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A Study Of Acceptance Toward Moringa Sheets

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ABSTRACT

Moringa sheets is a sheet-based product made with moringa leaves. Moringa Oleifera or 'Kelor' is a plant that is often used in local cuisine such as cooked with coconut milk or fried. Moringa sheet is inspired by nori seaweed sheets and utilizes carrageenan as a binding agent before undergoing the drying process. The utilization of moringa leaves in cooking is limited in Malaysia, despite the significant benefits that moringa leaves offer. Furthermore, the production of nori in Malaysia is very low because Malaysia is not a producer of seaweed. Therefore, the alternative to produce this product by using a vegetable source that is abundant in in Malaysia which are moringa leaves. The objective of this study is to create an inventive product akin to nori by utilizing moringa leaves. The production process of moringa sheets involves the bleaching method to remove the bitter taste from the leaves, followed by crushing the leaves using a heavy-duty blender and drying them at a temperature of 60°C using a dehydrator. Sensory Analysis was conducted with 35 panelist using scoring and hedonic tests. Sensory testing involves acceptance of the panelist to appearance, aroma, taste, mouthfeel, texture and overall samples. Among the three formulations tested sample 835 with 2% Carrageenan received the highest overall acceptance. Overall, the product meets the objective of innovation, and it is generally accepted by the majority of the panelists.

1.0 Introduction

Moringa Sheets is an innovative food product that resembles nori produced from seaweed. It is in the form of thin slices and crispy when eaten directly. The characteristics of moringa sheet are similar to the characteristics of nori in terms of stable texture (Rosida, Nurani & Ilmi, 2021). The use of moringa leaves as the main ingredient to replace seaweed is an innovation that uses plant-based ingredients that are around us. This makes it a green technology effort that helps maintain the impact on the environment. Moringa plant thrives abundantly in Malaysia, however, this tree is not utilized to the maximum.

The nutrients in the moringa tree can help increase the nutritional value of the food produced. The specialty of this moringa tree is that almost every part of the tree is edible and highly nutritious. In fact, it contains many important minerals and vitamins. Moringa leaf parts are increasingly recognized in the production of transformation products because they contain important bioactive compounds, including vitamins, carotenoids, phenolics, flavonoids, glucosinolates, isothiocyanates, tannins, and saponins. (Hodas, Zorzenon & Milani, 2021).

Accordingly, in line with the objective of the study to create inventive product, Moringa sheets which mimicked nori seaweed will be produced by using Moringa leaves.

The production of Moringa sheet uses carrageenan as a binding agent in which there are three formulations tested where different carrageenan percentages were observed to obtain the right amount of it to undergo the drying process. The right amount gives a crispiness sheet texture and the thickness is not too thick nor too thick. Thus, sensory evaluation has been made to identify which formulation is preferred and accepted. User acceptance in product is important to ensure the marketability of the product produced. A good reception will make this product suitable for marketing and at the same time it is economically beneficial as it will become a potential rival to imported nori seaweed. In fact, this innovation study helps improve environmental sustainability due to the carbon footprint.

2.0 Literature review

2.1 Nori

Nori is a popular food product in Malaysia even though it needs to be imported from abroad. It is produced from seaweed from the Pyropia genus. Usually, nori is dried or baked into thin, crispy pieces. As a product synonymous with Japanese cuisine, it is usually produced from species of the red algae genus nor purple layer Pyropia, including Pyropia yezoensis and Pyropia tenera. Nori usually produces in large, thin, dried sheet where it has a strong and distinctive flavor. The amino acids that found in processed seaweed such as glucine and glutamate could contribute to nori's flavor characteristics (Sinurat et al., 2022). In addition, the seaweed is rich with nutrients element such as protein, minerals, crude, fiber and vitamins (refer Table 1), especially vitamins A, C and B12.

Healthy food has become the food of choice for consumers, but now most consumers will make an additional choice which is halal food (Omar et al., 2022). Parallel to nori which is very popular among the people in Malaysia. Users will ensure that the products taken are halal products and certified by JAKIM through the Halal Logo. Therefore, the production of local products such as nori products is seen as very good because a lot of it is produced from foreign countries.

Currently most nori is imported from Japan, China or Korea, in fact these three countries are among the highest producers in the world (Rosida et al., 2021). In Malaysia, the main seaweed cultivation areas are in Sabah that located in the east coast area of Sabah mainly Semporna, Kunak and Lahad Datu. These areas are suitable for seaweed cultivation with shallow and sheltered sea area which is conducive and favorable factor for seaweed cultivation (Ku Yaacob, 2013). Unfortunately, the area of seaweed habitat and nori production manufacturers is very limited in Malaysia.

Table 1. Nutritional composition of various seaweeds species (Gamero-Vega, Palacios and Quitral, 2020).

