

Research Article

Halwa Candy: Healthy Choice for Fruit Alternative

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Abstract: Since, the COVID-19 outbreak, people are encouraged to eat healthy food including fruits. Eating fruit has many health benefits, for instance, lowering the risk of a certain disease. However, nowadays, not all people like to eat fruits which are very crucial for nutrients needed to maintain body health. Fruits can be consumed in fresh, frozen, canned, dried, or dehydrated forms. Fruits can also be consumed whole, sliced into pieces, pureed, mashed, or cooked. Therefore, halwa candy was introduced as an alternative, natural sweet for edible fruit. Halwa candy is produced for all ages group to enjoy the fruits in the form of candy and at the same time obtain its health benefits. It is convenient for the consumers to bring the Halwa candy around and enjoy it at any time of the day since the size of the candy is small-sized candy and portable. The ingredients are mainly halal gelatin, fruit extracts and honey. Thus, all the ingredients selected are halal and organic in order to make sure that the candy is healthy to consume. These products can find good marketable value in the future.

Keywords: fruit candy; halal; healthy choice; product development



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1. INTRODUCTION

With the COVID-19 infection, the majority of people have become interested in eating a healthy diet, taking supplements and searching for other alternatives to defend against the infection. COVID-19, also known as Corona Virus Disease, is an infectious disease caused by the SARS-CoV-2 virus which also can be transmitted via droplets or aerosols, airborne and surface transmission (World Health Organisation, 2021). An individual who contracts the virus will suffer from mild to severe respiratory illness such as cardiovascular disease, diabetes, or chronic respiratory disease. Amidst the COVID-19 outbreak, Vitamin C is one of the products that are high in demand. However, a study is

carried out to ascertain whether a higher chance of testing positive for the viruses that cause COVID-19 correlates with lower blood vitamin levels (Meltzer, et al., 2020) and there is no such correlation between the two. Even though no foods or dietary supplements can prevent or cure COVID-19 infection, vitamins are still high in demand and stocks are depleted at a faster rate at every store and supermarket. It has been proven that eating a healthy diet is vital for the immune system in the body. Eating a nutritious diet equates to getting enough nourishment for the body, which lowers the risk of obesity, heart disease, diabetes, and various cancers as well as other health issues.

Obesity is defined as abnormal or excessive fat accumulation that possesses a health risk. The obesity epidemic continues to worsen worldwide and threatens to be the commonest non-communicable disease. Brunei Darussalam (herein called Brunei), has seen a huge rise in the prevalence of obesity. According to a survey conducted by United Nations International Children's Emergency Fund (UNICEF) in 2019, Brunei Darussalam is ranked as the second highest in Southeast Asia at 14.1% where children aged between 5 to 19 years old are obese (Othman, 2020). The rate of obesity among children is also worrying because it is estimated to increase by 100 per cent between 2020 and 2035 if no action is taken to overcome this problem (Kon, 2023). Several reasons can contribute to the rate including high sugar intake in daily consumption, absence of fruits in their diet, the rising costs of healthy food and as a result, they chose to eat cheaper junk food. The alarming rate of obesity in Brunei Darussalam has driven our team into the invention of Halwa Candy. Halwa candies are made with mainly halal gelatin, fruit extracts and honey. As a result, people who do not like fruits can consume Halwa Candy as an alternative. Additionally, Halwa candy are made in a small-sized form to make them portable. Halwa candy caters to all age groups and offers a remedy for people with sweet teeth, those who are obese and sick.

Candy is enjoyed worldwide by people of all ages and has remained popular, with a significant demand in the global market for value-added functional candies (Lata, O. J., & Anand, 2018; V. & Dhanalaksmi, 2017). Besides, producing innovative candy with better nutrition may bring a new kind of candy to the existing assortment of candies available in the market (Kumar, Ranote, & Goraya, 2017; V. & Dhanalaksmi, 2017). Moreover, fruits are a rich source of nutrients and health-promoting phytochemicals, however, it is not possible to consume all these products in fresh condition because of their perishable nature (Lata, O. J., & Anand, 2018). Therefore, the preparation of candy from various fruits gives a better option for their processing and preservation.

2. MATERIAL & METHOD

2.1 Material

Halwa Candy was employed for this research. The main ingredients in the production of Halwa candy are orange fruit juice, stevia natural sweetener, honey and Halal gelatine, specifically fish gelatine.

2.2 Method

The study conducted a marketability analysis by sending out an online survey to the public. Then, followed the sensory evaluation of halwa candy by requesting a few judges' critiques to try tasting the given Halwa Candy and providing feedback for it. The study also conducts laboratory food test analysis.

