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Sensory Evaluation of Doughnuts made with Dates instead of Sugar as Sweetener.

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Abstract

A doughnut is a fried dough that has been leavened. For different varieties, different toppings and flavorings are applied, such as sugar, dates, chocolate, or maple glaze. These toppings or sweeteners are met with different customer reactions and have a direct relationship to sales turnover hence this study proposes to undertake a sensory evaluation of doughnuts made with dates instead of refined sugar as a sweetener. The study adopted a comparative research design. In this research, 10 selectively chosen lecturers of Hospitality Management Technology was selected as experienced panelist to carry out the comparism. The study was carried out in Ikorodu Metropolis, Lagos State. From the reports, 40% of the respondents stated that doughnut A (Sugar Sweetened) tasted better, 40% of them however believed that doughnut B (Date Sweetened) tasted better while 20% of them didn't see a significant difference in the taste of both doughnuts. As regards the texture, 60% of the respondents stated that doughnut A (Sugar Sweetened) had a better feel and texture, 40% of them believed that doughnut B (Date Sweetened) had a better feel and texture while 20% of them didn't see a significant difference in the feel and texture. Final comparism as regards the appearance of both doughnuts showed from 40% of the respondents that doughnut A (Sugar Sweetened) had a better appearance. 20% of them however believed that doughnut B (Date Sweetened) looked better than the doughnut sweetened with sugar and a last 40% of them didn't see any significant difference in the appearance of both doughnuts.

Keywords: Sensory evaluation, dates, sugar, doughnuts

1. INTRODUCTION

A doughnut is a fried dough that has been leavened. It is a popular sweet snack in many countries, and it can be cooked at home or purchased from bakeries, supermarkets, and franchised specialty sellers. Rings, balls, flattened spheres, twists, and other forms are examples of various shapes of doughnut. The ring doughnut and the filled doughnut, which are injected with fruit preserves, cream, custard, or other sweet fillings, are the two most prevalent types. Doughnuts can be glazed with sugar icing, spread with icing or chocolate, or sprinkled with powdered sugar, cinnamon, sprinkles, or fruit after they've been fried. They are frequently served with coffee, although they can also be served with milk. Doughnuts are typically deep fried from a flour dough, but other batters can be used as well. For different varieties, different toppings and flavorings are applied, such as sugar, dates, chocolate, or maple glaze. Water, leavening, eggs, milk, sugar, oil, shortening, and natural or artificial flavors may also be used in doughnuts.



Figure 1: A Glazed Yeast-Raised Ring American-Style Doughnut (Amos, 2010).

Sweeteners are food additives that are used or intended to be used as a tabletop sweetener or to lend a sweet taste to food (Mitchell, 2008). Tabletop sweeteners are items that include any allowed sweetener and are marketed to the final consumer. Sweeteners are divided into two categories: high intensity and bulk. High-intensity sweeteners have a sweet taste but are noncaloric, add little weight to meals, and have a higher sweetness than sugar, thus they're used in small amounts. Bulk sweeteners, on the other hand, are generally carbohydrates that provide energy (calories) and bulk to food. These have a sweetness similar to sugar and are used at similar quantities. Because the latest dietary guidelines require that total added sugar be limited to 10% of total daily calories, health-conscious people are looking for natural alternatives to sweeten food. Many regulatory organizations have examined the association between sweeteners and negative health effects for many years, and many sweeteners have been permitted as food additives after comprehensive safety tests and the establishing of safe levels of use.

Sweeteners	High-intensity (non-nutritive)	Synthetic artificial	Acesulfame Alitame Aspartame Cyclamate		Neotame Saccharin Sucralose	
		Semisynthetic	Neohesperidine dihydrochalcone			
		Natural	Glycyrrhizin Stevioside Thaumatococin			
	Bulk (nutritive)	Caloric	Sucrose Molasses Honey and maple syrup			
			Starch-derived sweeteners			Glucose Fructose
		Low-caloric	Sugar alcohols	Monosaccharides		Erythritol Mannitol Sorbitol Xylitol
				Disaccharides		Isomalt Lactitol Maltitol
		Hydrogenated starch hydrolyzates (HSH)				
		Tagatose				

Figure 2: Classification of sweeteners. (Yebara-Biurrun, 2005)

The date palm, *Phoenix dactylifera*, is a flowering plant species in the *Arecaceae* palm family that is grown for its tasty, sweet fruit. The species is commonly farmed in Northern Africa, the Middle East, and South Asia, as well as being naturalized in many other parts of the world. Date trees typically reach a height of 21–23 meters, either alone or in clumps with multiple stems coming from a single root system. Date fruits (dates) are oval-cylindrical in shape, measuring 3 to 7 centimeters in length and 2.5 centimeters in diameter, and ranging in color from bright red to bright yellow, depending on variety. Dates are exceedingly sweet and are eaten as sweets on their own or in confections because they contain 61–68 percent sugar by mass when dried.



