CONSUMER ACCEPTABILITY AND PROXIMATE ANALYSIS OF SELECTED SNACKS PRODUCED WITH NATURAL SWEETENERS FOR CHILDREN AND CONSUMERS

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ABSTRACT

The study investigated consumer acceptability and proximate analysis of selected snacks produced with selected natural sweeteners. Four (4) research questions were raised and one (1) hypothesis was tested. The research design adopted for this study is Research and Development Design (R&D). Judges evaluated 8 coded samples produced for appearance, aroma, texture, taste and overall acceptability. Sensory Evaluation was judged on a 7 point hedonic scale ranging from"1"which indicates "Dislike" to "7" which indicates "Like'' extremely using sensory evaluation score card (SESC). Proximate analysis was determined by calculating the nutrient content (Moisture, Protein, Ash, Fat, Crude fibre, and Carbohydrate). One way Analysis of Variance (ANOVA) was used to test for the significant differences in the nutrient and sensory properties of the samples. Result of sensory properties revealed that sample CHS (Chinchin with 100% sugar) was the most preferred in appearance, aroma, taste and overall acceptability (6.47±0.90). Result of nutritive composition showed that sample CHH (Chinchin with 100% Honey) has the highest protein (10.52%), fat (20.45%) and fiber (2.55%) contents. Results revealed a significant difference (P<0.05) in the sensory evaluation of snacks produced with sugar only and those produced with selected natural sweeteners. The study concludes that snacks produced with natural sweeteners are nutritive for all classes of people. Therefore, there should be continuous education in nutrition to advise people of the health benefits of snacks produced with these natural sweeteners (date and honey) as its nutritive, antioxidants and medicinal contents for the growth and development of children and consumers is high.

Key Words: ***Consumer, Acceptability, Proximate, Analysis, Snacks, Natural Sweeteners.***

INTRODUCTION

We all enjoy snack food once in a while. Snacks help us keep a positive mindset in time of pressure and stress inflicted from work, school and relationship (Jeff Lat, 2015). A study by Allison (2010) showed that children in the United States snacked on average six times per day, approximately twice as often as American children in the 1970s, this represent consumption of roughly 570 calories more per day than US children consumed in the 1970s (Mohney and Carr, 2016). A snack

is a small service of food and generally eaten between meals. Snacks comes in a variety of forms including packaged snack foods and other processed foods, as well as items made from fresh ingredients at home. A snack is composed of solid food(s), including those typically eaten with a utensil (with or without a beverage) that occurs between habitual meal occasions for the individual, is not a substitute for a meal, and provides substantially fewer calories than would be consumed in a typical meal (Johnson and Anderson,2010). Snacks are typically designed to be portable, perishable, quick and satisfying. It is a convenience food that often contain substantial amount of sweeteners, preservation and appealing ingredients such as chocolate, peanuts and typically designed flavours for children. (Wikipedia, 2019). Snacks can be a dessert, mid-day snack or midnight/bedtime snack. Examples of snacks are biscuits, cookies, doughnuts, cheeses, ice cream, popcorn, potato chips, chinchin, toast and short bread. This research is based on two snacks: chinchin and cookies. Chinchin is a fried snack in West Africa, a crunchy, baked or fried dough of wheat flour and other customary baking items (Akubor, 2004). Cookies are small sweet cake, variously shaped, filled but usually flat and chewy. Cookies usually contain flour, sugar and some type of oil or fat, it may include other ingredients such as raisings, oats, chocolate, chips, and nuts and so on (Isengard, 2008).

Sweeteners are substances used to improve the palatability and shelf life of food products (Andrew, 2018). A sugar substitute or sweeteners is a food addictive that provides a sweet taste like that of sugar while containing significantly less food energy, making it a zero calorie or low calories sweetener. Sweeteners are produced naturally or synthetically also called artificial sweetener (Wikipedia, 2018). Neascu and Madar (2014) defined natural sweeteners as sweetener produced by nature, without added chemicals or fancy machinery such as maple syrup, honey, date, steria, molasses and xylitol.