2.3 Preparation of Halwa Candy

The Halwa Candy was prepared by adding 80 grams of orange juice, 14.2 grams of honey, 3.6 grams of stevia natural sweetener and 9g of fish gelatine with 21.25 grams of water. Only the fruit juice, honey and stevia natural sweetener were added into the saucepan and heated up on the stove at medium heat until the mixture reached boiling. After boiling the mixture, the mixture was set to cool for 3 minutes and ensured it was warm enough to melt the fish gelatine. The fish gelatine was bloomed by mixing it with water until fully dissolved. The bloomed gelatine was added to the warm orange fruit juice mixture. The mixture was then poured into silicone moulds and cooled in the fridge for 30 minutes. The candies were popped out from the silicone mould carefully and placed in an airtight container to retain freshness. It has achieved the desired texture, consistency and taste and hence this attempt resulted to be the best result among the three attempts that were performed.

2.4 Sensory Evaluation of Halwa Candy

Using the best-formulated Halwa Candy that was made, it was distributed to a total of seven-judge critiques. The judges received the sensory evaluation sheet of the sample identified containing a hedonic scale of 10 points, ranging from “strongly dislike” (1) to “strongly like” (10) which were attributed to attributes of colour, texture, flavour and appearance as well as overall acceptance. This was to determine the quality while also assessing the market acceptability of the candy.

2.5 Market Acceptability Test

This research was conducted using a quantitative method in which a survey was distributed to general people aged 16 to above 45 years and the total number of respondents is 53 people. The survey was formed using Google Forms and distributed online through Whatsapp

2.6 Laboratory Analysis

The Halwa Candy was analysed at the Ibnu Sina Laboratory, Universiti Islam Sultan Sharif Ali, Sinaut Campus on April 18th 2022. Various food tests were analysed for protein, fat, starch and reducing sugar. Each test was carried out with three repetitions. The protein content was analysed using the biuret test, fat using the ethanol emulsion, the presence of starch using iodine, and reducing sugar using the Benedict.

3. FINDINGS

3.1 Halwa Candy

The final product of Halwa Candy is illustrated in Figure 1.



Figure 1. Halwa Candy

3.2 Sensory Analysis

Table 1 displays the sensory scores of Halwa Candy provided by each judge for each attribute as well as the average score.

Table 1. Mean Sensory Score of Halwa Candy

Sensory Attribute	1 st Judge	2 nd Judge	3 rd Judge	4 th Judge	5 th Judge	6 th Judge	7 th Judge	Avg.
Colour	7	7	8	10	8	10	9	8.4
Flavour	7	9	7	10	7	8	8	8
Texture (Softness)	7	8	7	10	8	7	8	7.9
Taste	8	7	8	10	7	7	9	8
Overall Acceptance	7	8	7	10	8	8	9	8.1

3.3 Market Acceptability of the Halwa Candy

According to the results, based on the responses from the respondents through the online questionnaire, the socio-demographic features of respondents which illustrates in Table 2.

Table 2. Respondents' Socio-Demographic Details

Variable	Description	<i>f</i>	%
Gender	Male	17	32.1
	Female	36	67.9
	Total	53	100
Age	16 – 19 years old	3	5.7
	20 – 29 years old	38	71.7
	30 – 39 years old	9	16.9
	45 and above	3	5.7
	Total	53	100.0
Occupation	Student	38	71.7
	Government	6	11.3
	Private	4	7.5
	Self-employment	1	1.9
	Other	4	7.5
	Total	53	100
Salary	Below 1000	44	83
	1001 – 2000	3	5.7
	2001 – 3000	2	3.8
	3001 – 4000	4	7.5
	Total	53	100.0

Table 2 shows that the male respondents were 32.1 percent, and women were 67.9 percent. The age of respondents between the 16-19 age group was 5.7 percent, and the biggest domination was the 20-29 age group, which reached 71.7 percent, and the age group 30-30 years was as much as 17 percent. Respondents with student backgrounds were 71.7 percent, the governments were 11.3 percent and private occupations with 7.5 percent, self-employment was 1.9 percent and other occupations resulted with a percentage of 7.5 percent.

Table 3 below tabulated the respondent's response which shows 98% of respondents were not aware that Brunei has local candy products. It also indicates that the Bruneian population is unaware of the nation's unique sweets products.

Table 3. Awareness of Local Candy Products in Brunei

Variable	Description	<i>f</i>	%
Do you aware that Brunei has produced local candy?	Yes	1	2
	No	52	98
	Total	53	100

The majority of respondents, as shown in Table 4, believed that Halwa Candy is marketable in Brunei because, among other things, Bruneian communities are very supportive of local products. As a result, selling local goods will not be difficult. Moreover, most of the responses stated that Bruneians are more into sweet products and that Halwa Candy is healthy. Both elements create an opportunity. As such, marketability in Brunei can be promising.