Figure 3: Date Palm (Shebs, 2005)

1.1 Aim and Objectives

The aim of this research is to undertake a sensory evaluation of doughnuts made with dates instead of refined sugar as a sweetener. The objectives of the study are to:

- produce a doughnut made with 50% dates and 50% sugar.
- produce a doughnut made with 20% dates and 80% sugar.
- produce a doughnut made with 80% dates and 20% sugar.
- produce a doughnut made with 100% dates.
- produce a doughnut made with 100% sugar.
- examine the reaction of respondents to doughnuts made with dates and sugar as a sweetener in their varied amounts.

2. LITERATURE REVIEW

2.1 Conceptual Framework

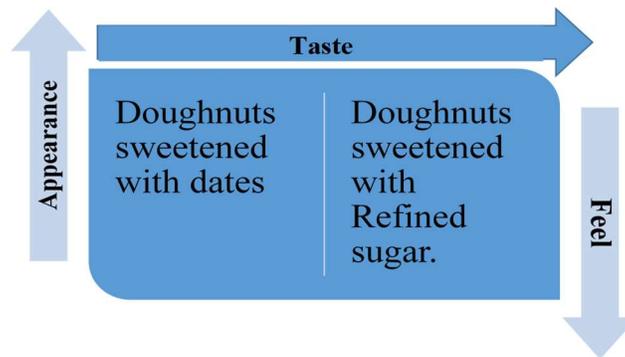


Fig 4: Conceptual Framework

2.2 Theoretical Framework

2.2.1 Theory of consumer consumption values

The theory focuses on consumer values, explaining why people buy or don't buy certain products, why they prefer one product type over another, and why they prefer one brand over another.

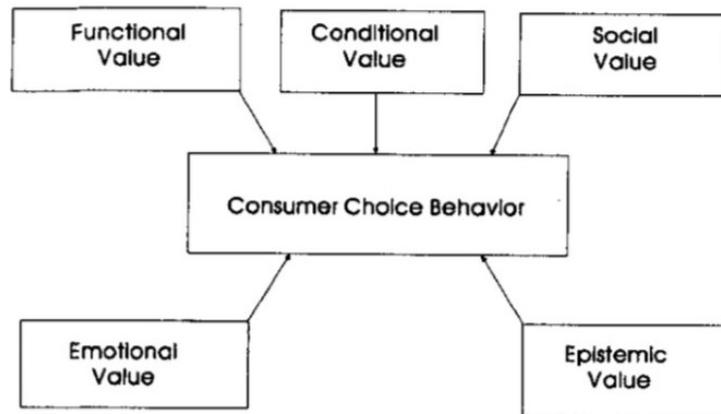


Figure 5: Consumer Consumption Value.

Functional Value

The perceived usefulness gained by a product's potential for functional or physical performance is defined as its functional value. A product's functional value is determined by the presence of key functional or physical characteristics. A profile of chosen qualities is used to determine functional value. Traditionally, the fundamental driver of customer choice has been assumed to be functional value. The functional value of a product can be determined by looking at its attributes or traits (Ferber, 1973), such as reliability, durability, and pricing. For example, the fuel economy and maintenance history of a vehicle may influence a purchase choice.

Social Value

The perceived benefit gained by a product's identification with one or more specific social groupings is known as its social value. A product's social worth is determined by its affiliation with stereotypical demographic, socioeconomic, and cultural-ethnic groups. A profile of choice images is used to determine social value. Highly conspicuous products (e.g., clothing, jewelry) are frequently influenced by social worth. A certain brand of automobile, for example, may be chosen for its social image rather than its mechanical performance. Even things that are commonly considered to be functional are regularly chosen based on their social significance. A product's symbolic or conspicuous consumption value has been known to exceed its functional utility (Veblen, 1899). Hyman (1942) was a pioneer in reference group research, arguing that group membership had an impact on individual behavior. Finally, Rogers (1962) and Robertson (1967) established the role of social values in consumer choice as a result of interpersonal contact and information distribution in their studies on opinion leadership and diffusion of innovations.

