.31^{b}	69.58±0.02^{a}
D	9.63±0.03^{a}	0.73±0.03^{b}	0.35±0.007^{b}	8.60±00.02^{a}	17.80±0.03^{b}	66.95±0.01^{a}
E	10.41±0.01^{a}	0.73±0.02^{b}	0.33±0.000^{c}	13.43±0.03^{b}	13.80±0.00^{a}	57.95±0.01^{a}

Values represent means of triplicate values ± sð (standard deviation) Sample means with the same superscripts in a Column are significantly different p≥0.05.

Tables 4-6 KEY

Sample A = (:50:50% F^1S^1 Fructose and Sucrose)
Sample B = (100%:0% F^1S^0 Fructose and Sucrose)
Sample C = (0%:100% F^0S^1 Fructose and Sucrose)
Sample D = (75%:25% F^2S^1 Fructose and Sucrose)
Sample E = (25%: 75% F^1S^2 Fructose and Sucrose)

D. Carbohydrates ranged between (53.60 to 83.62%) for B and E. at 40%, it was in the range of (65.00 to 69.53%) in samples D and C. while 50% included; (57.95 to 70.00%) in E and A respectively.

4.2 Discussions

From the study, it was revealed that a high moisture content was noticed in sample B at 30% and 40%, cookies and which could be due to differences in solubility and ratios of the formulation of the sweeteners (fructose and sucrose), [39] in the study of ``Effect of Drying Methods and Storage Conditions on Nutritional Value and Sensory Properties of Dehydrated Tomato Powder (*Lycopersicon esculentum*)'', stated that such amount of moisture contents at 30 and 40% samples can negatively affect the keeping quality of the products by contributed to increase in the growth of bacteria and fungi colony. [40] discovered that sucrose remains in crystalline form with a little interaction with water and that during baking, more water evaporates freely before sucrose is dissolved, leading to a drier biscuit, but at 50% (sample B of (100%) date fruit powder had the least moisture content (6.44) which was unusual for samples with substitution of sucrose with date fruit products to be low in moisture, from observation, the change in this sample where 75% (ratio 1:2) of sucrose was used at 50% and had a higher moisture content, could be due to longer ripening period of -the batter for 24 hours which allowed high

hydration of the wheat flour and table sugar this result agrees with (40) that ripening time allows flour to hydrates and soak up liquid in a dough, allowing free sugars to dissolved instead of being in crystal form. From the analyses, 6.44% in sample B (ratio 1:0) (100%) sucrose substitution with date palm fruit powder at 50%, was closely similar to the results reported in the standard moisture of 6.00 defined by [41].

The ash content of this present study closely compares well with the report of [42] where the ash content was between 0.92 to 1.26 at 70:20 in the study of Nutritional Quality of Biscuit Supplemented with Wheat Bran and Date Palm. The slight variable of (0.26) more in ash than the current study and which could be due to different geographical location where the date palm trees were planted.

Increased in fibre content have several health benefits, as it aids digestion in the colon and reduces constipation that often associates with products from refined grain flours [43].

Hooper Marta Lonnie et al. [44]. The amount of fat in date fruits was not up to recommended daily intake of fat therefore, fat % is within the range of low fat diets that could be prescribed for people with health problems that requires low fat diet, since the dietary reference intake (DRI) of 20% to 35% of total calories should come from fat for adults [44]. Fat serves as a lubricating agent that improves the quality of food products, in terms of flavor and texture. In this study, the fat contents of the samples cannot affect the keeping quality of the products. At 50 **%,**high protein values was observed as substitution of date was increased in percentage and at high ratios, while in sucrose, they were lower, high protein contents observed in date fruits samples could be used for daily need of a child of age 1-3 years but based on body weight (/0.75 or 0.80 g/kg) [45,46] the Recommended Dietary Allowance (RDA) for proteins ranges between 10-35%, as defined by ghr.nlm.nih.gov/primer/howgeneswork/ protein, the amount of protein in this current study (17.80%) is adequate.

The carbohydrate content at 30, 40 and 50% were low in all the samples with partial substitution of dates but, high in samples that has 100% free sugar for all the samples according to [6] products from date could be optimized and used as pharmaceutical products in treatment of diabetes the low carbohydrates observed in this study, could be used to combat health related problems from hyperglycemia. The study revealed that high carbohydrates content observed in sucrose substitution at significant levels at p≤ 0.001 and its effects could spike blood sugar in type II diabetics.

