



SUSTAINABLE EATING WITH ECO SPOON

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ABSTRACT

Edible spoons have emerged as a promising solution to plastic waste. They are a type of utensil that can be consumed after use, thus reducing the amount of plastic waste generated. Edible spoons are typically made from ingredients such as flour, cornstarch, or potato starch, and they come in a variety of flavors.

In 2021, Indian researchers developed a new type of edible spoon made from water chestnut flour. The study evaluated the quality of these spoons and found that they had good physical, sensory, and nutritional properties (Singh et al., 2021). The water chestnut flour spoons were also found to be a good source of fiber, protein, and minerals.

Edible spoons have the potential to revolutionize the food industry and reduce the amount of plastic waste generated. They can be used in a variety of settings, such as restaurants, cafes, and even at home. As the technology for producing edible spoons advances, we may see more widespread adoption of this eco-friendly alternative to plastic utensils.

The Stage-Gate model is a widely used product development process that helps businesses to manage innovation projects. It is a structured approach that breaks down the innovation process into stages, with specific criteria for moving from one stage to the next. The model is designed to ensure that resources are focused on the most promising ideas and that projects are aligned with business goals.

Keywords: Plastic waste, edible spoon, eco-friendly, utensil, alternative, model, process

ABSTRAK

Sudu yang boleh dimakan telah muncul sebagai penyelesaian yang memberangsangkan kepada sisa plastik. Ia adalah sejenis sudu yang boleh dimakan selepas digunakan, sekali gus mengurangkan jumlah sisa plastik yang dihasilkan. Sudu yang boleh dimakan biasanya dibuat daripada bahan-bahan seperti tepung, tepung jagung, atau kanji kentang, dan ia datang dalam pelbagai perisa.

Pada tahun 2021, penyelidik India membangunkan jenis sudu yang boleh dimakan yang diperbuat daripada tepung berangan air. Kajian menilai kualiti sudu ini dan mendapati ia mempunyai sifat fizikal, deria dan pemakanan yang baik (Singh et. Al,2021). Kastanye juga didapati sebagai sumber serat, protein dan mineral yang baik.

Sudu yang boleh dimakan berpotensi untuk merevolusikan industri makanan dan mengurangkan jumlah sisa plastik yang dihasilkan. Ia boleh digunakan dalam pelbagai keadaan, seperti restoran, kafe, dan juga di rumah. Seiring dengan kemajuan teknologi untuk menghasilkan sudu yang boleh dimakan, kita mungkin melihat penggunaan yang lebih meluas bagi alternatif mesra alam ini kepada kutleri lain.

Model Stage-Gate ialah proses pembangunan produk yang digunakan secara meluas yang membantu perniagaan mengurus projek inovasi. Ia adalah pendekatan berstruktur yang membahagikan proses inovasi kepada beberapa peringkat, dengan kriteria khusus untuk bergerak dari satu peringkat ke peringkat seterusnya. Model ini direka untuk memastikan sumber tertumpu pada idea yang paling menjanjikan dan projek itu sejajar dengan matlamat perniagaan.

Kata kunci: Sisa plastik, sudu yang boleh dimakan, mesra alam, alternatif, perkakas plastik,model, process

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The depiction of the study background, problem statement, objective, scope, significance, operation definition, and SWOT analysis would make up the whole of this chapter. The edible spoon applicability as an alternative for the current plastic spoon and how it will be implemented in accordance with the course requirements.

1.2 Background of Study

In recent years, environmental issues have become a major concern for many nations around the world, including Malaysia. As Malaysia experienced rapid economic development, it has led to rapid growth in industrialization and urbanization. This resulted in a number of environmental issues. One of the alarming environmental issues in Malaysia is the problem with plastic waste. According to Parker (2019), excessive use and poor management of plastic waste have caused severe environmental consequences, including pollution, habitat devastation, and health risks.

According to the National Solid Waste Department, Malaysia produces more than 30,000 tonnes of municipal solid waste (MSW) per day, or 1.17 kg per person (International Trade Administration, 2022). This is substantially more than the 17,000 tonnes per day of municipal solid waste that local governments and waste management concessionaires managed in the early 2000s.

In response to the increasing use of plastics, particularly disposable ones, and as consumer awareness of their negative environmental impact has increased, various alternative products have been developed. Currently, numerous entrepreneurs are attempting to replace disposable plastics with reusable or environmentally favorable alternatives. The creation of edible cutlery is one such solution. As an alternative to conventional plastic cutlery, scientists

have devised a method for creating flatware made from edible materials (Roy & Morya, 2022). This innovation has the potential to help reduce plastic waste in Malaysia and promote sustainable living.

The plastic waste issue in Malaysia has gained considerable attention in recent years. The excessive use of plastic has resulted in the clogging of drains and waterways, which leads to flash floods and has adverse effects on the ecosystem. It was reported by Solid Waste Corporation that the country's recycling rate in 2020 was 30.67 percent, lower than other countries in the Asia region such as Singapore at 59 percent, South Korea at 49 percent, and Taiwan at 60 percent (Diam, 2022). The low recycling rate in Malaysia has resulted in a significant amount of plastic waste being disposed of in landfills, which has a negative impact on the environment. Furthermore, plastic waste also poses a significant threat to marine life, as marine animals may mistake plastic debris for food, leading to injury or death.

In addition, plastic waste can also have harmful effects on human health, such as exposure to toxic chemicals and pollutants that can cause respiratory problems and other health complications.

1.3 Problem statement

Plastic pollution is a global problem that is growing exponentially due to both an increase in consumerism and the number of plastics used to manufacture the things we use daily. As of 2018, about 380 million tonnes of plastic are produced worldwide each year. From the 1950s up to 2018, an estimated 6.3 billion tonnes of plastic have been produced worldwide, of which an estimated 9% has been recycled and another 12% has been incinerated (Boro et al., 2020).

According to a recent WWF report, Malaysia is the top plastic consumer in Asia, responsible for 60% or about 8 million tonnes of plastic waste leaking into the oceans annually (Abdullah et al., 2021). Previous studies mention that plastic cutlery can release harmful chemicals such as phthalates and bisphenol A (BPA) when exposed to heat, posing potential health risks to consumers (Xu et. al, 2021).

Kabir and Hamidon (2021) proposed that edible cutlery is one of the solutions to reduce plastic waste. Edible cutlery can help reduce plastic waste because it is made from biodegradable and edible materials, eliminating the need for single-use plastic cutlery. A

study found that edible cutlery made from ingredients such as wheat flour, corn starch, and rice flour showed promise as an eco-friendly and sustainable alternative to plastic cutlery (Sharma et al., 2019).

So, our upcoming solution to reduce plastic waste is to produce edible cutlery in Malaysia that was made from natural and affordable ingredients such as wheat and flour.

With the rise in consumerism and the number of plastics used in the production of dairy products, plastic pollution has become a growing concern throughout the world. As of 2018, about 380 million tonnes of plastic are produced annually worldwide. Furthermore, between the 1950s and 2018, an estimated 6.3 billion tonnes of plastic were produced globally, of which an estimated 9% has been recycled and another 12% has been incinerated (Boro et al., 2020). A previous study has found that plastic cutlery can release harmful chemicals such as phthalates and bisphenol A (BPA) when exposed to heat, posing potential health risks to consumers (Xu et al., 2021).

According to a recent report by World Wildlife Fund (WWF), Malaysia is a significant contributor to the plastic waste issue, where it was found that Malaysia is responsible for 60% or about 8 million tonnes of plastic waste that leaks into the oceans annually (Abdullah et al., 2021). This startling statistic highlights the urgent need for effective solutions to reduce plastic waste in Malaysia. According to Kabir and Hamidon (2021), they have proposed that edible cutlery be one of the solutions to reduce plastic waste. The introduction of edible cutlery can help to reduce plastic waste. This is possible as the cutleries are made from biodegradable and edible materials, eliminating the need for single-use plastic cutlery. Another student by Sharma et al. (2019) also found that edible cutlery made from ingredients such as wheat flour, corn starch, and rice flour showed promise as an eco-friendly and sustainable alternative to plastic cutlery.