Table 4. Market Acceptability of Halwa Candy

Variable	Description	<i>f</i>	%
It is possible to market halwa candy in Brunei?	Yes	50	94.3
	No	3	5.7
	Total	53	100

Table 5 shows that the majority of respondents (69.8 percent) believed that there is competition for Halwa Candy in Brunei, while the remaining respondents (30.2 percent) disagreed, stating that there was no competition for Halwa Candy. According to one of the responders, Halwa candy is a relatively new product and is not well known to the general population. Some of the responses stated that the competition may be from the preferences of imported products, price-to-benefit ratio and long-term sustainability.

Table 5. Threats of Competitors of Halwa Candy

Variable	Description	<i>f</i>	%
Will it be a threat from competitors for Halwa Candy selling in Brunei?	Yes	37	69.8
	No	16	30.2
	Total	53	100

The questionnaire consists of a question asking for suggestions if there are any improvements needed to be done for Halwa Candy. Most responses in Table 6, state that many small local businesses are and have been significantly dependent upon their marketing/advertising and marketing and advertising is the main element to take into consideration and also packaging should be attractive to consumers. Packaging helps better market the product; hence, many companies redesign the packaging to maintain consumer appeal (Lata, O. J., & Anand, 2018).

Table 6. Suggestions for Halwa Candy

Variable	Response
Are there any suggestions or recommendations for Halwa Candy?	Marketing and advertising
	Packaging

3.4 Laboratory Analysis

3.4.1 Benedict's Test- Test for reducing sugars

Benedict's test is a simple and extensively used procedure for determining the presence of reducing sugars in a solution, such as glucose and fructose. To dissolve the sample, add 2cm³ of distilled water to a test tube after cutting and crushing just a small amount of the food sample to be analysed. After that, add 2cm³ of Benedict's solution to the sample, thoroughly mix it, and either boil

or soak the test tube in hot, boiling water for 2 minutes. Remove the test tube from the water bath and let it cool for two minutes. We also look at the colour of the solution. There are decreasing sugars. The solution initially turns from green to yellow to orange. Final result of Benedict's test of Halwa Candy illustrated in Figure 2.



Figure 2. Result of Benedict's test

3.4.2 Ethanol Emulsion Test - Test for Fats

The ethanol emulsion test is a simple and commonly used technique for determining the presence of fat in food samples. The nonpolar molecules that makeup fats are soluble in ethanol and other organic solvents but insoluble in water. The sample is crushed, placed in a dry test tube, and then 2cm³ of ethanol is added. The sample combination is then well shaken. Fill the test tube with 2cm³ of pure water, and then stir thoroughly. The results were negative since the solution remained clear shown in Figure 3, indicating that there were no fats present.



Figure 3. Result of Ethanol Test

3.4.3 Biuret Test - Test for Proteins

A simple but widely used method for determining if proteins are present in a food sample is the Biuret test. Amino acids form the building blocks of proteins, which are macromolecules joined by peptide bonds. The Biuret test depends on copper ions' capacity to interact with peptide bonds in an alkaline environment. A small amount of the food sample must be added to a test tube before a few drops of the Biuret reagent are added. The Biuret reagent is a combination of copper sulphate and sodium hydroxide. When the Biuret reagent is added to the food sample, it reacts with the peptide bonds in the protein molecules, forming a complex between the copper ions and the peptide bonds. If proteins are present in the sample, the solution will change colour from blue to purple. The intensity of the colour change is proportional to the concentration of proteins in the sample. This test indicates that our product includes protein since it developed a purple, violet, or lilac hue as shown in Figure 4.



Figure 4. Result of the Biuret test

3.4.4 Iodine Test - Test for Starch

A standard test for identifying starch in food is the iodine test. Iodine combines with the molecules of starch to produce a blue-black colour, making it a fast and precise approach to identifying starch. Food samples should be cut and crushed on a pristine white tile before being placed in a test tube with 1 cm³ of iodine solution and 2cm³ of water to dissolve it. Iodine test results show that if starch is present in a brown solution, it will turn blue-black; otherwise, it will remain brown. The result of this experiment demonstrates that our product contains no starch given that it produced a brown solution as shown in Figure 5.



Figure 5. Result of Iodine test

4. DISCUSSION

4.1 Halwa Candy Ingredients

4.1.1 Oranges

Oranges are a type of citrus fruit that is high in nutrients and low in calories. When oranges are included in a healthy and diverse diet, they maintain robust, clear skin and can help minimise a person's risk of a variety of ailments (Denopol, 2022). Oranges have grown in popularity due to their inherent sweetness, the large diversity of varieties, and diverse applications (Ware, 2019; Denopol, 2022). They can be eaten whole, added to juices and marmalades, or the zested peel can be used to impart tart flavour to pastries and desserts (Denopol, 2022; Ware, 2019). This well-known citrus fruit is well-known for its high vitamin C content. Oranges, on the other hand, include a wide range of other plant components and antioxidants that can reduce inflammation and fight disease (Ware, 2019).