4.3 Results

Mineral content of the samples at 30%, 40% and 50% mg/100g included; sodium (52.50 to 70.33)

Table 7. Mineral contents of the samples from date fruits powder and table sugar at 30%

Sample Code	Sodium	Potassium	Calcium	Magnesium	Phosphorous	Ferrous
A	64.40±0.03^{a}	35.70±0.00^{a}	224.20±0.07^{a}	120.80±0.03^{a}	55.60± 2.45^{a}	16.41±0.00^{a}
B	52.60±2.45^{a}	35.50±0.06^{a}	251.00±0.57^{a}	28.60±0.00^{a}	69.20± 0.10^{a}	8.12 ±.0.90^{a}
C	52.50±0.33^{a}	30.50±0.33^{a}	215.00±0.033^{a}	120.10±4.91^{a}	56.75 ±.0.00^{a}	15.71±.00^{a}
D	54.00±0.33^{a}	33.87±0.43^{a}	251.20 ±0.10^{a}	127.22±4.91^{a}	73.45±0.02^{a}	19.31±0.13^{a}
E	70.33±0.33^{a}	33.30±0.43^{a}	227.800±0.10^{a}	127.20±4.91^{a}	57.22± 0.40^{a}	20.20± 0.13^{a}

Values represent means of triplicate values ± sð (standard deviation) Sample means with the same superscripts in a vertical columns are significantly different p≥ 0.05

Table 8. Mineral contents of the samples from date fruits powder and table sugar at 40%

Sample Code	Sodium	Potassium	Calcium	Magnesium	Phosphorous	Ferrous
A	74.10±0.10^{b}	51.10±2.45^{b}	51.10±2.45^{a}	140.67±0.35^{a}	67.20±0.02^{b}	25.50±0.003^{a}
B	74.12±0.10^{b}	56..00±.00 ^{b}	231.00±0.00^{a}	148.30±0.00^{a}	64.14±0.10^{b}	30.07± 0.04^{a}
C	42.87±0.10^{b}	23.51±0.00^{b}	172.80±0.00^{a}	112.23± 0.13^{a}	54.14± 0.01^{b}	11.71 ± 02^{a}
D	51.20±0.00^{a}	33.50±0.03^{a}	232.37±0.06^{a}	124.60±0.40^{a}	59.23±0.02^{a}	17.71±0.00^{a}
E	45.53±0.07^{a}	30.60±0.00^{a}	214.00±0.00^{a}	118.43±0.06^{a}	58.73±0.02^{a}	16.11±0.003^{a}

Values represent means of triplicate values ± sð (standard deviation) sample means with the same superscripts in a Column are significantly the same at p≥0.05

Table 9. Mineral contents of samples from date fruits powder and table sugar at 50%

Sample Codes	Sodium	Potassium	Calcium	Magnesium	Phosphorous	Ferrous
A	72.00±0.33[a]	42.80±47.8[a]	226.70±23[a]	131.70±13[a]	65.80±65.76[a]	21.70±21.9[a]
B	41.23±0.03[a]	27.40±0.00[a]	201.00±0.07[a]	115.50±0.00[a]	56.18±0.03[a]	18.01±0.07[a]
C	59.87±0.33[a]	50.733±0.33[a]	227.50±0.00[a]	138.80±0.10[a]	60.78±0.61[a]	20.94±0.3[a]
D	76.20±0.33[a]	57.80±0.00[a]	250.87±0.33[a]	142.20±0.00[a]	71.36±0.003[a]	29.42±0.01[a]
E	66.70±0.00[a]	42.93 ±0.03[a]	223.10±9.81[a]	124.50±0.00[a]	63.33±0.02[a]	17.04±0.03[a]

Values represent means of triplicate values ± sð (standard deviation) Sample means with the same superscripts in a Column are significantly the same at p≥0.05.