With the development of edible cutlery, it becomes a viable solution to the plastic waste problem in Malaysia. Through the promotion of the use of eco-friendly and sustainable alternatives such as edible cutlery, it will be possible to reduce the negative impact of plastic waste on the environment as well as human health. Therefore, a study on the viability of producing edible spoons, a type of edible cutleries, in Malaysia that are made from natural and affordable ingredients such as wheat and flour and its acceptability by the users is important to understand if the idea of edible cutleries is viable to reduce the plastic waste issue.

To combat the increasing use of plastics, especially the one that is for single use only, various alternative products have been developed. This was also due to the increase in consumer awareness of their negative environmental impact. One of the possible solutions to this issue that has been gaining popularity around the world is edible cutlery. Edible cutlery is made from natural ingredients such as rice, wheat, and corn and is biodegradable and edible (Roy & Morya, 2022). It has gained popularity worldwide in recent years. The product offers a sustainable solution to reduce the use of single-use plastics and offers a healthier alternative to conventional plastic cutlery. With edible cutlery, entrepreneurs are trying to replace disposable plastics with edible cutlery or even other reusable or environmentally favorable alternatives. This innovation can possibly help to reduce plastic waste in Malaysia while promoting sustainable living.

1.3 Research objectives:

1. To develop an edible spoon to reduce plastic waste.
2. To examine the perceptions and attitudes of Malaysian consumers towards edible spoons as a sustainable and eco-friendly product.

1.4 Research Questions:

1. How edible spoons be developed to reduce plastic waste?
2. What is the attitude and perception of Malaysian consumers towards edible spoons as a sustainable and eco-friendly product?

1.5 Scope of Study:

The scope of this study is limited to the development and evaluation of the edible spoon as a sustainable alternative to plastic cutlery in Malaysia. The study will focus on the development of an edible spoon using natural and affordable ingredients such as wheat and flour. The study will also examine the perceptions and attitudes of Malaysian consumers toward the use of edible spoons as a sustainable and eco-friendly product.

The study will be conducted in the Shah Alam area of Malaysia. This will include the area around the capital city of Shah Alam as this area with the densest population in Malaysia, with a population of over 600 000 people (Population-hub, 2023). The diverse population that

is in this area will have individuals from different cultural and socio-economic backgrounds that can contribute to the study.

The study will involve the participation of Malaysian consumers, waste management experts, and food scientists. The research participants will be recruited through online advertisements and social media platforms, and they will be selected based on their willingness to participate in the study and their availability during the study period. The sample size will be determined based on the principle of saturation, which means that data collection will continue until no new information or insights are obtained from the participants.

1.6 Significance of study:

The result of this study can help to develop an edible spoon to reduce plastic waste. With the urgent need to overcome the growing issue of plastic pollution in Malaysia, the introduction of the edible spoon can help to reduce plastic waste by providing a sustainable alternative to traditional plastic spoons. Besides, the result from the study can also help to understand consumer perception and attitudes towards the edible spoon. This can provide insights into the potential market for this product, as well as identify potential barriers or challenges to its adoption. Furthermore, the result from examining the environmental impacts of edible spoons can provide insights into how to minimize or mitigate any negative impacts and ensure that edible spoon is a truly sustainable and eco-friendly alternative to traditional plastic cutlery.

1.7 SWOT analysis:

SWOT analysis is a strategic planning tool used to evaluate the strengths, weaknesses, opportunities, and threats involved in a project or business venture. It is a framework that helps organizations to identify internal and external factors that impact their operations and devise strategies to achieve their goals.

SWOT stands for Strengths, Weaknesses, Opportunities, and Threats. Strengths and weaknesses refer to internal factors, while opportunities and threats refer to external factors. A SWOT analysis is typically performed as part of a company's overall strategic planning process.

According to a study published in the International Journal of Business and Social Science, SWOT analysis has become one of the most commonly used tools for business

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| <p>Strengths:</p> <ul style="list-style-type: none"> • Environmental Friendly • Product is from natural resources • No need to dispose • Shape is customizable | <p>Weakness:</p> <ul style="list-style-type: none"> • Low standardization of product • Low production speed • Limited shelf life • Limited durability |
| <p>Opportunities:</p> <ul style="list-style-type: none"> • Emerging Market • Growing interest from communities in unique food experience • Development of new flavors • Collaboration with other companies such as ice cream companies | <p>Threats:</p> <ul style="list-style-type: none"> • Various cutlery used due to the eating culture in Malaysia • Competition from a traditional plastic spoon • Changes in consumer preferences • Supply disruptions |

analysis and decision-making, especially in the areas of marketing, management, and strategic planning (Mullins, Orville, & Walker Jr, 2013).

Swot Analysis of the edible spoon

1.8 Operational terms:

For the purpose of this study, the following terms are defined below:

a. Edible spoon

An edible spoon is a type of utensil that is made from food materials, such as flour, corn, or rice, and is designed to be consumed after use, thereby reducing waste and offering a sustainable alternative to traditional plastic or metal utensils. (Amin et. al., 2018).

b. Plastic spoon

A plastic spoon is a type of utensil that is made from plastic material and is commonly used for eating and serving food due to its low cost, durability, and convenience. (Martin et.al.2019).

c. Eco-friendly

Eco-friendly refers to products, services, and practices that have a reduced impact on the natural environment and are designed to promote sustainability. (Gallagher et.al. 2017).

d. Environmental impacts

Environmental impact refers to the effect that human activities have on the natural environment, including changes to ecosystems, biodiversity loss, and climate change. (Konig et.al. 2017).

e. Perception

Perception refers to the process by which sensory information is selected, organized, and interpreted to give meaning to the environment and guide behavior. (Rangelov et.al.,2018).

f. Attitude

Attitude refers to a learned predisposition to respond to a particular object or situation in a consistent and evaluative way, and it influences behavior and decision-making. (Eagly et.al 2017).

1.9 Conclusion

The implementation of this project is made within the problem statement, research objectives, and research scope that was mentioned earlier throughout the period of 4 months. A Gantt chart has been developed for the purpose of monitoring the planning and implementation of research activities. The Gantt chart of the research is shown in Appendix I of the report.

CHAPTER 2

LITERATURE REVIEW

2.1 Environmental issue:

Edible spoons have emerged as a promising solution to plastic waste. According to Singh (2021), Indian researchers developed a new type of edible spoon made from water chestnut flour. The water chestnut spoon is biodegradable, and compostable, and has a shelf life of up to six months. This innovative solution can help reduce plastic waste while also providing a nutritious and sustainable alternative to traditional plastic cutlery.

In 2020, the world faced a series of environmental crises that served as a stark reminder of the urgent need for action on climate change and other environmental issues. From fast-spreading wildfires in Australia and the western United States to devastating floods in Asia and Africa, the impact of human activities on the natural world was clear.

The COVID-19 pandemic also highlighted the interconnectedness of human and environmental health, as the virus spread rapidly in areas with high levels of air pollution and deforestation. The pandemic also led to a temporary reduction in greenhouse gas emissions, providing a glimpse of what a more sustainable future could look like.

Despite these challenges, there were also signs of progress in 2020. Many countries announced ambitious plans to reach net-zero carbon emissions, and renewable energy continued to grow as a share of global energy consumption. According to *Environmental Issues in 2020: A Wake-Up Call for the Planet*

2.2 Plastic waste/textile waste:

Plastic waste and textile waste are two of the major environmental concerns globally. The production and disposal of textile waste have similar negative impacts on the environment as compared to plastic waste.