Emotional Value

A product's emotional value is defined as the perceived utility derived from its ability to elicit emotions or affective states. When a product is connected with specific sentiments, or when it causes or perpetuates those feelings, it gains emotional value. The emotional worth of a product is determined by a profile of feelings connected with it. Emotions are typically related with products and services (e.g., the romance aroused by a candlelight dinner, the fear aroused while viewing a horror movie). Aesthetic products are frequently related with emotional worth (e.g., religion, causes). More concrete, ostensibly practical objects, on the other hand, have emotional worth. Some meals, for example, evoke feelings of comfort when linked to childhood memories, while consumers are frequently said to have "love affairs" with their automobiles.

Epistemic Value

The perceived benefit derived from a product's ability to inspire curiosity, give novelty, and/or satisfy a demand for knowledge is known as epistemic value. Questionnaire items pertaining to curiosity, novelty, and knowledge give a product epistemic value. Completely novel experiences are unquestionably epistemic. A product that delivers a simple change of pace, on the other hand, can have epistemic value. The consumer may choose the product because he or she is bored or satisfied with their current brand (as in trying a new sort of coffee), is intrigued (as in visiting a new nightclub), or wants to learn more about it (as in experiencing another culture). Theory and various significant areas of research have shaped our understanding of epistemic values. Product search, trial, and switching behaviors have been linked to exploratory, novelty-seeking, and variety-seeking reasons (Katz and Lazarsfeld, 1955; Howard and Sheth, 1969; Hansen, 1981; Hirschman, 1980).

Conditional Value

The perceived utility acquired by a product as a result of the unique situation or combination of circumstances confronting the decision maker is known as conditional value. In the existence of antecedent physical or social contingencies that enhance a product's functional or social worth, it gets conditional value. A profile of choice contingencies is used to calculate conditional value. The usefulness of a product is frequently contingent on the situation. Some things, for example, are only used during the holiday season (e.g., Christmas cards), while others are connected with once in a lifetime occasion (e.g., a wedding gown), and yet others are only utilized in emergency situations (e.g., ambulance service).

Several areas of research have also influenced conditional value. Howard (1963) emphasized the relevance of learning that occurs as a result of experience with a given circumstance. Howard and Sheth (1969) built on Howard's previous work by characterizing construct inhibitors as non-internalized forces that obstruct purchasers' desires. Sheth (1974) formalized the idea of inhibitors in his model of attitude-behavior link in the form of anticipated scenarios and unexpected happenings. A number of researchers during the 1970s investigated the predictive ability of situational factors recognizing that behavior cannot be accurately predicted on the basis of attitude or intention alone, (Belk, 1974; Sheth, 1974; Park, 1976; Bearden and Woodside, 1977).

In different choice contexts, the theory's five consumption values make different contributions. For example, a consumer might decide to buy bitcoins as an inflation hedge (functional value) as well as a sense of security (emotional value). Social, epistemic, and conditional value may have little influence. A gold bracelet, on the other hand, might be purchased by the same customer because it will be admired by people whose taste she or he admires (social value). The other four consumption values are unlikely to have much of an impact.

2.3 Dates as a substitute for refined sugar

According to scientific evidence, increased sugar consumption is one of the primary causes of dental cavities, glucose intolerance, diabetes mellitus, cardiovascular diseases, obesity, hypertension, and behavioral disorders such as hyperactivity in children. In many parts of the world, added sugar consumption is significantly higher than the dietary guidelines of health organizations. Sucrose is the most widely used sweetener in a wide range of beverages. Sugar cane or sugar beets generate the white crystalline material we know as sugar. However, as technology advances, more and more research and projects on replacing these types of sweeteners are being carried out.

Furthermore, numerous researchers have used dried fruits to sweeten traditional recipes since the sugar incorporated within the structure of intact fruits differs from that of added sugar. Syrups, spreads, sugar, and flour made from dates have all been used as sweeteners in food. In one serving, a pitted Medjool date has 66 calories, 18 grams of carbohydrates, 16 grams of natural sugar, and 2 grams of fiber. It contains minerals such as copper, magnesium, calcium, and B vitamins. Adding a few dates, or chopped pitted dates, to a meal can boost the fiber content quickly. This provides a number of benefits, including the maintenance of the digestive system. Dates are a popular fruit in the Middle East, particularly in the Persian Gulf region. Due to its unique features and components, it is a one-of-a-kind fruit. Iran is one of the world's top producers of dates, producing around 800,000 tons each year. Date could be utilized as a component in food processing businesses due to its high nutritional content and low cost (Dowson and Aten, 1962).