Table 7-9 KEY

Sample A = (:50:50% F^1S^1 Fructose and Sucrose)
Sample B = (100%:0% $F^1S°$ Fructose and Sucrose)
Sample C = (0%:100% $F°S^1$ Fructose and Sucrose)
Sample D = (75%:25% F^2S^1 Fructose and Sucrose)
Sample E = (25%: 75% F^1S^2 Fructose and Sucrose)

in B and A, (45.87 to 74.10) for E and A and (41.23 to 76. 20) in B and D, Potassium were (30.50 to 37.30%) in C and E, (30.60. to 56.0) in E and B (27.40 to 57.80) B and D, calcium (215.97 to 251.20) in C and D, (42.87 to 74.12) C and B (41.23 to 76. 20) B and D magnesium included (28.60 to 127.22) B and D, (112 to148.30) for C and B (115.50 to 142.20) phosphorus; (55.60 to 73.46) in A and B and (54.14 to 67.20) C and A. (56.18 to 71.36) for A and D. ferrous were (8.12 to 20.20) for B and E (11.71 to 30.07) C and B (17.04 to 29.42) in E and D

4.4 Discussion

From the analyses, an increase in all the minerals were observed as substitution of date fruits were increased, while decreased value were noticed in those that contain low or no date fruits powder at various significant level of p≤0.05, the study indicated that dates contain higher amount of minerals (sodium, potassium, calcium, magnesium, phosphorous and ferrous) the study also revealed that all mineral contents at 50% were higher in sample D where B was the least even though both had higher proportions of date at 75% and 100% each.

Table 10. Phytochemical contents of samples from date fruits powder and table sugar at 30%

Sample code	Tannic acid	Flavonoids	Phenolic Acid	Saponin	Carotenoid	Alkaloid
A	2.22±0.01[a]	3.04±0.04[a]	9.32±0.07[b]	1.35±.007[a]	8.45±0.010[a]	0.08±0.00[a]
B	2.9±0.07[a]	3.74±0.07[a]	23.58±0.00[a]	2.09±0.01[a]	8.77±0.00[a]	0.19±0.007[a]
C	1.8±0.01[b]	2.33±0.30[a]	7.38±0.07[a]	1.00±0.01[a]	5.31± 0.02[a]	0.40±0.00[b]
D	1.97±0.01[c]	2.56±0.00[b]	13.66±0.12[a]	1.65±0.007[c]	8.66± 0.00[a]	0.14± 0.00[b]
E	1.94±0.03[b]	2.27±0.03[b]	9.60±0.10[b]	1.57±0.11[b]	8.33± 0.01[a]	0.37±0.033[b]

Values represent means of triplicate values ± sð (standard deviation) Sample means with the same

Table 11. Phytochemical contents of samples from date fruits powder and table sugar at 40%

Sample code	Tannic acid	Flavonoids	Phenolic acid	Saponin	Carotenoid	Alkaloid
1:1	2.41±0.01[a]	4.96±0.07[a]	15.8870.03[a]	2.25±0.01[a]	2.25±0.01[a]	0.14±0.00[a]
1:0	3.36±0.01[a]	5.85±0.04[a]	16.43±0.00[a]	2.47±0.00[a]	2.56±0.00[a]	0.25±0.007[b]
0:1	2.20±0.03[a]	3.78±0.00[a]	8.71±0.07[a]	1.05±0.02[a]	1.05± 0.02[a]	0.10±0.00[c]
2:1	3.44±0.04[b]	5.91±0.007[b]	11.92±0.02[a]	1.08±0.02[c]	2.35±0.007[a]	0.22±0.01[b]
1:2	2.82±0.01[a]	4.48±0.04[a]	11.81±0.07[b]	2.30±0.00[c]	2.30±0.00[c]	0.19±0.007[c]

Values represent means of triplicate values ± sð (standard deviation) Sample means with the same superscripts in a Column are significantly the same at p≥0.05

Table 12. Phytochemical contents of samples from date fruits powder and table sugar at 50%

Sample code	Tannic acid	Flavonoids	Phenolic acid	Saponin	Carotenoid	Alkaloid
1:1	2.81±0.003 [a]	6.00± 0.00 [a]	16.00± 0.03[a]	2.25±0.03[a]	2.25±0.01[b]	0.14 ±0.00 [a]
1:0	5.00±0.003 [a]	6.96±0.07 [a]	16.43±000 [a]	2.46±0.00[a]	2.47± 0.00 [a]	0.25±0.00[a]
0:1	2.76±0.013[b]	4.07±0.07 [a]	8.713±0.07 [a]	1.05±0.01 [a]	1.05±0.01[c]	0.10±0.00 [a]
2:1	4.25±0.02 [a]	5.60±.56 [a]	11.92±0.02 [a]	2.35±0.01 [a]	2.36±0.007[b]	0.22±0.00 [a]
1:2	3.66±0.02 [a]	5.15± 0.04 [a]	11.81±0.07 [a]	2.30±0.00[b]	2.30±0.00[b]	0.20±0.0[a]

Values represent means of triplicate values ± sð (standard deviation) Sample means with the same superscripts in a Column are significantly the same at p≥0.05.