Plastic waste is a main contributor to pollution in the environment and has significant bad consequences for the health of humans and the well-being of ecosystems (Alabi et al., 2019). Plastic pollution can be harmful to wildlife, contributing to the devastation of habitats, and causing toxic chemicals to be released into the environment (UN Environment

Programme, 2022). In addition, waste plastic contributes to the production of greenhouse gases and the warming of the planet (Major, 2021). This is due to plastics' reliance on fossil fuels for their supply chains contributes to the current climate catastrophe. Milton (2022) has further identified that an estimated 12.5 to 13.5 million metric tons of carbon dioxide are emitted annually by the extraction and transportation of fossil fuels during polymer production.

On the other hand, waste from the textile industry has also become a growing concern with the fashion industry being an industry with a high turnover of trends (Dottle & Gu, 2022). This has led to the industry contributing significantly to the problem. The production of textiles requires significant amounts of resources, including water, energy, and raw materials, and also contributes to carbon emissions (European Parliament, 2020). The disposal of textiles in landfills is also a major concern as textiles take up a lot of space while also releasing harmful chemicals into the environment. According to Brown (2021), textile waste generates greenhouse methane gas and leaches toxic chemicals and dyes into the groundwater and soil when it enters the landfill.

According to Kumar et al. (2021), both plastic wastes have significant negative impacts on the environment, and efforts are needed to reduce waste and promote sustainability. Patti et al. (2020) have argued that this is also the same when it comes to textile waste as it also negatively impacted the environment. While there are challenges in developing sustainable alternatives and promoting circularity in these industries, the benefits of reducing waste and promoting sustainability are significant. This has led to a growing increasing interest in developing sustainable alternatives to single-use plastic and increased recycling and waste reduction efforts (OECD, 2022). To overcome textile waste, sustainable fashion has also been well promoted to reduce waste and promote circularity in the industry (Jacometti, 2019).

2.3 Biodegradable product / recycle:

Biodegradable plastics have a shorter residence time in the natural environment than conventional plastics. Besides, another advantage of biodegradable products is that they can be produced from a range of materials that can be naturally degraded by microorganisms into eco-friendly and beneficial materials such as carbon dioxide and methane (Samir et al., 2022). The introduction of biodegradable products can potentially reduce waste and pollution in the environment. Where it was found that the utilization of biodegradable materials will make a

contribution to sustainability and a reduction in the amount of effect human activity has on the environment.

It is not always the case that biodegradable products are more environmentally beneficial when they are disposed of in landfills. It was also argued by Kubowicz and Booth (2019) that the degradation of biodegradable products is highly dependent on environmental conditions, and they continue to endure processes that generate microplastics. Besides, some biodegradable is also equally not compostable just like disposable plastics. According to a review by Kjeldsen et al. (n.d.), biodegradables may also leave behind toxic residue. These challenges highlight the importance of carefully considering the environmental impact of biodegradable product production and disposal.

2.4 Edible spoon cutlery:

Edible spoon cutlery has been touted as an innovative solution to the growing problem of plastic waste in the environment. According to Roy and Morya (2022). Furthermore, Valusamy and Narayanan (2019) have argued that the biodegradability of edible spoon cutlery means that it does not contribute to the accumulation of plastic waste in the environment. Leading to the accumulation of plastic waste in landfills and oceans. In contrast, edible spoons degrade naturally (Roy & Morya, 2022) and do not release harmful chemicals or microplastics into the environment.

A study by Tenenbaum (2019) has pointed out that plastic cutlery is a significant contributor to this problem, with an estimated 40 billion plastic utensils used annually in the United States alone. The introduction of edible spoon cutlery can significantly reduce this plastic waste by providing a viable alternative.

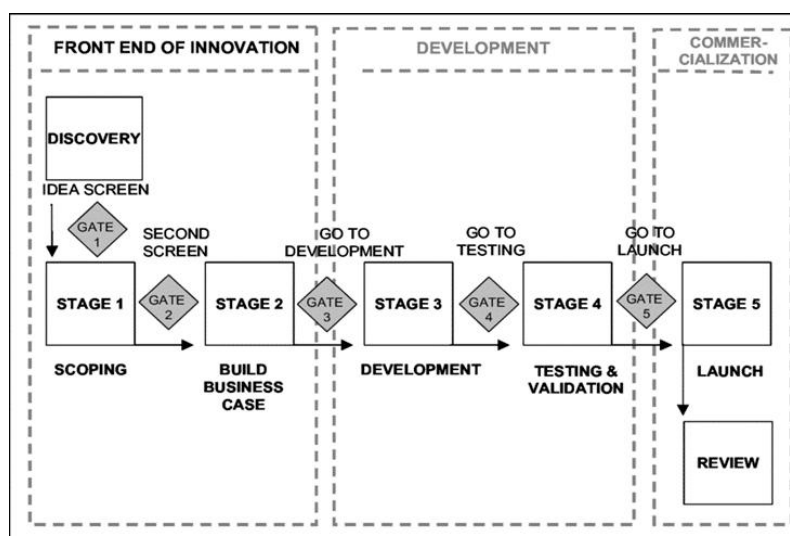
2.5 The Stage Model

The Stage-Gate model is a widely used project management framework for new product development. It divides the product development process into a series of stages, each with its own set of activities and deliverables, and includes decision points or "gates" between stages where cross-functional teams evaluate project progress and decide whether to continue or terminate the project (Cooper, 2019).

According to Cooper (2019), the Stage-Gate model has been shown to improve product development performance and success rates, reduce development costs and cycle times, and increase customer satisfaction. It provides a structured approach to managing product development, enabling teams to focus their efforts on the most promising ideas and identify and address potential risks and problems early in the process.

Several studies have examined the effectiveness of the Stage-Gate model. For example, a meta-analysis of 33 studies found that organizations using the Stage-Gate model had higher product success rates, shorter development times, and lower development costs compared to those using traditional, non-structured approaches to product development (Song & Parry, 2018).

In a literature review report, you can discuss the Stage-Gate model as a framework for managing new product development processes, summarize its key features and benefits, and provide evidence from relevant studies that support its effectiveness.



2.6 Conclusion

In conclusion, environmental issues such as improper waste disposal, plastic waste, and textile waste have significant negative effects not only on the natural world but also on the well-being of humans and animals. Accumulation of waste in landfills and oceans is to blame for pollution, habitat devastation, and bioaccumulation of toxic chemicals in the food chain. In addition, the production and disposal of hazardous waste are major contributors to carbon emissions and the depletion of natural resources. Nonetheless, there is a growing interest in developing sustainable alternatives such as reducing the use of single-use plastics, promoting recycling and waste reduction initiatives, and promoting circularity in the fashion industry. Specifically, there is a growing interest in developing alternatives to single-use plastics that are environmentally friendly. These are significant benefits that are realizable. It is crucial to continue research and the development of risk-free, effective, and long-term solutions in order to mitigate the negative effects of environmental problems and preserve the planet for future generations.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

Research methodology is a critical aspect of any research project, as it determines how the research questions will be answered, and what evidence will be collected and analyzed. A robust methodology ensures that the research is conducted systematically, rigorously, and ethically and that the findings are valid, reliable, and generalizable. This section of the report outlines the research methodology used in this study and justifies the choices made. (Saunders, 2019).

3.2 Research Design

Based on our product types and to help manage our project innovation, we decided to use the Stage-Gate model as our guideline for the product development process. According to a study by Hoenig and Tyebjee (2019), the Stage-Gate model is effective in improving the success rate of innovation projects.

Here is an example of how the Stage-Gate model could be applied to the development of an edible spoon:

Stage 1: Idea Generation - The first stage in the Stage-Gate model is to generate ideas for the product. In this stage, the team would brainstorm potential ideas for an edible spoon. This could include researching existing products in the market and identifying areas for improvement. So our group decided to develop an edible spoon.

Stage 2: Concept Development - Once a promising idea for the edible spoon has been identified, the next stage is to develop a concept for the product. This would involve creating a basic design for the spoon, considering factors such as the ingredients, size, shape, and texture.