Seaweed Species	Nutrition				
	% Protein	% Total lipid	% Carbohydrate	% Crude fibre	% Ash
Gracilaria cervicornis	19.70	0.43	63.10	5.65	-
Pyropia tenera	36.60	3.04	-	3.26	11.55
Kappaphycus alvarezii	16.24	0.74	27.40	29.40	-
Undaria pinnatifida	15.69	2.23	-	2.92	29.84

2.2 Moringa

The innovation developed is to use a type of plant that is rich in nutrients, namely moringa leaves. Moringa oleifera belonging to the family of Moringaceae that an effective remedy for malnutrition. The fact that Moringa could provide 7 times more vitamin C than oranges, 10 times more vitamin A than carrots, 17 times more calcium than milk, 9 times more protein than yoghurt, 15 times more potassium than bananas and 25 times more iron than spinach makes it a sustainable remedy for malnutrition (Gopalakrishnan, Doriya & Kumar, 2016). Almost every part of this tree is edible and highly nutritious, and contain many essential minerals and vitamins (refer Table 2). It has been reported that Moringa has a higher nutrient content than other vegetables and fruits (Abdull Razis, Ibrahim & Kntayya, 2014).

Every part of the plant can also be used for therapeutic purposes, the leaves are used as nutritional supplements, the seeds for water purification, the roots for spice in cook, the oil as a biofuel, the trunk as a gum producer and the flowers as a source of honey (Trigo, Castello & Ortola, 2023). The diversity functional part of this tree is the Moringa leaves that are also known as store house of nutrients. Moringa leaves contain important bioactive compounds, including vitamins, carotenoids, phenolics, flavonoids, glucosinolates, isothiocyanates, tannins, and saponins. Thereby it is commonly known for its medicinal power (Hodas et al., 2021). Quercetin is the most vital component on Moringa oleifera leaves which used as inhibitor for the growth of cancer cell. Traditional medicine techniques used Moringa leaves to treat different diseases which mainly include gastrointestinal problems, headache, inflammation, anemia, fever, eye infection, bronchitis, poor nutrition, inner ear infection, skin infection. Furthermore, it provides a vigorous mixture of direct and indirect antioxidants that can explain its various health promoting effects (Malemnganbi and Singh, 2021).

Table 2. Nutritional composition of moringa oleifera leaves, flowers, immature pods (Grosshagauer, Pirkwieser, Kraemer & Samoza, 2021)

Seaweed Species	Nutrition			
	% Protein	% Total Fat	% Carbohydrate	% Dietary Fibre
Leaves	22.4	5.0	27.1	31.0
Flowers	18.9	2.9	36.0	32.5
Immature pods	19.3	1.3	25.0	46.8

3.0 Methodology

The sample preparation process involves the preparation process of ingredients namely moringa and carrageenan. Moringa leaves were freshly collected from Kampung Tanah Merah, Muar. Only the leaf part is used to ensure the texture of the product is not too rough (Anjani, Zakaria & Widowaty, 2021). These moringa leaves will be soaked in salt water for 30 minutes before being rinsed and these leaves are bleached using hot water (Rathnayake and Navarathna, 2017) for 5 minutes. This process aims to reduce the bitter taste of moringa leaves.

Next, these leaves are ground using a heavy-duty blender until smooth with a capacity of 1:2 water ratio. The next process is to cook the moringa puree with carrageenan at the rate of F1-1%, F2-2% and F3-3% based on the weight of the puree. This mixture will be poured into a container before being dried using a dehydrator at a temperature of 600C for 4 hours.

The next process is a sensory test involving 35 respondents. The samples are labeled with F1 – 276, F2- 835 and F3- 902. Each of these formulations will be evaluated using scoring and hedonic tests (Anjani et al., 2021) to see the acceptance of respondent based on appearance, aroma, taste, mouthfeel, texture and overall samples (Ruiz-Capillas and Herrero, 2021). SPSS version 21 software was used to assist the analysis process of the study findings.

4.0 Discussion of analysis and findings

Based on the 3 selected formulations that are 1%, 2% and 3% of carrageenan, a sensory test evaluation was done. The Sensory test evaluation involves evaluating the panel's acceptance of 6 attributes namely appearance, aroma, taste, mouthfeel, texture and overall.

The findings from the sensory test evaluation involving 6 attributes, through ANOVA-Test, it was found that the P-value is greater than 0.05 indicating a significant difference between samples. This is proven through Table 3 which is the result of Tukey's HSD ("honestly significant difference"). The findings show that there is a significant difference between the products. In fact, the findings show a significant acceptance of the 835 sample from all the attributes measured.

Table 3: Tukey's HSD result for sensory scores of Moringa Sheet.