4.1.2 Honey

It is well-known that honey has nutritional advantages. Honey can be used as a good substitute for sugar or sucrose due to its low glycaemic index, high antioxidant content, and role as a significant

supply of carbs. Honey has a lot of nutritional and health benefits. Its low glycaemic index makes it a sweeter but healthier substitute for sweeteners, and its antibacterial capabilities are extremely helpful in almost every aspect of infection and healing. Honey's therapeutic advantages have been related to its anti-inflammatory and antioxidant properties, as well as to its capacity to boost the immune system. Additionally, adding honey to meals increases the nutritional value of the item and extends its shelf life (Rana, et al., 2018).

Honey is a unique insect product that is high in carbohydrates but low in protein and fat. Honey's nutritional value is determined by the levels of glucose and fructose it contains (Sahlan, et al., 2019). The pockets of nectar from various flowers and various types of bee honey produce tasty treats, which are thick with gold till black. The flavour and perfume of the nectar are significantly influenced by the type of flower from which it was harvested (Kek, Chin, Yusof, Tan, & Chua, 2017).

Honey contains a significant amount of sugar in addition to pollen and other digestive enzymes. Aside from these vitamins, honey also contains minerals including calcium, salt, potassium, magnesium, iron, and even radium. Other vitamins found in honey are vitamins A, B1, and B2. Due to its high level of usefulness, honey contains antibiotics as well as other organic acids such as malic, tartaric, citric, lactic, and oxalic (Sahlan, et al., 2019). Honey is essential for the growth of newborn infants because it includes folic acid, which helps improve blood composition by increasing the number of erythrocytes (Sahlan, et al., 2019), and haemoglobin. Therefore, offering children honey can increase their haemoglobin levels (Bradschneider & Crailsheim, 2010).

According to (Alvarez-Suarez, Giampieri, & Battino, 2013), honey is employed in a wide range of vivid ways in various products. The component honey can be found in many goods. The purpose of the use of honey in food products is that sweets taste like that can kids enjoy and consume frequently.

4.1.3 Stevia

Sweeteners are one of the most important substances in the food industry (Gasmalla, Yang, & Hua, 2014). Stevia is widely utilised as a sweetener and flavour enhancer in the food and beverage sectors (Naik & Poyil, 2022). The second-largest market is the one for health products. The by-products market is the third-largest. To enhance the flavour of regional teas, medicines, meals, and beverages, stevia extract is widely utilised in countries such as Japan, China, Russia, Korea, Paraguay, Argentina, Indonesia, Malaysia, Australia, and New Zealand, among others. (Gasmalla, Yang, & Hua, 2014; Naik & Poyil, 2022). An all-natural sweetener is stevioside. Since stevia extract comes from a natural source, people who care about their health may prefer it to other low-calorie sweeteners (saccharin, aspartame) (Gasmalla, Yang, & Hua, 2014; Díaz-Montes, García-Depraet, & Castro-Muñoz, 2021).

Because stevia extracts can be up to 300 times sweeter than sugar, it has become more and more popular as a low-carb and low-sugar alternative (Naik & Poyil, 2022). According to medical studies, Stevia could also aid in lowering blood pressure and obesity (Naik & Poyil, 2022). Stevia is a popular natural sweetener among those following carb-restricted diets because it does not affect blood glucose levels (Hossain, Islam, Islam, & Akhtar, 2017; Gasmalla, Yang, & Hua, 2014).

4.1.4 Fish Gelatine

A particular kind of gelatine called "fish gelatine" is made from the skin, scales, and bones of fish. Due to its halal and kosher certification and suitability for people who follow a vegetarian or vegan diet, it has grown to be a well-liked substitute for regular gelatine, which is made from animal collagen. The use of fish gelatine in gummy candies has several advantages. Clearer appearance since fish gelatine has a lower melting point than conventional gelatine, it produces gummy candies that are less cloudy or foggy. Additionally, fish gelatine can enhance texture. Compared to standard gelatine, fish gelatine can produce a softer and more elastic texture in gummy candies. Due to fish gelatine's greater

resistance to heat and humidity, gummy candies created with it have a longer shelf life than those made with standard gelatine. Collagen, which is abundant in fish gelatine and beneficial for bone, skin, and joint health. Fish by-products are used to create fish gelatine, which is a more environmentally friendly alternative to standard gelatine, which is made from animal collagen. Overall, the usage of fish gelatine in gummy candies can offer several advantages, such as improved look, texture, shelf life, and potential health advantages.