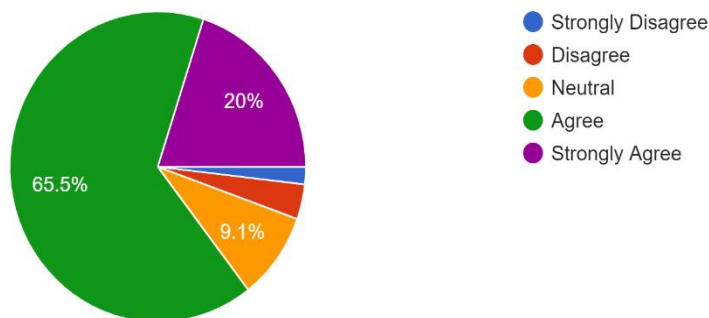
Stage 3: Feasibility Study - In this stage, the team would conduct a feasibility study to determine if the concept for the edible spoon is technically and commercially feasible. This might include testing the product with a focus group to get feedback on taste and texture, as

well as identifying potential suppliers for the ingredients. This is the result of our feasibility studies:

Wu et al. (2020) highlighted the importance of need analysis in identifying opportunities for innovation and designing products that better meet the needs and preferences of users and consumers. The study uses a combination of surveys and focus groups to identify user preferences and pain points with existing smartwatch interfaces and suggested that need analysis can inform the design of more intuitive and user-friendly smartwatch interfaces (Wu et al., 2020). While Hertzog (2008) recommended that a minimum of 30 participants be required to obtain an estimate of the variability of the outcome measure. Therefore, this study did a need analysis of the product with 30 respondents as a sample size. The findings of the need analysis as per the diagram below:

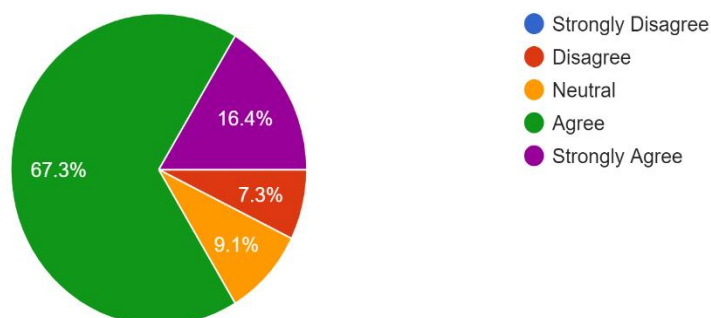
Edible spoon are bio-degradable in nature

55 responses



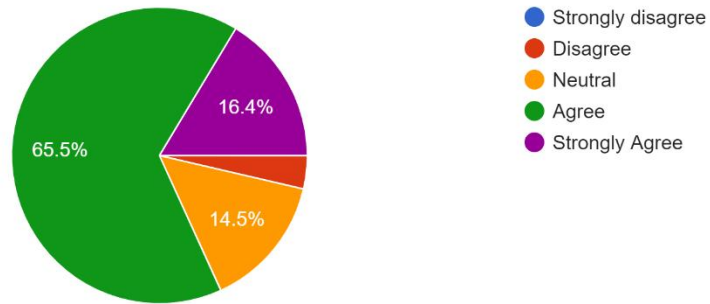
Edible spoon is something new to the community*

55 responses



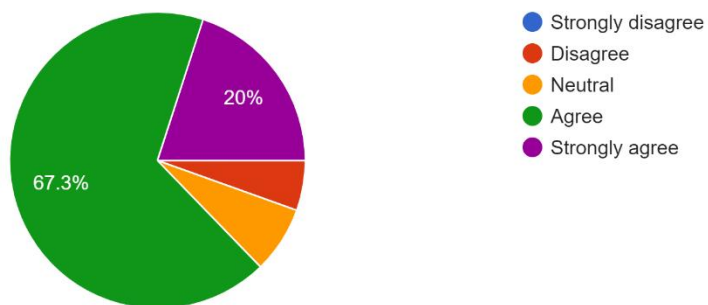
Edible spoon is an alternative for disposable plastic spoon

55 responses



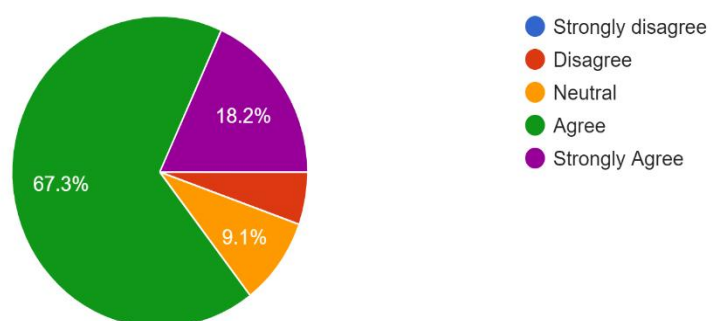
Edible spoon are eco friendly

55 responses



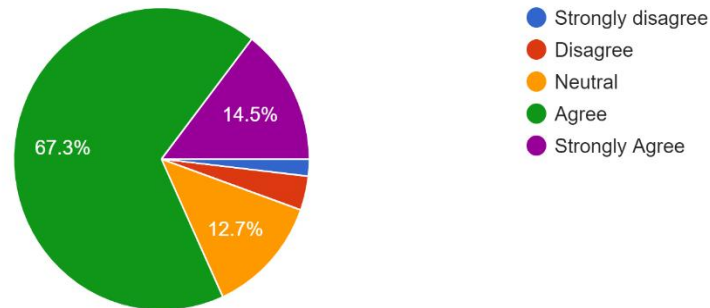
Edible spoon is durable to use

55 responses



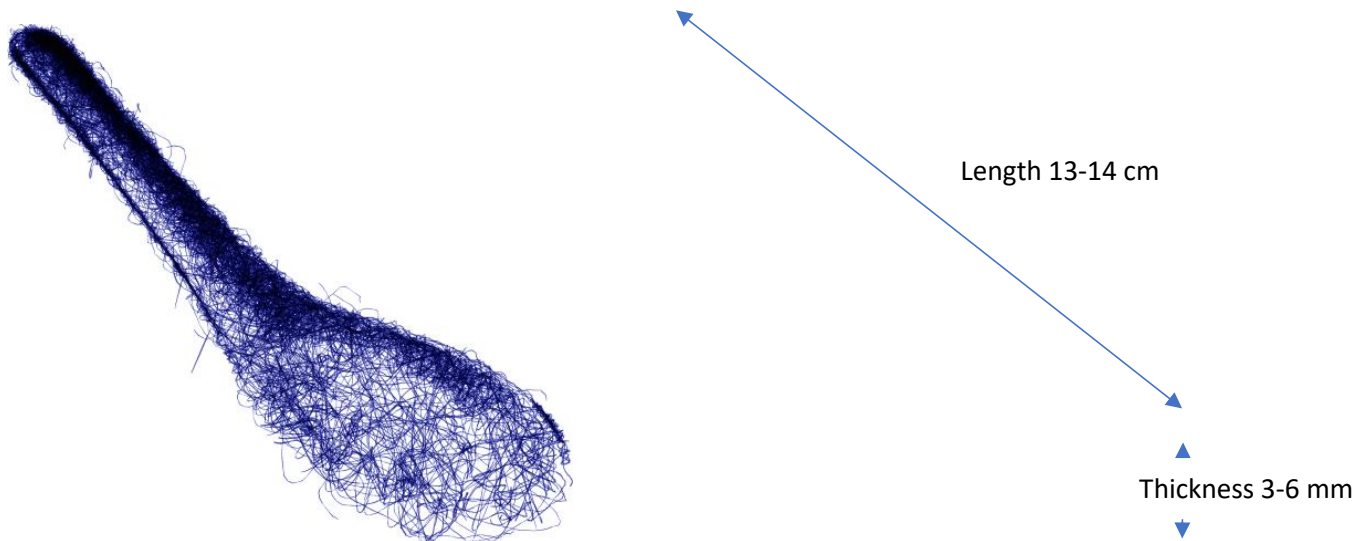
Edible spoon is easy to handle while eating

55 responses



Gate 1: Go/No-Go - Based on the results of the feasibility study, the team would make a decision to proceed with the development of the edible spoon.