Dates are edible fruits of the date palm tree (*Phoenix dactylifera*) which is grown in many tropical regions of the world. Date is also called '*Dabidun*' in Hausa language. Dates are chewy with a sweet flavour, they are also high in some important nutrients and have a varieties of advantages and uses. Dates contain several vitamins and minerals in addition to fiber which may be beneficial for preventing constipation and controlling blood sugar and several types of antioxidants that may help prevent the development of certain chronic illnesses (Elliott, 2018). Date can be chopped, candied, stuffed and added to various recipes, besides their rich taste, they are a power house of nutrition that can greatly boost your energy. Muslims break their fast with date in holy month of Ramadan. They are great combination of taste and health (Vineetha, 2014). The sugar content of ripe dates is about 80%, the remainder consists of protein, fiber and trace elements including boron, cobalt, copper, fluorine and zinc (Al-Shahib & Marshall, 2003). Dates are rich in vitamins B1, B2, B3 B5, A and C, fiber, calcium, iron, phosphorus, sulfur, potassium, copper, manganese and magnesium (Mazlan, 2018).

Honey is a thick, sweet liquid made by honeybees, low in vitamins and minerals but may be high in some plant compounds. One tablespoon of honey (21grams) contains 64 calories (Gunnars, 2018). It contains a number of antioxidants including phenolic compounds like flavonoids. Honey

is medicinal helping to cure some illnesses, ailments, injuries. WHO recommends honey as a natural cough remedy for children above one year (Nordquist, 2018). Honey are used in cooking, baking, desserts, as a spread on bread, as an addition to various beverages such as tea, coffee, in making sauces and as a sweeteners in some commercial beverages (Hunt & Atwater, 2015). A mixture of sugars and other carbohydrates, honey is mainly fructose (about 38%) and glucose (about 32%) with remaining sugar including maltose (7.1%), sucrose (1.3%) and other complex carbohydrates (National Honey Board, 2011).

The proximate composition of foods includes moisture, ash, crude lipid, crude protein, crude fiber and carbohydrate content. These food components may be of interest in the food industry for product development, quality control and regulatory purpose (Prodrug Research, 2016). Sensory evaluation is a scientific discipline that applies principles of experimental design and statistical analysis to the use of human senses (sight, smell, taste, touch and hearing) for the purposes of evaluating consumable products (Wikipedia, 2019). Obesity which is often caused by consuming too much sugar is considered the strongest risk factor for childhood obesity and diabetes. Experts believe that sugar consumption is a major cause of obesity and many chronic diseases such as diabetes (Kubala, 2018). Sub-Sahara Africa has the fastest growing rate of diabetes with Nigeria having a prevalence rate between 3-5%. Table sugar (sucrose) contains no or relative low vitamins and minerals and it is major cause of diabetes, obesity and other sugar related problems. This study want to proffer solution to child obesity and other sugar related problems by replacing sugar (sucrose) with natural sweeteners (dates and honey) which contains more of other sugars, vitamins, minerals, antioxidants and other trace useful nutrients to our daily snacks. This study therefore investigated consumer acceptability and proximate analysis of selected snacks produced with selected natural sweeteners (Date and Honey).

MATERIALS AND METHODS

Research and Development Design (R&D) was the experimental design *adopted for this study.* Hassan (2003) defined *Research and Development Design (R&D)* as the disciplined investigation conducted in the context of the development of a product for the purpose of improving on the thing being developed.

Sample Formulation

Eight products were formulated as follows; CHS= Chinchin with 100% Sugar (control), CHD= Chinchin with 100% Date, CHH= Chinchin with 100% Honey, CHSDH= Chinchin with 40% Sugar, 30% Date, 30% Honey, CKS= Cookies with 100% Sugar (control), CKD= Cookies with 100% Date, CKH= Cookies with 100% Honey, CKSDH= Cookies with 40% Sugar, 30% Date, 30% Honey

Sources of Raw materials: Wheat flour, date fruit, sugar, baking powder, eggs were purchased from Oja-oba market, Ilorin West Local Government Area of Kwara State. Honey was purchased from the TEC center, University of Ilorin, Ilorin, Nigeria.

Production Process of the Products

Processing of date fruit powder: The date fruit was sorted and cleaned to be free from unwanted substances, it was washed in a warm water and the seed is been removed by cutting the shell into

smaller pieces. It was then dried in the oven at 60°C for 24 hours. The dried date was grinded and then sieved to have a fine and uniform powder.

Table I: Recipe for the Production of Cookies

Ingredients	Quantity (g)
Flour	500
Fat	250
Sugar	200
Salt	0.4
Powdered milk	5.0
Baking powder	2.0
Egg	13.7
Vanilla flavour	1.0 (ml)
Water	100 (ml)

Source: Kin kabari and Giami (2015)

Note: The sugar (sucrose) was substituted with date and honey in different formulas. One formula with sugar (sucrose) was used as a control.