4.2 Sensory Evaluation of the Halwa Candy

A total of seven judges critique the samples of Halwa Candy in terms of taste, texture and colour to be rated accordingly out of 10, then individually calculated to find the average score of each judge. As can be observed from Table 1, all the average scores of sensory evaluations are around 7.9 to 8.4. This appears that there is a net positive response towards the colour, flavour, softness and overall opinion of Halwa Candy as a product.

The quality of food products is strongly influenced by their colour. Given that, colour is an attribute that can draw customers towards any product and this explains that the visual evaluation of colour usually takes place first out of all the other categories (Winarmo, 1997). According to (Huang, 2023) it is found that individuals preferred foods with warm-colour filters (red and orange) over cool-colour filters (green and blue). From the study's findings, it can be inferred that there is a general tendency of individuals to prefer eating food with warm-colour themes compared to cold-colour themes. This is supported by the results of the colour evaluation in the sensory analysis by the seven judges to be an average of 8.4. This indicates that the orange colour of the Halwa Candy is seen as an acceptable colour as a candy product for consumer purchase.

Food acceptability is highly influenced by texture, this is because the enjoyment of eating is influenced by the sensory qualities experienced in the mouth. (Mahat, et al., 2020; Suebsaen, Suksatit, Kanha, & Laokuldilok, 2019; Zavistanaviciute, et al., 2022). The texture in the sensory analysis is judged by the softness of the halwa candy. The softness of the halwa candy was influenced by the amount of gelatine and honey used during the preparation process. The amount of fish gelatine used in the preparation of halwa candy has increased from the first attempt. This is because the desired gummy texture was not achieved with the low gelatine content. As fish gelatine directly contributes to the softness and chewiness texture of candy products, an increase in its use as an ingredient will more easily yield the desired texture. As such, the use of fish gelatine was increased in the finalized recipe. The trial and error have finalized that the amount of honey was reduced from the first attempt. This is due to the high amount of water content in honey. Water content in candy affects the structure of hard candy. As halwa candy is a type of hard candy due to its gummy-like texture. The structure and the gummy-like texture of the Halwa Candy are important elements to consider. The hard candy will not be able to solidify if the moisture content is too high (Sahlan, et al., 2019), which will result in either the creation of too soft or it will easily melt. Due to the high-water content in honey. The results are finalized by reducing the honey in preparation to reduce the water content and have a more stabilized structure and a soft and pleasant gummy-like texture. This correlates with the positive scores of the softness of the halwa candy with an average of 7.9 and this shows that the Halwa Candy has an acceptable and affable gummy-like texture.

The flavour plays a significant role in deciding how likeable a product is, leading to its demand and marketability. This is observed in the sensory analysis of Table 1 which shows the positive response to the orange flavour of Halwa Candy. This indicates that the selected flavour for the product was both accepted and likeable by all seven judges. A similar observation can also be found in the taste of the product, which is also an important factor in its likeability. This is evident by the responses found in the questionnaire which highlight the general affinity for sweet flavour profiles. To exemplify, one response states that the general population of Brunei tend to like sweet products. The Halwa Candy is designed to have a sweet flavour and taste to match this pattern. The sensory analysis of both the

flavour and taste of halwa candy as shown in Table 1 scored a high average of 8, which suggests that the Halwa Candy has a likeable flavour and taste.

In short, candy and toffee are important confectionery products (Lata, O. J., & Anand, 2018). It is prepared from different fruits and vegetables that are naturally very nutritious as they possess most of the constituents of the fruit and vegetable from which they are prepared. These are attractive in stickiness, taste, flavour, colour and overall acceptability and nutritional quality. As Lata, O. J., and Anand (2018) mention that fruit and vegetable candies are becoming more popular due to their great acceptability, and higher nutritional value.

In conclusion, there is a net positive response to the Halwa Candy as indicated by the high score of 8.1 in the average overall acceptance of the product from all seven judges. However, due to the small number of participants, this evaluation cannot be applied to the general opinion of the population of Brunei towards the product. Nonetheless, not a single judge rated any sensory character below 7 out of 10, which indicates that Halwa Candy is of likeable taste and texture. Thus, it can be concluded and argued that Halwa Candy can perform well as a product by satisfying the taste and textural desires of consumers.

4.3 Marketability Test of Halwa Candy

According to Table 3, nearly all participants were unaware of local candy products in Brunei. While it can be suggested that, when applied to a larger population, a high percentage would respond similarly in being unaware of local candy products, it is an inaccurate claim. This is because roughly 70% of survey respondents came from the 20-29 age group as indicated in Table 2. This does not imply that the majority of the unaware respondents would come from this age group. Instead, it means that the responses from other age groups have not been factored in enough to produce accurate results due to the low variety and number of participants. A higher variety and number of participants may significantly affect the results which would provide a more accurate claim. Despite so, only 1 of 53 participants responded in being aware of local candy products. As such, it cannot be ignored that 98% were unaware, instead, it would be correct to rule the results as accurate and reliable only to a certain extent.