Stage 4: Design and Development - In this stage, the team would create a prototype of the edible spoon and test it in a lab or kitchen. They would refine the recipe and design based on feedback from taste testers and optimize the manufacturing process.



Early sketch of edible spoon design

This is our design sketch for the edible spoon. We estimated for the ideal length of the spoon would be around 13-14 cm with an ideal thickness measured around 3-6 mm so that it could be thick enough to stay in shape when used but thin enough to be bitten and chewed.



Step 1: Ingredient

Preparation

Prepare the ingredient and make sure the ingredient were in the right measurement. The ingredient that was used to make the edible spoon are:

1. 1 kilogram of Ataa flour (RM12)
2. 3 tablespoons of salt (3.00)
3. 4 tablespoons of oil (2.50)
4. 250 ml of water (2.00)

With the number of ingredients with their accurate measurement above, we can make at least 200 pieces of the edible spoon with it. The price combined for all the ingredients listed above



were at least RM19.50.



Step 2: Dough Mixing

Put the water and mix it together. Then slowly mix in the oil and salt a little bit. Mix the dough then add the remaining salt and mix it again together again until it is thoroughly mixed. Let the dough rest for 10 minutes.



Step 3: Shaping

Spread the flour on the board to prevent the dough from sticking on the board surface, then flatten the dough using the rolling pin. After the dough has been flattened a few times, bring out the mold, which is the metal spoon, and coat it in oil. Measure the dough and cut it based on the mold. Use another mold to make sure the dough stays in shape even after bake. Cut the remaining part of the dough into the mold. Finally, arrange the mold on the baking tray.



Step 4: Baking

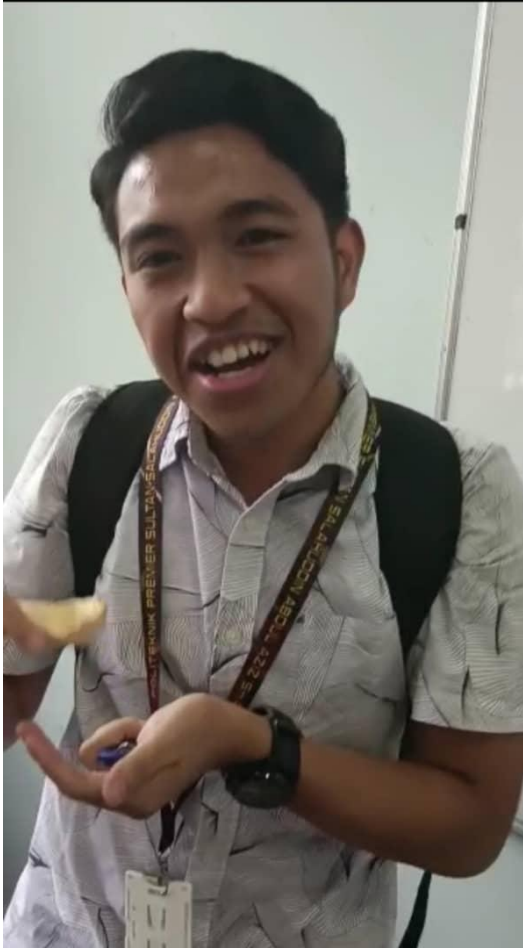
After finishing arranging the mold on the baking tray, put it in the oven or microwave. Set the heat to 120 °c and the timer to 30 minutes. Make sure the oven or microwave was set to heat on the front and the back part. After 30 minutes, take it out and let it rest for about 10 minutes and the edible spoon is ready to eat.

Stage 5: Testing - Once the prototype has been developed, the team would conduct more extensive testing of the edible spoon to ensure that it meets all relevant food safety standards and regulations.

Results of the development:



First attempt



Comments from the tester:

1. Too thick to bite and chew
2. Weird tastes
3. Bad shape
4. The smell is overpowering other food



Second Attempt



Comments from the tester:

1. Taste is good and did not overpower other tastes
2. The thickness is pretty thick and a little bit harder to bite and chew.
3. Could fix the shape to be better.



Third attempt

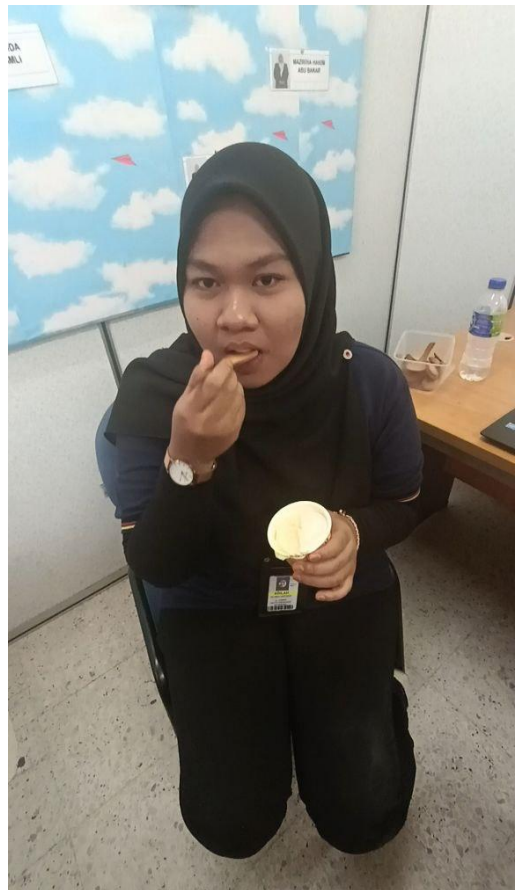


Comments from the tester:

1. The shape is just nice.
2. Product taste is like 'capati', which is pretty good.
3. The thickness needs to be improved, still pretty hard to bite and chew.
4. The smell is not too strong.

Gate 2: Go/No-Go - Based on the results of the testing, the team would make a decision on whether to move forward with the launch of the product.

Stage 6: Launch - In the final stage of the Stage-Gate model, the team would launch the edible spoon into the market, creating a marketing strategy to promote the product to potential customers.



Gate 3: Post-Launch Review - After the launch of the product, the team would conduct a post-launch review to evaluate the success of the product and identify any areas for improvement.

Sampling Technique

The study of this edible spoon most suitable sampling technique is non-probability sampling. This is because the non-probability sampling techniques, such as convenience sampling or snowball sampling, may be more practical and feasible to use in such cases, as they allow for flexibility in selecting participants who are readily available or who can refer other potential participants. Non-probability sampling techniques can be more cost-effective and time-efficient compared to probability sampling techniques.

The technique of non-probability sampling most suitable for edible spoon products is convenience sampling. Convenience sampling involves selecting participants who are easily accessible and readily available, making it practical and feasible for studies where the target population is readily accessible. According to Palinkas (2015), convenience sampling is a non-probability sampling technique where participants are selected based on their availability or accessibility, and is commonly used in research for its ease and convenience in data collection.

Design

According to Roscoe (1975), a sample size greater than 30 and less than 500 is suitable for most behavioral studies. Johansen and Brooks (2010) also suggested that 30 representative participants from the population of interest are a reasonable minimum recommendation for a pilot study where the purpose is a preliminary survey or scale development. Thus, this study will have 50 respondents that will participate in the testing and validation stage for the edible spoon product.

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*, 42(5), 533-544.

Overall, the Stage-Gate model can provide a structured approach to developing an edible spoon, helping to ensure that the product is technically and commercially feasible, and meets customer needs and expectations.

3.3 Conclusion

This chapter begins with an introduction and then describes the research design employed in this study. Population and sample study is also mentioned before discussing the research methodology used to conduct this research. In collecting data, library, and field

research are used. The data that were collected are then analyzed and discussed and the results are displayed.