Table 13-15 KEY

Sample A = (:50:50% F^1S^1 Fructose and Sucrose)
Sample B = (100%:0% $F^1S^°$Fructose and Sucrose)
Sample C = (0%:100% $F^°S^1$ Fructose and Sucrose)
Sample D = (75%:25% F^2S^1 Fructose and Sucrose)
Sample E = (25%: 75% F^1S^2 Fructose and Sucrose)

4.5 Results of the Phytochemical Contents at 30, 40 and 50% mg / 100 g Included

Tannic acid (1.8 to 2.9 mg), (2.20 to 3.44) and (2.76 to 5.00) flavonoid (2.27 to 3.74), (3.78 to 5.91) and (4.07 to6.96) phenolic acid (7.38 to 23.58), (8.71 to 16.43), (8.71 to 16.43) Saponin (1.00 to 2.09), (1.05 to 2.47) and (1.05 to 2.46) Carotenoid included; (5.31 to 8.77), (1.05 to 2.56), (1.05 to 2.47) Alkaloid (0.08 to 0.40), (0.10 to 0.25) and (0.10 to 0.25) C and B for all the samples.

4.6 Discussions on Phytochemical Contents at 30, 40 and 50% mg / 100 g Included

The analyses revealed that tannic acid, phenolic acid, Saponin and carotenoid were significantly high in sample B but, low in sample C, while alkaloid and flavonoid were high in D and both were lower in E and C, this is an indication that cookies with date fruit powder contents has increased in phytonutrients but at acceptable level. From observation, all the samples indicated that sample B (100%) date fruit powder had higher contents of phytochemicals while C the least at ratios) 1:0 (100%) date fruit and 0:1 (100% table sugar), the phytochemical contents at 50% were increased as the dates increases but all were within allowable limits. An increased amount in these samples has an edge advantage over the samples C therefore cookies with higher phytochemicals but within acceptable limit can be used for treatment of diseases and disorders since phenolic acid are antioxidant that are associated with reduced risk of chronic diseases, possibly via a variety of bio-mechanisms including ant-oxidation and anti-inflammation [47]. The potent biological activity of alkaloids has led to their exploitation as pharmaceuticals and for clinical use including; anti-inflammatory, analgesic, antitumor, anticonvulsant, diuretic, and antiarrhythmic effects, among which the anti-inflammatory effect is very prominent and commonly used in the treatment [48]. The analgesics are used as anticancer agents, gout suppressant colchicine, muscle relaxant and antibiotic [49].

4.7 Results

Sensory evaluation in terms intensity of taste, colour, flavour, crispness and texture of the products;

The sensory attributes of the samples at various treatment of (30%, 40% and 50%) in terms of intensities (taste, colour, flavour, crispness and texture) was reported; taste (7.00 to 8.30), (6.60 to 8.17) 2:1 and 0:1 in both samples but 50% was (5.27 to 8.00) in 1:0 and, 1:1, the colour included; (5.16 to 7.70),in 2:1 and 0:1 while 40% and 50% were (6.17 to 7.67) in 1:0 and 1:1 and (5.37 to 8.37) in ratios 2:1 and, 0:1, Flavour; (5.10 to 8.10) for 2:1 and 0:1, while (5.77 to 8.67) and (6.27 to 7.67) were both were 1:0 and 1:2, crispness were (5.77 to 7.27) for 2:1 and 0:1, (5.77 to 8.70) 1:0 and 1:2 and (6.00 to 7.17) for 0:1 and 1:0, the texture was in the range of (6.767 to 7.87) in ration 1:0 and, 0:1 (5.67 to 7.50) for 2:1 and 1:1 and (6.00 to 7.07) in 0:1 and 1:1.