Another point of observation is that over 90% of respondents agreed that the tested product would be marketable in the country following Table 4 despite being unaware of local sweets. This response pattern is justifiable following the consensus that demand makes the market. To exemplify, various responses and reasonings from respondents from Table 4 support this theory. Respondents argue that local sweet products like the Halwa candy are relatively new to the local people and thus bring attraction for their uniqueness, health benefits and support for local businesses. However, some have stated that the product's marketability may be temporary or unstable due to the naturally low population of the country. Nonetheless, whilst the results are not fully reliable, it can be safely concluded that the majority of respondents were in support of Halwa candy and are likely to see at least a significant fraction of the same support when applied to the population of Brunei.

There is a shift in support of Halwa Candy as observed in Table 5. Roughly 70% of respondents believe that the product will face competition in the local market. Common responses in Table 5 indicate that Halwa Candy's marketability depends on many variables such as preference for imported products, price-to-benefit ratio and long-term sustainability. This suggests that although there is a largely positive response to and support Halwa Candy, its success depends on more than just the product itself. Several factors other than demand may affect the business of Halwa Candy as highlighted by the responses. This is further exemplified by one response in Table 6, which states that many small local businesses are and have been significantly dependent upon their

marketing/advertising. As such, given the justified responses, the survey's feedback must be weighed considerably in determining the success of Halwa Candy in both the short and long term.

4.4 Laboratory Analysis

4.4.1 Benedict's Test- Test for reducing sugars

Figure 2 reveals the end colour of Benedict's solution in response to a sample of Halwa Candy. The orange colour solution indicates that there is a moderate amount of reducing sugar present in the product. There is an estimated 1.0% to 1.5% grams of reducing sugar in any mass of Halwa Candy. The test results followed expectations, as ingredients like honey and oranges were used, which contain reducing sugars such as fructose. Thus, for every 100g of Halwa Candy, it can be roughly estimated to have 1g to 1.5g of reducing sugar. According to American Heart Association, the recommended daily consumption of sugars (reducing sugars included) is roughly 25g to 36g per day. In comparison with the average sugar content of similar products such as gummy candies which can contain up to 20g of sugar per 100g, Halwa Candy has only a fraction as much. Furthermore, reducing sugars are naturally healthier than simple sugars because it more slowly increases blood glucose levels, unlike simple glucose which spikes the levels instead. As such, Halwa Candy more than safely follows daily sugar intake guidelines while being a healthier alternative than the average candy for its use of reducing sugars. The reason for its sweetness despite the low sugar content is due to the use of the natural sweetener Stevia as a healthy substitute. Nonetheless, it can be concluded that there is a moderate but healthy amount of reducing sugars present in Halwa Candy.

4.4.2 Ethanol Emulsion Test - Test for Fats

Figure 3 shows the result of the Ethanol Emulsion Test when tested with a sample of Halwa Candy. The image indicates that the solution remains a clear colour without any hints of emulsion being present. This result suggests that there are no lipids present in any amount of Halwa Candy. It is unlikely to argue that a minuscule amount of lipids can be present via fatty acid synthesis. This is because, in theory, fructose or sugars can't be converted into lipids without the required enzymes for the necessary processes to take place (Engelking, 2015). Furthermore, the end solution did not reveal any small form of diluted cloudy precipitate that can be used to argue for even a small amount of fatty acids. As such, it is more likely that lipids are not present nor able to form in the Halwa Candy.

4.4.3 Biuret Test - Test for Proteins

The test tube in Figure 4 shows the end colour solution of a sample of Halwa Candy tested for protein using the Biuret Test. The colour shifted from a blue colour to a light lilac colour which indicates a small presence of protein. The standard Biuret method can detect protein concentrations from 0.5mg/ml to 2.5mg/ml (Lindon, Tranter, & Koppenaal, 2017). When compared with the light lilac colour in Figure 4, it indicates that the protein present in the solution must fall closer to 0.5mg/ml rather than 2.5mg/ml in concentration. This is because the darker the end solution colour is to purple; the more protein molecules are present. As the end colour solution in Figure 4 is a light lilac colour instead of a dark purple, it is more likely that the solution contains protein in the lower range rather than high range concentration. While it is more accurate to determine the protein concentration through the calculation of Beer-Lambert's equation using the absorbance of a spectrophotometer, the estimated protein amount is unlikely to be significant if inaccurate. As the protein concentration is likely to be closer to 0.5mg/ml as indicated by the solution colour in Figure 4, any protein more present due to inaccurate estimation is negligible as they are unlikely to significantly impact the nutritional contents of the product. The results when following theory, were expected, as the only protein source used in the making of Halwa

Candy was fish gelatine which was added in controlled amounts. Thus, it can be accurately concluded that there is a small amount of protein present in Halwa Candy.