CHAPTER 4

DATA ANALYSIS RESEARCH FINDINGS

4.1 Introduction

This chapter will represent the results that have been obtained to see the effectiveness of our innovation project, edible spoon which has been produced in the picture given in stage 3 above. The result from our online questionnaire was analyzed in more detail to draw conclusions based on our objectives which have been stated below.

4.2 Reliability test of Questionnaire

According to

Scale: ALL VARIABLES

Case Processing Summary

| | | N | % |
|-------|-----------------------|----|-------|
| Cases | Valid | 24 | 100.0 |
| | Excluded ^a | 0 | .0 |
| | Total | 24 | 100.0 |

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|------------------|--|------------|
| .907 | .909 | 8 |

The feedback survey was sent to 30 respondents

4.3 Descriptive Analysis

Descriptive analysis, also referred to as descriptive statistics, is a statistical technique that summarizes and presents data in a way that shows understanding and interpretation. It involves the calculation of measures such as central tendency dispersion, and graphical representations to describe the main features and patterns of a dataset (Tabachnick et. al,2013)

4.3.1 Respondent Demographic Profile

Researchers provided online questionnaires to the public population that tested the product and received responses from respondents. These questions are related to the respondents' profile and their status in the society. This project have requested respondents personal information such as gender, age, level of education as of now and their marital status as of now.

| Demographic | Category | Frequency | Percentage% |
|--------------------|--|-----------|-------------|
| Gender | Male | 13 | 43.3 |
| | Female | 17 | 56.7 |
| Age | 15 and below | 6 | 20 |
| | 21-30 | 16 | 53.3 |
| | 31-40 | 4 | 13.3 |
| | 41-49 | 3 | 10 |
| | 50 and above | 1 | 3.4 |
| Level of education | High school/SPM | 11 | 36.7 |
| | Undergraduate (Certificate/Diploma/Degree) | 16 | 53.3 |
| | Postgraduate (Master/PhD) | 3 | 10 |
| Marital Status | Single | 80 | 26 |
| | Married | 20 | 4 |

Based on table 4.3 above, it has shown the profile of respondents for this project. According to gender, there are 45.8% of male and 54.2% of female respondents equivalent for two genders to 30 people. According to the age group, there are 25% comes from age below 15, and 41.7% comes from age between 21 and 30. 12.5% comes from the age between 41-49 and another 4.2% comes from the age of 50 and above. According to the

education level, High school/SPM graduate is 41.7% of this study while undergraduate will make up 45.8% of the study. The other 12.5% will be from postgraduate respondents. According to the marital status of the respondent, 75% is married meanwhile 25% will be from the single respondent.

Gender
30 responses

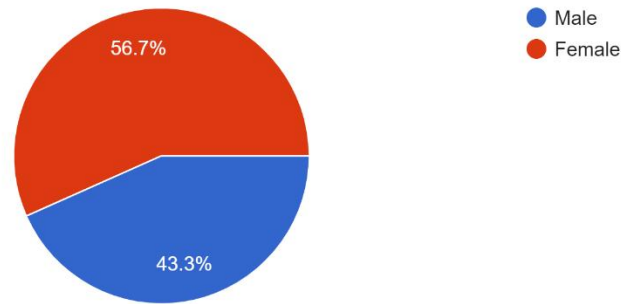


Figure 4.1.1

This particular survey has 30 respondents with 56.7% which amounted to 17 female respondents and the other 43.3% amounted to 13 male respondents. From here we can see that female respondents are slightly more compared to male respondents.

Age
30 responses

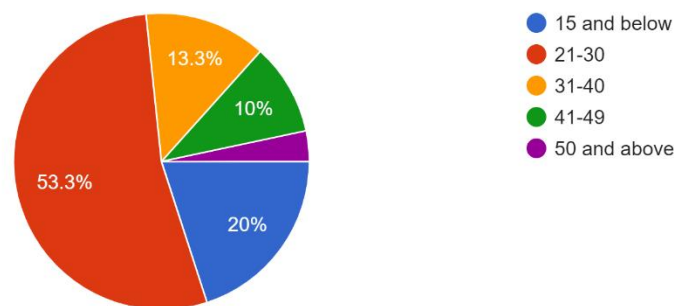


Figure 4.1.2

The figure above shows the age group of the respondents. Respondents age ranges from 15 and below to 50 and above and is broken down into 5 groups of ages. 15 and below have made up 20% (6) of the total respondents. 21-30 have become the biggest age group for

respondents with 53.3% (16), mainly because the product tester is mainly the student of Politeknik Sultan Salahuddin Abdul Aziz Shah. 31-40 with 13.3% (4) is in the minority with 41-49 comprised of 10%(3) of the chart. 50 and above age group completed the whole chart with 3.3% (1).

Levels of education

30 responses

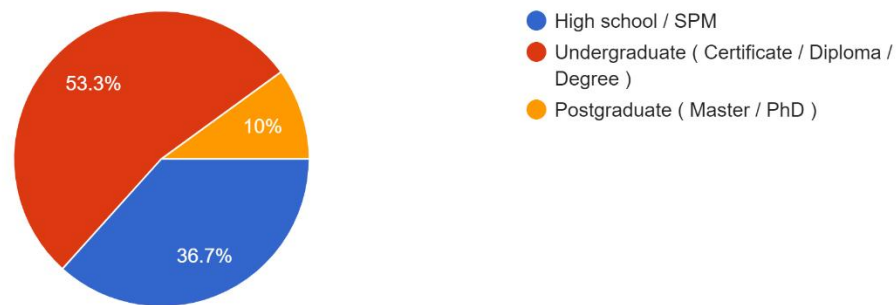


Figure 4.1.3

The figure above shows the profile for the respondents level of education. Undergraduate made up the most of the chart with 53.3% equalled to 16 of the respondents. Once again, this is largely because most of the respondents are students from Politeknik Sultan Salahuddin Abdul Aziz Shah. High school/SPM certificate is in the second with 36.7% equalled to 11 respondents while postgraduate made up the whole chart with 10% amounting to 3 of the respondents.

Marital Status

30 responses

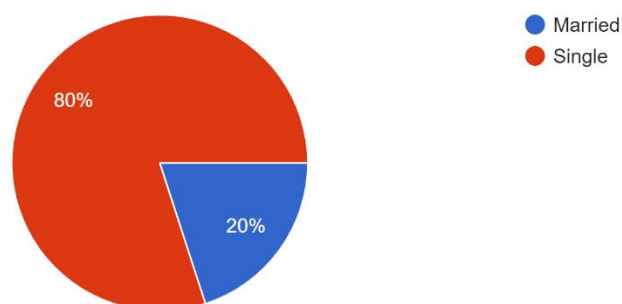


Figure 4.1.4

The figure above shows the difference in marital status among the respondents. Single respondents made up a large part of the pie chart with a staggering 80% equal to 24 of the respondents. Married respondents completed the pie chart above with another 20% equal to 6 people.