Table 13. Sensory evaluation of samples from date fruits powder and table sugar at 30%

Sample code	Taste	Colour	Flavour	Crispness	Texture
1:1	7.767±0.03	7.47±0.033	6.77±0.03	7.27±0.03	7.77±0.03
1:0	7.003±0.003	6.61±0.003	6.07±0.03	6.63±0.03	6.77±0.03
0:1	8.30±0.003	7.70±0.003	8.10±0.00	7.27±0.03	7.87±0.03
2:1	7.00±0.00	5.16±0.160	5.10±0.00	5.77±0.03	7.50±0.00
1:2	7.70±0.003	7.70±3.070	6.27±0.03	7.00±0.00	7.47±0.03

Values represent means of triplicate values ± sd (standard deviation) Sample means with the same superscripts in a Column are significantly the same at p≥0.05

Table 14. Sensory evaluation of samples from date fruits powder and table sugar at 40%

Sample code	Taste	Colour	flavour	Crispness	Texture
1:1	7.67±0.33	7.67±0.03 [c]	7.27 ±0.03	7.27±0.03	7.47±0.03 [a]
1:0	7.27±0.03	6.17±0.03 [a]	5.77±0.03	5.77±0.03	5.77±0.03 [a]
0:1	8.17±0.03	7.47±0.03 [a]	7.47±0.03	7.47±0.03	7.27±0.03 [b]
2:1	6.60±0.00	6.67±0.03 [a]	7.77±0.03	7.77±0.03	5.67±0.33 [a]
1:2	7.27±0.03	6.70±0.03 [b]	8.66±0.03	8.70±0.03	7.48±0.03 [b]

Values represent means of triplicate values ± sd (standard deviation) Sample means with the same superscripts in a Column are significantly the same at p≥0.05

Table 15. Sensory evaluation of samples from date fruits powder and table sugar at 50%

Sample code	Taste	Colour	Flavour	Crispness	Texture
1:1	8.00±0.03 [a]	7.87±0.03 [a]	6.367±0.03 [b]	7.06±0.00[b]	7.05±0.00 [a]
1:0	5.27±0.03 [a]	5.67±0.03 [a]	6.27±0.03[a]	7.17±0.03[b]	6.167±0.03[a]
0:1	5.867±0.03[b]	8.37±0.03 [a]	7.00±0.00[b]	6.00±0.00[a]	6.00±0.00 [a]
2:1	5.767±0.03 [a]	5.37±0.03 [a]	7.067±0.03[b]	6.47±0.06 [b]	6.47±0.03 [a]
1:2	6.30±3.067 [a]	6.00±0.00 [a]	7.67±0.03[c]	7.02±0.00[a]	7.01±0.00 [b]

Values represent means of triplicate values ± sd (standard deviation) Sample means with the same superscripts in a Column are significantly the same at p≥0.05

Tables 13 -15 KEY
1:1 (50:50% both sweeteners)
1:0 (100:0% date fruit sweetener)
0:1 (0:100% table sweeteners)
2:1 75:25% date fruits and table sugar)
1:2 25:75% date fruits and table sugar)

4.8 Discussion

The results of sensory evaluation of the samples at 30% show that at ratio 0:1 (100%) sucrose was rated higher in terms of Taste, Colour and flavour. while ratio 2:1 75% date fruits was low, the high rating of sucrose cookies could be due to panellists being used to the taste of the cookies produced with table sugar that they are used hence, due to changes in new innovation they were not rated much.

At 40%, sample were mostly accepted and scored high in colour in ratio 1:1 while flavour and crispness and texture were high in sample 1:2 (sucrose) while samples that contains fructose were low in textures are low.

Then at 50%, the findings showed that taste, crispness and texture rated high in ratios 1:1 (50:50%) that is at equal measures of the both sweeteners and mostly accepted and rayed high in terms of colour in ratio 0:1 (100%) table sugar.