Method Used in the Production of Cookies

The ingredient were carefully weighed and placed in a clean bowl. Date powder or honey was added to margarine and was manually mixed until fluffy. The eggs used were broken into a bowl and whisked thoroughly, the whisked egg and milk powder were added during mixing and then mixing continued for about 30 minutes. Sieved flour, baking powder and flavor were slowly added to the mixture; the ingredients were mixed thoroughly and kneaded to form a dough with the addition of water. The dough was then rolled into a thin sheet using a rolling board sprinkled with flour, the flattened dough was love-shaped in several small pastries with the help of a cookie cutter. The cut slices were placed in oiled baking trays and baked in the oven at 160ºC for 15 min, cooled, packaged in polyethylene bags and kept in a plastic container.

Table II: Recipe for the Production of Chinchin

Ingredients	Quantity (g)
Flour	200
Sugar	40
Baking powder	2.0
Nutmeg	1.0
Salt	0.5
Margarine	25
Water	15ml
Powdered milk	15
Egg	1 whole egg

Source: Akindele *et al* (2017)

Note: The sugar (sucrose) was substituted with date powder and honey in different formulas. One formula with sugar (sucrose) was used as a control.

Method used in the Production of Chinchin

Flour, date powder or honey, butter, egg, baking powder, nutmeg, water, and milk were thoroughly mixed together appropriately in a large bowl. The dough was placed on a floured surface and kneaded until smooth and elastic. The kneaded dough was rolled out to 1 cm thickness and then cut into small squares 1 cm by 1 cm in size. Vegetable oil was poured inside a frying pan and allowed to heat up to 170°C. The dough cubes were placed in the hot oil and the chinchin was deep fried for 5 minutes until golden brown. The fried chinchin was removed, drained of the excess oil and left to cool before being packaged.

Sensory Evaluation: Testing Sessions was conducted among the students of the Department of Home Economics and Food Science, University of Ilorin. The panelists were 30 in numbers with ages between 18-25 years. The eight products were blindly coded. The sensory evaluation was done after which the panelists rinsed their mouths with water vigorously to rid-off residues. The scores for all attributes were recorded on the score sheets.

Method of Data Analysis

The judges evaluated the samples using a 7 - point hedonic scale. Where (7 points) was expressed as like extremely, (6 points) like moderately, (5 points) like slightly, (4 points) neither like nor dislike, (3 points) dislike slightly, (2 points) dislike moderately, and dislike extremely (1 point). The nutrient content assessment was calculated with Association of Analytical Chemists. (AOAC, 2010) method. Data collected was analyzed using descriptive statistics such as mean and standard deviation and inferential statistics - one way analysis of variance (ANOVA) was used to test for significant differences in the acceptability of cookies and chinchin. Hypothesis was tested using independent t-test at a 0.05 level of significance.

Table III shows the Mean ($\bar{x}$) and Standard Deviation of Organoleptic Properties of Selected Snacks (cookies and chin chin) Produced with Selected Sweeteners (date and honey).The results showed the mean value for the colour, aroma, taste, texture and overall acceptability for each of the formulated samples. The colour of the samples ranged from 4.20 to 6.47, Aroma of the samples ranged from 4.97 to 6.03, Taste of the samples ranged from 5.13 to 6.20, Texture of the samples ranged from 4.83 to 6.23. The Overall Acceptability of the samples ranged from 5.17 to 6.47.

Table III: Mean ($\bar{x}$) and Standard Deviation of Organoleptic Properties of Selected Snacks (Cookies and Chin chin) produced with natural sweeteners (date and honey)