4.3.2 Central Tendencies Measurements of Construct

In this part, the researcher gave respondents 30 statements on suitable eating with an edible spoon in order of importance. The central tendency measurement of constructs refers to measures of center or central location as a summary measure that attempts to describe a whole set of data with a single value that represents the middle or center of its distribution. In this project, we can see that the mean is measured and described by the standard deviation. Each score will be determined by the mean and as evidenced by this data was listed as followed:

SECTION I: ASPECT OF PRESENTATION DESIGN

| ITEM | VARIABLES | Means | Means | Standard Deviation |
|------|---|-----------|-----------|--------------------|
| | | STATISTIC | STATISTIC | STATISTIC |
| 1 | The materials used for the making of the edible spoon are bio-degradable in nature making them environmentally friendly and capable of returning to the earth without leaving harmful residues behind | 4.2 | 4 | 0.71438 |
| 2 | I like the concept of an edible spoon, which is a unique and eco-friendly solution for reducing waste and enhancing the overall dining experience can be a fun and rewarding way to broaden one's culinary horizons and | 4.2667 | 4 | 0.78492 |

| | | | | |
|----------------------|---|--------------|----------|-----------------|
| | contribute to sustainable living practice | | | |
| 3 | In response to the growing environmental concerns related to single-use plastic waste, edible spoon is a sustainable alternative to disposable spoons. | 4.2667 | 4 | 0.78492 |
| 4 | It is becoming increasingly important to prioritize eco-friendly practices and products, which are those that are designed to minimize harm to the environment and support sustainable resource management. | 4.2667 | 4 | 0.78492 |
| 5 | Sometimes, it can be valuable to break away from the monotony of daily life and intentionally seek out new experiences that deviate from our usual routine. | 4.1667 | 4 | 0.83391 |
| 6 | The edible spoon also can be considered as an innovative and sustainable alternative to traditional metal cutlery. | 4.2 | 4 | 0.76112 |
| 7 | The edible spoon has actually proven to be a remarkably durable and reliable utensil for various types of food consumption | 4.2333 | 4 | 0.72793 |
| 8 | The edible spoon also offers a unique and convenient ease of handling while eating, as its compact and ergonomic design fits comfortably in the hand | 4.3667 | 4 | 0.7184 |
| TOTAL AVERAGE | | 4.376 | 4 | 0.763813 |

From table 4.3.1, which is **Section I: Aspect of Presentation Design**, the highest mean is for item 6 (4.3667) with a standard deviation of 0.724. While the lowest mean is for item 4 (4.1667) with a standard deviation of 0.83391. The mean average for the aspect of presentation design was 4.376. Based on table 4.3.1 above, the researcher will examine each of the 8 items individually and show the results as a pie chart.

The materials used for the making of the edible spoon are bio-degradable in nature making them environmentally friendly and capable of returning to the earth without leaving harmful residues behind
30 responses

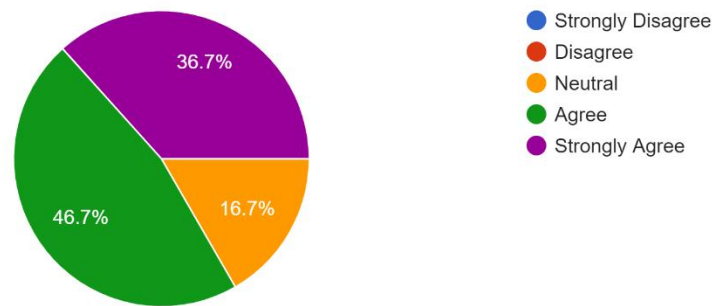


Figure 4.2.1

Figure 4.2.1, the materials used for the making of the edible spoon are bio-degradable in nature making them environmentally friendly and capable of returning to the earth without leaving harmful residues behind is 5 respondents neutral (16.7%),14 respondents agree (46.7%),11 strongly agree (36.7%)

I like the concept of an edible spoon, which is a unique and eco-friendly solution for reducing waste and enhancing the overall dining experience can be ...ons and contribute to sustainable living practices.
30 responses

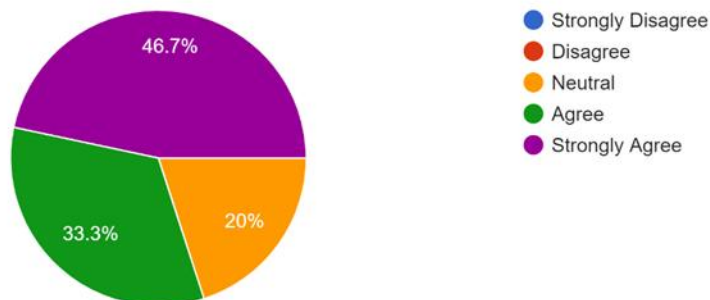


Figure 4.2.2

Figure 4.2.2, I like the concept of an edible spoon, which is a unique and eco-friendly solution for reducing waste and enhancing the overall dining experience can be a fun and rewarding way to broaden one's culinary horizons and contribute to sustainable living practices is 6 respondents in neutral (20%), 10 respondents agree (33.3%), 14 respondents strongly agree (46.7%)

In response to the growing environmental concerns related to single-use plastic waste, edible spoon is a sustainable alternative to disposable spoons.

30 responses

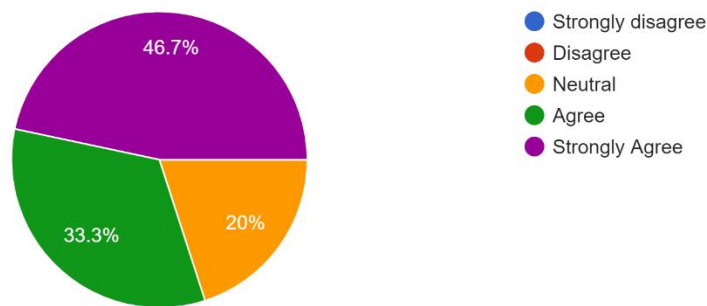


Figure 4.2.3

Based on the analysis in figure 4.2.3, the highest response is strongly agreed in response to the growing environmental concerns related to single-use plastic waste, the edible spoon is a sustainable alternative to disposable spoons which is 46.7% (14 people). While 33.3 % (10 people) of the respondents also agreed with the statement and 20% (6 people) of the respondents chose neutral.

It is becoming increasingly important to prioritize eco-friendly practices and products, which are those that are designed to minimize harm to the environment and support sustainable resource management.

30 responses

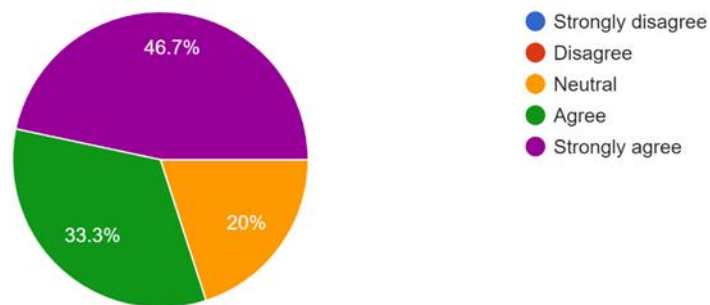
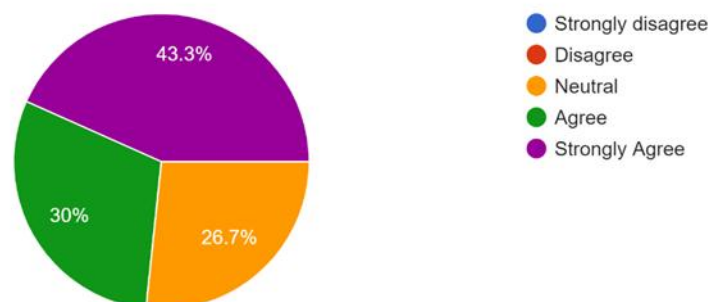


Figure 4.2.4

In figure 4.2.4, a total of 46.7% (14 people) strongly agree and 33.3% (10 people) agree It is becoming increasingly important to prioritize eco-friendly practices and products, which are those that are designed to minimize harm to the environment and support sustainable resource management. While 20% (6 people) gave a neutral answer.

Sometimes, it can be valuable to break away from the monotony of daily life and intentionally seek out new experiences that deviate from our usual routine.

30 responses



F

Figure 4.2.5

Based on the analysis in figure 4.2.5, the highest response is very much strongly agreed that it this valuable to break away from the monotony of daily life and intentionally seek out new experiences that deviate from our usual routine., which is 43.3% (13 people). While 30% (9 people) of respondents agreed with the statement and 26.7% (8 people) of the respondents chose neutral about being valuable to break away from the monotony of daily life and intentionally seek out new experiences that deviate from our usual routine.

The edible spoon also can be considered as an innovative and sustainable alternative to traditional metal cutlery.