Dates are abundant in carbohydrates and contain natural sugars and nutritional fibre (Shafiei, Karimi and Taherzadeh, 2010). This fruit has a natural sweetness and a flavor that is distinct

and delicious (Đorđević and Đurović-Pejčev, 2015). The sugars found in dates are primarily fructose and glucose. In comparison to sucrose, they have more health benefits and are sweeter. On the one hand, the sugar's naturalness aids sugar absorption in the body, while on the other hand, it is effective in reducing several health concerns associated with normal sugar, such as obesity, hypertension, diabetes, and mellitus (Zaid and Arias-Jiménez, 2002). Sugars produce osmotic solutions, which are intense and highly concentrated solutions due to their hydrophilic qualities and appropriate solubility.

The hydroxyl group is formed when sugar molecules form hydrogen bonds with H₂O molecules. To improve viscosity, sweeteners absorb H₂O. The ability of a sweetener to absorb water is determined by its molecular size and weight. Saccharides with a lower molecular weight have a stronger ability to absorb water, resulting in increased viscosity. The use of date syrup in food products has been the subject of several research. Date syrup was employed as a sweetener and flavoring ingredient in ice cream and frozen fruit at varied syrup quantities in a study. It was discovered that the higher the date syrup concentration in the juice, the higher the viscosity and the shorter the melting time. The use of date syrup as a sweetener and flavor in dairy products has been the subject of more research.

This research found that low-fat water cow's milk flavored with date syrup and fermented milk products, such as yogurt flavored with date syrup, produced positive results. In a separate study, a vanilla-chocolate drink was manufactured from milk and water mixed with mashed date and sugar and was found to be superior to the control agent, which was simply sugar (Đorđević and Đurović-Pejčev, 2015; Habibi-Najafi and Alaei, 2006). Because of the growing importance of health and the cautions issued about the use of accessible beverages, the trend toward natural beverages such as fruit juice and non-alcoholic beer has developed in recent years.

3. METHODOLOGY

Sensory assessment is a science that studies, analyzes, and interprets people's reactions to items as they are perceived via their senses. It's a way of figuring out whether product differences are noticed, what causes them, and whether one product is preferred over another. Affective and analytical methods are two broad categories of sensory evaluation (Institute of Food Technologists, 1981). In affective approaches, consumer panels or trained panelists are utilized to answer questions like: Which product do you prefer? Which of the goods do you think is the best? What are your thoughts on this product? How frequently would you buy/use this item? To have more confidence in the interpretation of the results, affective approaches require a significantly bigger panel size than analytical approaches.

Discrimination (or difference) and descriptive approaches are the most frequent analytical methods for sensory evaluation. Discrimination tests can be done to see if products are different, if a specific product feature is different between samples, or if one product has more of a particular feature than another. Discrimination tests can be completed by experienced panelists. Descriptive approaches are used to create more detailed profiles of a product by asking panelists to identify and measure different aspects inside the product. For descriptive methods, trained panelists must be utilized.

3.1 Research Design

The study adopted a descriptive survey design. A descriptive study is concerned with determining the frequency with which something occurs or the relationship between variables

(Bryman and Bell, 2003). Thus, this approach was appropriate for this study, since the researcher intended to collect detailed information through descriptions and was useful for identifying variables and hypothetical constructs. This method provided descriptions of the variables in order to answer the research questions in the study. Survey design also allows comparisons between response from respondents giving the right perspective on the research topic. The choice of this technique was guided by the fact that the case study aims at generating findings, which would facilitate a general, understanding and interpretation of the problem. The population for this study was 10 lecturers of hospitality management technology, Yaba College of Technology, Yaba, Lagos State which would act as our experienced panelist.

4. DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Data Analysis

Same/Different difference testing method followed by a preference test was adopted in the study. The Same/Different method was adopted to be able find out if there was a sensory difference among the doughnuts made with dates and sugar in the varied quantities. While the preference test was done as a follow-up on the results of the Same/Different method to select the doughnuts with better appearance, taste and feel. Descriptive statistical tools such as tables, frequency distribution and percentages were adopted. This is to ensure that the data presentation and analysis was carried out in a very clear and simple manner. Summary of table presentations and percentage analysis were carried out as data analysis for the descriptive aspects of the research instrument while Statistical Package for Social Science (SPSS), 23.0 versions were used for relevant inferential statistical analysis aspect of the study whose aim is to test the stated research hypotheses for either acceptance or rejection at the end. The findings from the field exercise were used to answer the research questions and test the stated research hypotheses, upon which conclusions and recommendations were based as final output of the study.