4.4.4 Iodine Test - Test for Starch

Figure 5 reveals the results of the Iodine Test in response to Halwa Candy to detect the presence of starch. The solution did not shift to another shade of colour and remained a brown-coloured solution. As such, starch is not present in Halwa candy and it is unlikely that there is any minute amount present within the product. This is because there were no traces of blue-black precipitates nor any observable change from brown into any other colour that can be used to argue for the possible presence of starch. Furthermore, the results follow the theory that starch (amylose and/or amylopectin) can only be synthesised via certain enzymatic reactions with glucose molecules. While there are glucose molecules present in Halwa Candy from the honey ingredient, its conversion to starch via polymerization cannot take place due to the unavailable enzymes needed (Kang, Wang, Guo, Zhu, & Guan, 2006). Furthermore, reducing sugar molecules such as fructose and dextrose found in the honey, orange and stevia ingredients are not the simple glucose molecules needed by the enzymes for starch synthesis. As such, there is no possibility for the formation of starch in Halwa Candy. Thus, it is likely that starch is not present in any amount of the candy product.

5. CONCLUSION

Halwa Candy is produced with orange fruits as the flavour mixed with honey, stevia natural sweetener and fish gelatine. All of the ingredients are carefully chosen based on the taste, texture, nutrition and flavour it will contribute to the final products. Since candy is the source of natural ingredients present in fruits, therefore, the products have less or no calories, because it provides nutritional value in terms of vitamins, minerals, antioxidants and energy. So, Halwa Candy could be a healthy alternative for calories.

In addition, the steps to produce Halwa Candy are produced with the idea to make the product easy to carry, halal, safe, enjoyable and most importantly, consumer-friendly. Three methods are used to create consistent findings including a questionnaire spread via Google sheet form, sensory evaluation and laboratory analysis. The first method includes gathering a mixture of qualitative and quantitative data in which the dominant question targets the marketability of Halwa Products in Brunei. During the second method, seven random judges are chosen to provide feedback on numerical data on the colour, flavour, softness and taste of halwa candy. The last method, laboratory analysis, includes checking the nutritional facts of Halwa Candy on the presence of protein, reducing sugar, fat and starch. The findings on the laboratory analysis are such that there is the presence of protein and reducing sugar, while fat and starch are absent. It is to be noted that even though there is a presence of sugar, the sugar content in Halwa Candy proved to be less than the store-bought candy. Hence, through a proper and precise analysis made by the team, Halwa Candy is surely a healthier and safer alternative for people to consume.

In future research, an increase in the number of participants in both the questionnaire and judges would provide more reliable findings. In addition, the inclusion of more variety in participants such as more participants in different age groups and district residences would capture a more accurate estimated opinion of Brunei's population towards Halwa Candy. Lastly, experiments to measure the results of the laboratory analysis such as through spectrophotometer reading comparisons should be conducted instead of estimation to procure accurate nutritional facts.