4.9 Results

The postprandial effect of cookies showed (5.64 to 7.87) in ratio 1:0 and 1:2 and (6.20 to 6.8) for 1:1 and 1:2 at 30% and 40% respectively and at 50%, it was between (6.20 to8.05)

4.10 Discussion on Postprandial Effects

At 30%,The postprandial effects on experimental animals (albino rabbits) at 30, 40 and 50% revealed that at 30%, there was variations of 2.13 mmol/L (38.34g) in blood glucose level between ratio 1:0 (100) date powder and 1:2 (75%) sucrose of which ratio 1:2 was higher than 1:0 indicating that even though date fruits was

Table 16. Postprandial effects of samples from date fruits powder and table sugar at 30%

Ratios	1:1	1:0	0:1	2:1	1:2
F	3.80±0.03[a]	4.13±0.03[a]	2.77±0.03[a]	7.7±0.05 [a]	7.16±0.03[a]
G	6.70±0.06[a]	5.64±0.03[C]	5.83±0.03[a]	7.16 ±0.00[a]	7.77±.036[a]

Values represent means of triplicate values ± sd (standard deviation) Sample means with the same superscripts in a Column are significantly the same at p≥0.05

Table 17. Postprandial effect of samples from date fruits and table sugar on at 40%

Ratios	1:1	1:0	0:1	2:1	1:2
F	6.4±0.03 [a]	6.01±.03 [a]	5.00±0.33 [b]	6.60 ± 0.03 [b]	4.70±0.10 [b]
G	6.20±0.07[b]	6.76±0.10[a]	6.80±0.03 [a]	6.30±0.07 [a]	6.82 ±3.07[b]

Values represent means of triplicate values ± sd (standard deviation) Sample means with the same superscripts in a Column are significantly the same at p≥0.05

Table 18. Postprandial effect of samples from date fruits powder and table sugar on 50%

Ratios	1:1	1:0	0:1	2:1	1:2
Initial blood glucose	7.00±0.03[b]	5.30±0.00 [b]	6.33±0.03[a]	5.12±0.07[b]	7.66±0.11[a]
Postprandial effect	6.20±0.03[a]	7.50± 0.06[a]	8.05±0.02[c]	6.30±0.03[a]	7.01±3.07[a]

Values represent means of triplicate values ± sd (standard deviation) Sample means with the same superscripts in a Column are significantly the same at p≥0.05; KEY for Tables: 16 - 18
Initial blood glucose = F; Postprandial effect = G; 1:1 (50:50% both sweeteners)
1:0 (100:0%date fruit sweetener); 0:1 (0:100% table sweeteners)
2:1 75:25% date fruits and table sugar)
1:2 25:75% date fruits and table sugar)

100%, it was still the least at postprandial effect; according to (50) blood glucose level of 4.0 to 5.4 is normal and means a blood glucose normal 7.77 mmol/L (139.86 g) as seen in 1:2 75% sucrose is significantly high and elevation of glucose up to that amount is diagnosed diabetic.

At 40 %, it was observed that the initial blood glucose for sample 1:1 was (6.4.) which according to [50], is considered normal blood glucose and recommended for goal for adults, at postprandial level a reduced amount was noticed in the sample that contained date fruits, from this study therefore, intake of date fruits is a healthy diets and such sample that has such inhibitory effect, could be optimized and used as a functional and potential treatment for type II diabetes due to their bioactive nutrients that has such functional nutrients but, ratio 0: 1 100% sucrose that was increased up to (1.83 mmol/L) (32.94 mg) considering the fact that it was low in initial blood glucose and increased at postprandial may result into blood glucose incidence.

The glycemic index at 50% in the initial glucose was higher in value (7.00 mmol/L), but at postprandial examination, the value of the blood glucose was reduced in the animals that consumed 100 g cookies sweetened with *Phoenix dactylifera* L at 30 minutes. From the observation, a reduction from initial blood glucose at postprandial effect from the same sample was noticed and it was impressive therefore, such the sample could be used as pharmaceutical products to regulate blood sugar level this study is in conformity with [6].

5. CONCLUSION

Production, quality evaluation and postprandial effects of high fibre fructose sweetened confectionery snacks (cookies) as a functional diets revealed the clinical trial from postprandial effects on 30 albino animals of which some animals with high blood glucose at initial blood sugar, were significantly decreased in value after intake of cookie samples that were sweetened with date fruits sweetener. Also evidence drawn from this study showed that if at 30 minutes of intake of a sample and the blood glucose rises up to 139 g (7.7 mmol/L), such diet should be reduced or avoided. From professional point of view, samples that reduced sugar level to normal at 30 minutes after intake can be used as a functional diet to treat type II diabetes. Then the inhibitory effects of date fruits at 50% in ratio 1:0 (date palm) only can be modified and optimized and use as a potential pharmaceutical therapy in type II diabetes.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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