4.2 Data Presentation and Interpretation

A total of 10 questionnaires were administered, retrieved and analyzed. This gave a response rate of 100%. The background characteristics of the respondents are presented in Table 1.

Table 1: Socio-Demographic Status

Variables	Frequency (n=10)	Percentage (%)
Age		
31 - 40	4	40
41 - 50	3	30
51 - 60	3	30
Gender		
Male	4	40
Female	6	60
Ethnic Group		
Yoruba	6	60
Igbo	1	10
Others	3	30
Educational Qualification		
Variables	Frequency (n=10)	Percentage (%)
HND/PGD/BSC	7	70
Masters	2	20

PhD	1	10
Experience		
5 - 10 years	4	40
Above 10 years	6	60

Table 2: Experienced Panel (Lecturers) response to questions

Doughnuts sweetened with refined sugar was labelled as Doughnut A

Doughnuts sweetened with dates was labelled as Doughnut B

Variables	Frequency (n=10)	Percentage (%)
Which of these doughnuts was sweetened with sugar?		
Doughnut A	10	100
Doughnut B	0	0
Which of these doughnuts was sweetened with dates?		
Doughnut A	0	0
Doughnut B	10	100
Which of these doughnuts taste better?		
Doughnut A	4	40
Doughnut B	4	40
No significant difference	2	20
Which of these doughnuts has a better feel and texture?		
Doughnut A	6	60
Doughnut B	2	20
No significant difference	2	20
Which of these doughnuts has a better appearance?		
Doughnut A	4	40
Doughnut B	2	20
No significant difference	4	40

5. RESULTS

The result of this study showed that majority (40%) of the respondents were between 31-40 years old. This justified the fact that the respondents were well aged as experienced panelist. Also, majority were Females (60%), while (30%) were males. The reason for higher proportions among the female respondents might be because there are more female staff in the hospitality industry. A higher percentage of the respondents (60%) were of the Yoruba ethnic group while the remaining were sparsely found among the Igbo (10%) and others (30%). This can be attributed to the fact that the study was carried out in an area predominantly populated by the Yoruba's. Also, as regards the educational qualifications of the respondents, it was found that 70% of them had qualifications between HND, PGD and BSC while 20% of them possessed masters' degrees and a last 10% of them had PhD certification. Further enquiry showed that 40% of the respondents had experience of 5 – 10 years in the hospitality industry while 60% of them had experiences of above 10 years in the hospitality industry. This extremely justified the selection of the population as experienced panelist to carry out the comparative analysis.

In a bid to ensure that the process of comparism between the both samples was credible and to validate the experience of the sample population, the doughnuts sweetened with sugar and dates was anonymously labelled as doughnut A and doughnut B respectively before carrying out the process. After presenting the doughnuts to the panelist to look at, taste and feel them 100% of the respondents could adequately identify doughnuts sweetened with sugar and distinguish it from that sweetened with dates. When further enquiry was made, 40% of the respondents stated that doughnut A (Sugar Sweetened) tasted better, 40% of them however believed that doughnut B (Date Sweetened) tasted better while 20% of them didn't see a significant difference in the taste of both doughnuts.

As regards the texture, 60% of the respondents stated that doughnut A (Sugar Sweetened) had a better feel and texture, 40% of them believed that doughnut B (Date Sweetened) had a better feel and texture while 20% of them didn't see a significant difference in the feel and texture. Final comparism as regards the appearance of both doughnuts showed from 40% of the respondents that doughnut A (Sugar Sweetened) had a better appearance. 20% of them however believed that doughnut B (Date Sweetened) looked better than the doughnut sweetened with sugar and a last 40% of them didn't see any significant difference in the appearance of both doughnuts.

6. CONCLUSION

After close study of literature and carrying out of the required practical, the researcher can deduce that:

- Doughnuts sweetened with sugar doesn't have significant difference in appearance from doughnuts sweetened with dates.
- The taste of doughnuts sweetened with sugar to that sweetened with dates is subjective on the person carrying out the taste and is also subject to other factors like situation, mood, labelling etc.
- Doughnuts sweetened with sugar tends to have a smoother feel compared to doughnuts sweetened with dates.

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