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References

- Alvarez-Suarez, J., Giampieri, F., & Battino, M. (2013). Honey as a source of dietary antioxidants: structures, bioavailability and evidence of protective effects against human chronic diseases. *Current Medicinal Chemistry*, 20(5), 621-638.
- Bradschneider, R., & Crailsheim, K. (2010). Nutrition and health in honey bees. *Apidologie*, 41(3), 278-294.
- Denopol, F. (2022). *Bits and Pieces about Oranges*. Retrieved June 13, 2023, from National Nutrition Council: <https://nnc.gov.ph/regional-offices/mindanao/region-ix-zamboanga-peninsula/9451-bits-and-pieces-about-oranges>
- Díaz-Montes, E., García-Depraect, O., & Castro-Muñoz, R. (2021). Chapter 7 - Membrane technologies for the extraction and purification of steviol glycosides. In C. Galanakis (Ed.), *Steviol Glycosides* (pp. 159-199). Academic Press. doi:10.1016/B978-0-12-820060-5.00007-8
- Engelking, L. (2015). *Textbook of Veterinary Physiological Chemistry* (3rd ed.). Elsevier Science.
- Gasmalla, M., Yang, R., & Hua, X. (2014). Stevia rebaudiana Bertoni: An alternative sugar replacer and its application in food industry. *Food Engineering Reviews*, 6(4), 150-162.
- Hossain, M., Islam, M., Islam, M., & Akhtar, S. (2017). Cultivation and uses of stevia (Stevia rebaudiana Bertoni): A review. *African Journal of Food, Agriculture, Nutrition and Development*, 17(4), 12745-12757.
- Huang, J. (2023). A Study on the Effect of Color on Human Food Perception.
- Kang, G., Wang, Y., Guo, T., Zhu, Y., & Guan, C. (2006). Yi Chuan = Hereditas, 28(1), 110-116.
- Kek, S., Chin, N., Yusof, Y., Tan, S., & Chua, L. (2017). Classification of entomological origin of honey based on its physicochemical and antioxidant properties. *International Journal of Food Properties*, 20(Supplement 3), S2723-S2738.
- Kon, J. (2023). *Call to stamp out obesity*. Retrieved June 13, 2023, from Borneo Bulletin: <https://borneobulletin.com.bn/call-to-stamp-out-obesity/>
- Kumar, H., Ranote, P., & Goraya, R. (2017). Development and Quality Evaluation of Guava (cv. Punjab Pink) Candy. *International Journal of Pure and Applied Bioscience*, 5(6), 119-126.
- Lata, D., O. J., S., & Anand, A. (2018). Candies and Toffees Prepared from Fruits and Vegetables. In I. Chakraborty, P. Paul, A. Mani, A. Tiwary, & K. Prasad (Eds.), *Trends and Prospects in Processing of Horticultural Crops* (pp. 121-199). New Delhi: Today and Tomorrow's Printers and Publishers.
- Lindon, J., Tranter, G., & Koppelaar, D. (Eds.). (2017). *Encyclopedia of Spectroscopy and Spectrometry*. Elsevier Ltd.
- Mahat, M., Sabere, A., Shafiee, S., Nawawi, M., Hamzah, H., Jamil, M., . . . Safian, M. (2020). The Sensory Evaluation and Mechanical Properties of Functional Gummy in the Malaysian Market. *Preprints.org*, 2020100213. doi:10.20944/preprints202010.0213.v1
- Meltzer, D. O., Best, T., Zhang, H., Vokes, T., Arora, V., & Solway, J. (2020). Association of Vitamin D Status and Other Clinical Characteristics With COVID-19 Test Results. *AMA Netw Open*, 3(9), e2019722. doi:10.1001/jamanetworkopen.2020.19722
- Naik, V., & Poyil, T. (2022). Application of Stevia (Stevia rebaudiana Bertoni.) in food products. *The Pharma Innovation Journal*, 11(7), 2056-2060.
- Obesity*. (n.d.). Retrieved April 28, 2023, from World Health Organization (WHO): https://www.who.int/health-topics/obesity#tab=tab_1
- Othman, A. (2020). *Brunei records highest child obesity rate in region*. Retrieved June 13, 2023, from The Star: <https://www.thestar.com.my/aseanplus/aseanplus-news/2020/06/26/brunei-records-highest-child-obesity-rate-in-region>
- Rana, S., Mishra, M., Yadav, D., Subramani, S., Katore, C., & Prasad, G. (2018). Medicinal uses of honey: a review on its benefits to human health. *Progress in Nutrition*, 20(Supplement 1), 5-14. doi:<https://doi.org/10.23751/pn.v20i1-S.6394>

- Sahlan, M., Ridhowati, A., Hermansyah, H., Wijanarko, A., Rahmawati, O., & Pratami, D. (2019). Formulation of hard candy contains pure honey as functional food. *AIP Conference Proceedings*. doi:10.1063/1.5096743
- Suebsaen, K., Suksatit, B., Kanha, N., & Laokuldilok, T. (2019). Instrumental characterization of banana dessert gels for the elderly with dysphagia. *Food Bioscience*, 32, 100477. doi:10.1016/j.fbio.2019.100477
- V., A. K., & Dhanalaksmi, B. (2017). Development of Ghee Residue Candy Incorporated with Orange Peel. *Indian Journal of Veterinary and Animal Sciences Research*, 46(6), 1143-1149.
- Ware, M. (2019). *What to know about oranges*. Retrieved June 13, 2023, from Medical News Today: <https://www.medicalnewstoday.com/articles/272782>
- Winarmo, F. (1997). *Food Chemistry and Nutrition*. Jakarta: Gramedia.
- World Health Organisation. (2021). *Coronavirus disease (COVID-19): How is it transmitted?* Retrieved April 28, 2023, from World Health Organization (WHO): <https://www.who.int/news-room/questions-and-answers/item/coronavirus-disease-covid-19-how-is-it-transmitted>
- Zavistanaviciute, P., Zokaityte, E., Starkute, V., Ruzauskas, M., Viskelis, P., & Bartkiene, E. (2022). Berry By-Products in Combination with Antimicrobial Lactic Acid Bacteria Strains for the Sustainable Formulation of Chewing Candies. *Foods*, 11(9), 1177. doi:10.3390/foods11091177