Sample	Colour	Aroma	Taste	Texture	Overall acceptability
CHS	$6.47^{a}\pm1.20$	$6.03^{a}\pm0.93$	$6.17^{a}\pm1.18$	$5.87^{a\,b}\pm1.17$	$6.47^{a}\pm0.78$
CHD	$4.37^{cd}\pm1.90$	$4.97^{b}\pm1.35$	$5.27^{b}\pm1.41$	$5.20^{b\,c}\pm1.10$	$5.40^{b}\pm1.04$
CHH	$5.40^{b}\pm0.97$	$5.03^{b}\pm1.0$	$5.50^{b}\pm0.94$	$5.20^{b\,c}\pm1.19$	$5.57^{b}\pm0.82$
CHSDH	$4.93^{c}\pm1.29$	$5.23^{b}\pm1.19$	$5.30^{b}\pm0.92$	$5.37^{b\,c}\pm0.89$	$5.27^{b}\pm0.98$
CKS	$6.33^{a}\pm0.84$	$6.03^{a}\pm1.22$	$6.20^{a}\pm0.96$	$6.23^{a}\pm0.90$	$6.40^{a}\pm0.62$
CKD	$4.20^{d}\pm11.61$	$4.97^{b}\pm1.25$	$5.13^{b}\pm1.20$	$4.83^{c}\pm1.44$	$5.17^{b}\pm1.21$
CKH	$5.40^{b}\pm1.13$	$5.20^{b}\pm0.89$	$5.20^{b}\pm1.13$	$5.23^{b\,c}\pm1.19$	$5.33^{b}\pm1.12$
CKSDH	$5.43^{b}\pm1.36$	$5.43^{ab}\pm1.17$	$5.23^{b}\pm1.28$	$4.93^{c}\pm1.46$	$5.57^{b}\pm1.04$

Mean ± SD. Means with the same superscript within the same column are not significantly ($p < 0.05$) different

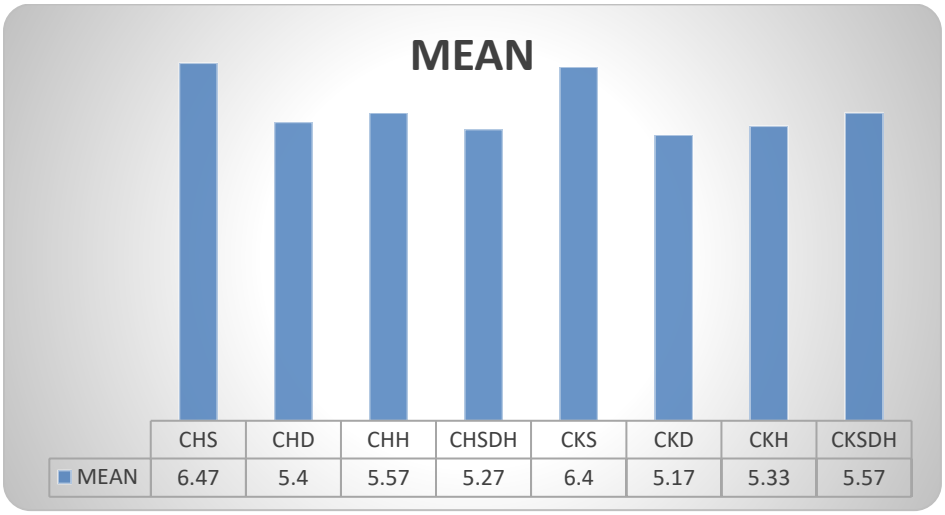

Figure I: Level of general acceptability of selected snacks (cookies and chin chin) produced with natural sweeteners (date and honey).

Figure I shows that for Overall Acceptability, CHS = Chin chin with 100% sugar was the most preferred with mean score of ($\bar{x}$ = 6.47), while CKD = Cookies with 100% Date, was the least preferred with mean score ($\bar{x}$ = 5.17).

Table IV shows the proximate composition of selected snacks (cookies and chin chin) produced with natural sweeteners (date and honey). The results showed the values of Moisture, Ash, Protein, Crude Fat, Fiber and Carbohydrate content in percentage (%). The table showed that Moisture content of the selected snacks (chin chin and cookies) produced with natural sweeteners (date and honey) samples ranged from 6.02 % to 10.60%. Crude protein of the samples ranged from 9.25 % to 10.82%. Crude fat content of the samples ranged from 8.07% to 20.45%. Crude fiber content of the samples ranged from 1.83% to 2.55%. Total Ash content present in the samples ranged from 1.07% to 2.40%. Carbohydrate Content of the sample ranged from 53.56% to 73.63%.