ATTRIBUTES	Control	276	835	902
Appearance	4.34±0.152c	3.83±0.258a	4.31±0.240c	4.17±0.313b
Aroma	4.31±0.195b	3.95±0.306a	4.35±0.216b	4.34±0.256b
Taste	4.27±0.205b	3.99±0.284a	4.25±0.278b	4.23±0.229b
Mouthfeel	4.37±0.385b	3.91±0.272a	4.37±0.373b	4.11±0.333b
Texture	4.35±0.165b	3.98±0.329a	4.33±0.180b	4.29±0.243b
Overall Flavour	4.49±0.238c	3.98±0.308a	4.44±0.291c	4.25±0.333b

The findings of the study were also proven through a spider's web chart to see the acceptance of the best formulation. The results of the study found that from the three formulations 276, 835, 902 and control (nori sheet). The acceptance of the control product is high compared to other formulations. This indicates that most of the panelists recognized the taste of the control sample (nori sheet). However, the Moringa sheet developed in the 835-formulation showed acceptance equivalent to that of the control. Despite being a newly innovated product, in terms of appearance, aroma, taste, mouthfeel, texture, and overall flavor, it is comparable to nori sheets

This is evident when referring to the spider web chart (Refer to Figure 1). The blue line represents control sample, orange line represents sample 276, gray line represents sample 835 and yellow line represents sample 902. This chart indicates that the gray line (835) exhibits a higher acceptance vote compared to samples 276 and 902. Additionally, there is an equivalent acceptance level observed between formulation 835 and the control sample (blue line)

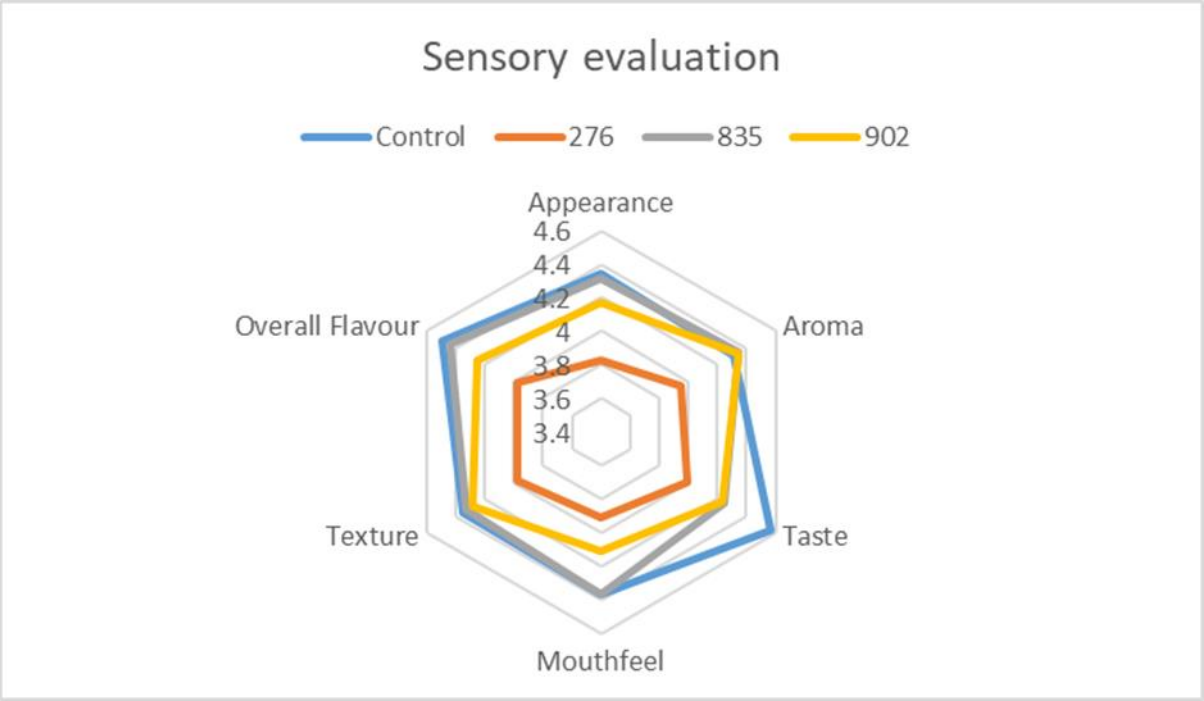

Figure 1.1: Spider plot for sensory scores of Moringa Sheet

5.0 Conclusion and future research

The production of moringa sheet is an innovation with great potential in the local food market. The research done helps reduce the dependence of nori imported from foreign countries. The use of moringa-based products is not only able to compete with nori, but it also helps provide nutritional value and a variety of other functions according to the needs of users. This study also shows that the products produced can solve the problem statement of the study, which is the lack of diversity in the use of moringa in food products. At once it successfully fulfils the objectives of the study. Referring to the sensory findings of the sensory test evaluation also shows consumer acceptance of moringa sheet products. The hope is that this product can be developed to be marketed not only in Malaysia, but internationally.

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Author Contributions

Hairul, N.H.H. Author: Conceptualization, Methodology, Data Curation and Writing: **Palal, N.H. Author**: Conceptualization, Methodology, Data Curation, Supervision, Writing and Editing; **Abidin, M.H.S.Z. Author**: Conceptualization, Validation, Writing-Reviewing and Editing.

Conflicts of Interest

The manuscript has not been published elsewhere and is not under consideration by other journals. All authors have approved the review, agree with its Submission and declare no conflict of interest in the manuscript.

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