30 responses

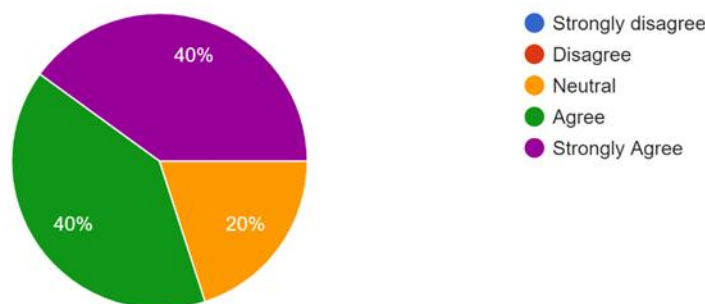


Figure 4.2.6

Based on the analysis in figure 4.2.6, the highest choice is the edible spoon also can be considered an innovative and sustainable alternative to traditional metal cutlery, which is strongly degree 40% (12 people). While 40% (12 people) of respondents agreed with the statement and 20% (6 people) of the respondents chose neutral about the edible spoon also can be considered an innovative and sustainable alternative to traditional metal cutlery

The edible spoon has actually proven to be a remarkably durable and reliable utensil for various types of food consumption

30 responses

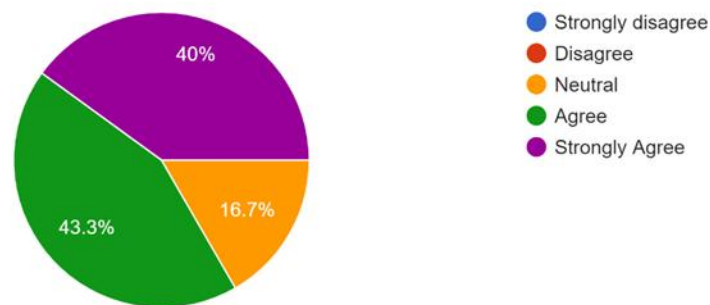


Figure 4.2.7

Based on the analysis in figure 4.2.6, the highest choice is the edible spoon has actually proven to be a remarkably durable and reliable utensil for various types of food consumption, which is strongly degree 40% (12 people). While 43.3% (13 people) of respondents agreed with the statement and 16.7% (5 people) of the respondents chose neutral about the edible spoon has actually proven to be a remarkably durable and reliable utensil for various types of food consumption

The edible spoon also offers a unique and convenient ease of handling while eating, as its compact and ergonomic design fits comfortably in the hand

30 responses

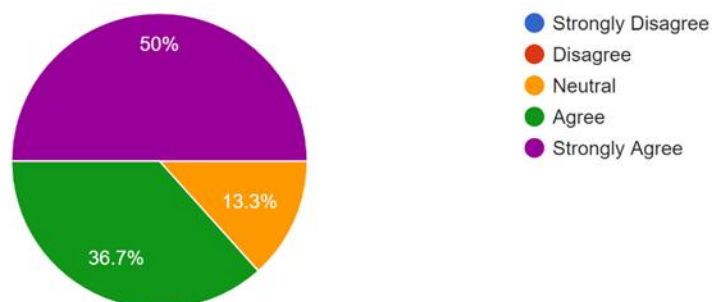


Figure 4.2.8

In figure 4.2.8, a total of 50% (15 people) strongly agree and 36.7% (11 people) agree about the edible spoon also offers a unique and convenient ease of handling while eating, as its compact and ergonomic design fits comfortably in the hand. While 13.3% (4 people) gave a neutral answer.

4.4 Conclusion

In conclusion, this chapter has highlighted a clear view of the whole data analysis and research findings. The explanation and description of the data analysis also have been collected and stated by questionnaires that we created for the public in the table clearly explained in this chapter.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter will discuss the findings, limitations, future recommendations, and conclusion for the whole report. This is to ensure that the edible spoon product can achieve its objective that was set before the development of the edible spoon begin.

5.2 Findings

This chapter will delve into the objectives and considerations regarding reducing plastic waste and ensuring the marketability of edible spoons in Malaysia. It discusses how the product is designed to be eco-friendly and attractive to consumers, thereby aiming to have a positive impact on the environment while capturing a significant market share. The edible spoon product has been developed using the stage-gate model as our model for the development of the edible spoon. The findings found that the intention to use edible spoons as an alternative to plastic spoons is at a high level. The study was carried out using a Google Form questionnaire and given out to 30 public respondents. The data of the study have been analyzed using SPSS and it showed that there is demand for edible spoons as an alternative to plastic spoons

5.3 Limitations

There will always be an advantage and disadvantages when developing a product and this edible spoon is no exception. For this project, there are a few restrictions that arise while developing the product. Listed here are a few of those restrictions:

The first limitation is the time restrictions while developing the product. Developing and testing the Eco-spoon can be time-consuming, especially when students also have other academic commitments, extracurricular activities, and personal obligations to attend to. Students will have to balance their daily life with other subject assignments while developing the edible spoon.

The second restriction is that our product is not properly labeled. The right packaging and testing cannot be completed in time for the deadline due to time limitations and excessive concentration on the development of the edible spoon.

The last stated limitation is there is no proper costing for this project. The cost for doing the project is inconsistent and not static. Plus, edible spoons may be more expensive compared to regular plastic or metal spoons.

5.4 FUTURE RECOMMENDATIONS

While it has many limitations, this edible spoon product will only move forward with more innovations towards it. Based on the limitations in the sections above, here are a few future recommendations for future research on the Eco-spoon:

The first recommendation is that proper planning and appropriate allocation of time for each stage should be conducted for future projects. Edible spoon is still a new and rare thing in the current market, so this product will need more research from many researchers. Thus, more study on the edible spoon will help to increase awareness about its usage and widen its acceptance to the public.

The second recommendation is that Eco-spoon needs proper labeling and testing. The labeling of this product will be done if given more time to the researchers while the testing should be done by the qualified tester for a more precise evaluation.

The last recommendation is that future studies should have proper budgeting throughout the research process. The budget is needed especially during the development and the testing part. Without a proper budget, it can hinder the progress during the research and ultimately waste much time for the researchers while developing the Eco-spoon.

5.5 Conclusion

Edible spoons are an eco-friendly and sustainable alternative to plastic cutlery. The product is made from a blend of flours, such as wheat, rice, corn, or millet, and come in a range of flavors, including sweet and savory. Edible spoons are biodegradable and will break down naturally in the environment, and do not require any additional resources to recycle or dispose of. Besides, edible spoons also offer a unique culinary experience and are healthier than plastic utensils that may contain harmful chemicals. While they are not yet widely available, their popularity is growing, and they may soon become a common sight in restaurants and cafes around the world.

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APPENDIX I: GANTT CHART

| Activity | Months/Weeks | | | | | | | | | | | | | |
|---|--------------|---|---|---|---|---|---|---|---|----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Topic Choosing | | | | | | | | | | | | | | |
| Literature Review | | | | | | | | | | | | | | |
| Consultation with Supervisor | | | | | | | | | | | | | | |
| Proposal Planning | | | | | | | | | | | | | | |
| Product Design and Development | | | | | | | | | | | | | | |
| Product Testing and Validation | | | | | | | | | | | | | | |
| Final Report | | | | | | | | | | | | | | |
| Final Report and preparation for Final Presentation | | | | | | | | | | | | | | |

APPENDIX II: QUESTIONNAIRE

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Age *

- 18-24
- 24-30
- 31-38
- 39-45
- 45-55
- 56 and above

Gender *

- Male
- Female

Levels of education *

- SPM
- Diploma
- Degree
- Masters and above



Edible spoon are bio-degradable in nature *

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

Edible spoon is something new to the community* *

- Strongly Disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

Edible spoon is an alternative for disposable plastic spoon *

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

Edible spoon are eco friendly *

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Edible spoon is an alternative for metal cutlery *

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

Edible spoon is durable to use *

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

Edible spoon is easy to handle while eating *

Strongly disagree

Disagree

Neutral

Agree

Strongly Agree