Table IV: Proximate analysis of selected snacks (cookies and chin chin) produced with natural sweeteners

Sample	Moisture	Crude protein	Crude fat	Crude fiber	Total ash	Carbohydrate
CHS	10.45^{ab}±0.01	10.17^{c}±0.03	19.47^{d}±1.18	1.93^{e}±1.17	1.07^{g}±0.03	57.92^{d}±0.05
CHD	10.60^{a}±0.04	10.66^{b}±0.02	20.07^{c}±1.41	2.25^{c}±1.10	1.36^{e}±0.02	55.07^{e}±0.11
CHH	10.46^{ab}±0.36	10.82^{a}±0.04	20.45^{a}±0.94	2.55^{a}±1.19	2.18^{b}±0.03	53.56^{f}±0.28
CHSDH	10.21^{b}±0.03	10.61^{b}±0.06	20.29^{b}±0.92	2.16^{d}±0.89	1.68^{d}±0.01	55.04^{e}±0.01
CKS	6.17^{d}±0.02	9.65^{d}±0.03	8.14^{f}±0.96	2.46^{b}±0.90	2.40^{a}±0.04	71.20^{c}±0.02
CKD	6.22^{d}±0.03	9.64^{d}±0.02	8.37^{e}±1.20	1.92^{ef}±1.44	1.80^{c}±0.01	72.07^{b}±0.04
CKH	6.70^{c}±0.02	9.48^{e}±0.02	8.13^{f}±1.13	1.83^{g}±1.19	1.67^{d}±0.03	72.21^{b}±0.06
CKSDH	6.02^{d}±0.04	9.25^{f}±0.03	8.07^{f}±1.28	1.87^{fg}±1.46	1.17^{f}±0.01	73.63^{a}±0.08

Mean ± SD. Means with the same superscript within the same column are not significantly (p< 0.05) different ***(date and honey). Keys:*** *CHS= Chin chin with 100% Sugar (control), CHD= Chin chin with 100% Date, CHH= Chin chin with100% Honey, CHSDH= Chin chin with 40% Sugar, 30% Date, 30% Honey, CKS= Cookies with 100% sugar (control), CKD= Cookies with 100% Date, CKH= Cookies with 100% Honey, CKSDH= Cookies with 40% Sugar, 30% Date, 30% Honey.*

Hypothesis Testing:

Hypothesis There is no significant difference in the sensory evaluation of selected snacks (cookies and chin chin) produced with sugar and that of natural sweeteners (date and honey).

Table V: **t-test of difference in the sensory evaluation of selected snacks (cookies and chin chin) produced with sugar and that of natural sweeteners (date and honey).**

Group	Mean	Standard deviation	Df	T-cal	P(2-tailed)
Sugar	10.90	1.42	28	39.15	.000
Natural Sweetners (Date & Honey)	11.72	1.25			

$\alpha = 0.05$

Table V showed a calculated t value of 39.15, and P value of .000. Since the p value is less than the alpha value (P<0.05), the hypothesis which states that 'there is no significant difference in the sensory evaluation of snacks produced with sugar and that of natural sweeteners (date and honey) is rejected. This implies that there is a significant difference in the sensory evaluation of snacks produced with sugar and that of natural sweeteners (date and honey).

DISCUSSION

The result of the sensory evaluation revealed that for Appearance, the sample CHS = Chin chin with 100% sugar was the most preferred $\bar{x}$ = (6.7 ±1.20), while sample CKD = Cookies with 100% date was the least preferred $\bar{x}$ = (4.20±11.61).For Aroma, CHS = Chin chin with 100% sugar and CKS = Cookies with 100% sugar were the most preferred $\bar{x}$ = (6.03 ± 0.93) and (6.03 ±1.22), while sample CHD = Chin chin with 100% date and CKD = Cookies with 100% date were the least preferred $\bar{x}$= (4.97 ±1.35) and (4.97 ±1.25).For Texture, CKS = Cookies with 100% sugar was the most preferred $\bar{x}$ = (6.20 ± 0.96), while sample CKD = Cookies with 100% date was the least preferred $\bar{x}$= (4.93±1.44).For Taste, Cookies with 100% sugar was the most preferred $\bar{x}$ = (5.13 ±1.20), while sample CKD = Cookies with 100% date was the least preferred $\bar{x}$ = 6.20 (± 0.96).For Overall Acceptability, CHS = Chin chin with 100% sugar was the most preferred $\bar{x}$ = (6.47± 0.93), while Cookies with 100% date was the least preferred $\bar{x}$= (5.17± 1.21). This may be because the panelists proved that they hold to the traditional comprehension of what good and tasty snacks are. The reason for such behavior lies in the attitude and expectations of the consumers in spite of the existing recommendation of the nutrition experts to restrict the intake of foods high in refined sugars (Nowicka & Bryngelsson, 2006). This result is not in agreement with Folorunso *et al.*, (2018) who produced cookies and chin chin from wheat-date fruit flour blend and reported that

chin chin produced from wheat and 40g date had the highest value in terms of overall acceptability, taste and flavor with values of (7.87±0.97), (7.70±1.15) and (7.90± 1.18) respectively.

Result on level of acceptability revealed that sample CHS = Chin chin with 100% sugar was the most preferred with mean (6.47± 0.78), 25% while sample CKD = Cookies with 100% date was the least preferred with mean score (5.17± 1.21), approximately 25% of the judges accepted each of the samples. This may be due to the higher sweetness impacted by the date which may not be totally acceptable to the panelists (Ghnimi & Kamal-Edin, 2017). This acceptability difference may be because of expectations of the consumers, that according to Hutchings (2003) arise from two major sources, from the belief and from the sensory input, a particular smell, touch or a visual stimulus), are closely connected with the century-long usage of the sugars as sweetener. As soon as we taste sweetness we expect the familiar taste and the texture of sugars, and if we detect another taste, a cooling effect or harshness, an uncontrollable mechanism in our subconscious triggers suspicion. On the other hand, date and honey has some outstanding properties, it has less energy content than sugars, it is suitable for diabetics and it is recognized as non-cariogenic. Hassanein, Gebreel and Hassan (2010) reported the effect of honey as strong antibacterial agent against bacterial species in their study and concluded that honey has been found to control wound infections and accelerate wound healing. All these properties are currently considered as very important for the consumers. The question is then, how to stimulate people to change their diets towards non-conventional new products, in this case with date and honey that are beneficial for their health. Studies have already shown that the general health interest of the consumers is a good predictor for food choices (Zandstra, de Graaf, & Van Stavern, 2001).

Results from the proximate composition showed that CHD = Chin chin with 100% date had the highest moisture content with (10.60%) and CKSDH = Cookies with 40% sugar, 30% date and 30% honey had the lowest moisture content with (6.02%). CHH = Chin chin with 100% honey had the highest protein content (10.82%), while CKSDH = Cookies with 40% sugar, 30% date, 30% honey had the lowest protein (9.25%), this was in relation to the work reported by Olalekan-Adeniran and Ogunwolu (2018) who carried out an evaluation on the quality of oven-roasted and honey-coated cashew nut and reported that there was a significant increase in protein content of the honey-coated cashew nut when compared with the oven- roasted cashew nut. This was supported with the fact that was reported by Ndije and Dandogo (2014) who carried out a research on different honey samples and found out that honey has a significant amount of protein which could help increase the protein content of food where it is being added. CHH = Chin chin with 100% honey had the highest fat content (20.45%), while CKDSH = Cookies with 40% sugar, 30% date, 30% honey had the lowest fat content (8.07%), this is in contrast to the work reported by Yusuf (2016) who reported that honey had no fat content in his research of comparing honey baked and sugar baked cake. CKS = Cookies with 100% sugar had the highest fiber content (2.46%), while CKH = Cookies with 100% honey had the lowest fiber content (1.83%). CKS = Cookies with 100% sugar had the highest ash content (2.40%), while CHS = Chin chin with 100% sugar had the lowest ash content (1.07%). CKSDH = Cookies with 40% sugar, 30% date, 30% honey had the highest carbohydrate (73.63%), while Chin chin with 100% honey had the lowest

carbohydrate (53.56%), the low carbohydrate was due to the fact that an increased protein in food leads to a reduction in the carbohydrate present in the food, this is similar to the work reported by Aminu et al, (2016), who fortified wheat flour with soy bean and pea flour in the production of cookies.

Result of the hypothesis revealed a significant difference ($P<0.05$) in the sensory evaluation of selected snacks (cookies and chin chin) produced with sugar and that of natural sweeteners (date and honey). Similar results were reported by Winkelhausen, Jovanovic-Malinovska, Velickova and Kuzmanova (2007) who investigated application of xylitol, as low energy alternative sweetener in baked products. Statistically significant differences ($P < 0.001$) were detected between the samples containing sucrose and xylitol in all texture attributes and in the cooling effect, but no difference in the sweetness was observed.

CONCLUSION

This study concludes that Snacks (Chin chin and cookies) produced with natural sweeteners (date and honey) can be recommended as snacks that could be consumed by all classes of consumers, both the young and old.as it has higher nutritive contents and contains less calories and can be very helpful especially for children. There should be continuous education in nutrition to change the dietary behavior of the individuals. Therefore, one way could be to advise people of the health benefits of the products with date and honey and another way could be to introduce this products to the individuals as early as their childhood for them to be accustomed with the products date and honey.

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