Healthy Spinach Noodles: A Functional Food Innovation For Children Who Are Reluctant To Eat Vegetables

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Abstract: Vegetable consumption among children in Indonesia is still very low, while instant noodle consumption is very high. This raises concerns about long-term health impacts. A food innovation is needed that can insert vegetable intake into foods that are already popular with children, such as noodles. This study aims to create and test consumer acceptance of a functional food innovation in the form of healthy spinach noodles as an alternative strategy to increase vegetable consumption. This study is an experimental study with organoleptic testing of 34 respondents. Data were collected through a questionnaire with a hedonic scale of 1-5. The results of the organoleptic test showed a very high overall acceptance level of 83.2%. In detail, the appearance aspect achieved acceptance of 97%, taste 91%, texture 79%, color 85%, and aroma 64%. No respondents gave a rating of dislike or somewhat dislike in all aspects. The healthy spinach noodle innovation was successfully created and very well received by respondents in terms of organoleptic. This product has great potential to be an effective strategy to increase vegetable intake, especially in children who are reluctant to consume vegetables in their whole form.

1 INTRODUCTION

Vegetables and fruit are nutritional needs that are rarely liked and often ignored by school-age children, adolescents, and adults. They tend to prefer attractive and tasty foods that lack good nutritional quality. Vegetables are an important food that must always be consumed at every meal because they are one of the requirements for a balanced nutritional menu. Dietary patterns applied in childhood will influence eating patterns in adulthood, so getting children used to consuming vegetables from an early age is very important. A study conducted by (Nuraeni et al., 2023) showed consume enough vegetables.

Meanwhile, the results of the most recent survey, the Indonesian Health Survey (SKI 2023), stated that only 3.3% consumed vegetables according to the WHO recommendation of 5-7 servings/week. Children's rejection of vegetables is generally caused by the taste being considered unappealing, the texture being different from processed foods, and the influence of social environments such as friends and parental parenting styles.

On the other hand, Indonesia was the world's second-largest consumer of instant noodles in 2023, with total consumption reaching 14.54 billion servings (SKI, 2023). This low vegetable

consumption can have long-term health impacts. Lack of vegetable consumption, which is a source of vitamins, minerals, and fiber, can trigger obesity and various non-communicable diseases such as heart disease, stroke, diabetes, colon cancer, and hypertension. Instant noodle consumption has increased sharply since the Covid-19 pandemic, reaching 12.52 billion servings in 2020. The majority of Indonesians over the age of 3, approximately 60.7%, consume instant noodles or other instant foods one to six times per week. Furthermore, 33.4% consume them less than three times per month, while the remaining 5.9% consume them more than once a day (Yuniarti, 2023).

We are familiar with various noodle products, such as wet noodles, dry noodles, vermicelli noodles, and rice vermicelli. Both wet and dry noodles are made from wheat flour, but their final processes differ. Compared to other staple foods, noodles have several advantages, including a distinctive flavor and, most importantly, their convenient packaging. However, noodles have a major drawback: their nutritional content is still very low, particularly in protein and fiber. This is because the primary ingredient in noodles is flour, which contributes to their high carbohydrate content (Afifah, 2023).

Addressing the low nutritional content of noodles requires product innovation based on functional foods such as vegetables or fruits. One such innovation is spinach noodles

2 METHOD

This research is a product research and development study or *research and development*

(R&D) which aims to develop new products by innovating Spinach Noodle products. Implementation began in May - June 2024. Product criteria were organoleptic indicators, including color, taste, aroma, texture, and appearance. Data collection was conducted through observation using organoleptic test instruments with 34 panelists. This research model used the 4D (*define, desi*sources. From there, repeated experiments are conducted to establish the best basic recipe, which will serve as the starting point for product innovation for Noodles with Vegetables .

Design stage carried out was designing a recipe for product development by adding spinach to the noodle dough. *development* stage involves testing the developed recipe. The test results will form the basis for revising and improving the recipe. *Dissemination* phas involve disseminating the product through offline exhibitions. The product development results are tested on panelists using sensory testing.

Tool

The equipment used in making spinach noodles consists of a container, noodle grinder, spatula, stove, pan, blender, sieve, measuring cup, scales, bowl, spoon, oven, steamer, and knife.

Material

Manufacturing Process Method Making Spinach Noodles:

1) Prepare the necessary tools and materials
2) Wash the spinach until clean, then take the leaves, then blend the spinach using additional water.
3) After that, strain the spinach that has been blended, then take the juice.

4) Put the flour, salt, and eggs into a bowl, then stir until evenly mixed using a spatula.

5) Gradually add the spinach juice to the mixture.

6) Then knead the noodle dough using your hands until smooth.

7) After the dough is smooth, the dough is divided into several parts and then weighed.

8) Roll out the dough using a noodle rolling machine, sprinkle the noodle dough with tapioca flour so that the noodles produced do not stick.

Table 1 Spinach Noodle Ingredients

No	Noodle Ingredients	Amount
1	High protein wheat flour	500 gr
2	Egg	2 grains
3	Spinach	150 gr
4	Mineral water	200 ml
5	Salt	Enough
6	Tapioca flour	250 gr

Table 2 Spinach Noodle Ingredients

| No	Seasoning Ingredients	Amount
1	Garlic	7 cloves
2	Red onion	9 cloves
3	Salt	1 tsp
4	White pepper powder	1 tsp
5	Sugar	2 tbsp
6	Chicken stock powder	½ tbsp
7	Chili sauce	1 tbsp
8	Soy sauce	1 tbsp
9	Cooking oil	200 ml

Manufacturing Process Method

1) Prepare the necessary tools and materials

2) Wash the spinach until clean, then take the leaves, then blend the spinach using additional water.

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4) Put the flour, salt, and eggs into a bowl, then stir until evenly mixed using a spatula.

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6) Then knead the noodle dough using your hands until smooth.

7) After the dough is smooth, the dough is divided into several parts and then weighed.

8) Roll out the dough using a noodle rolling machine, sprinkle the noodle dough with tapioca flour so that the noodles produced do not stick.

9) Steam the ground noodles for 10 minutes. Then, let them cool.

10) Preheat the oven to 100 degrees. Then, add the steamed noodles and let them sit for 60 minutes, until they're dry.

11) Boil the noodles that have been oven- baked until cooked for approximately 5 minutes.

12) Then drain, then ready to serve.

Making the Seasoning:

1) Thinly slice the shallots and garlic

2) Heat a frying pan with cooking oil, then fry the shallots and garlic alternately until brown.

3) Remove and drain the fried onions.

4) Prepare a blender. Add the shallots, fried garlic, sugar, salt, and chicken stock powder. Blend until smooth.

5) Prepare a container, add the blended spices,

then add the chili sauce and soy sauce, then stir until evenly mixed.

6)   Seasoning ready to use
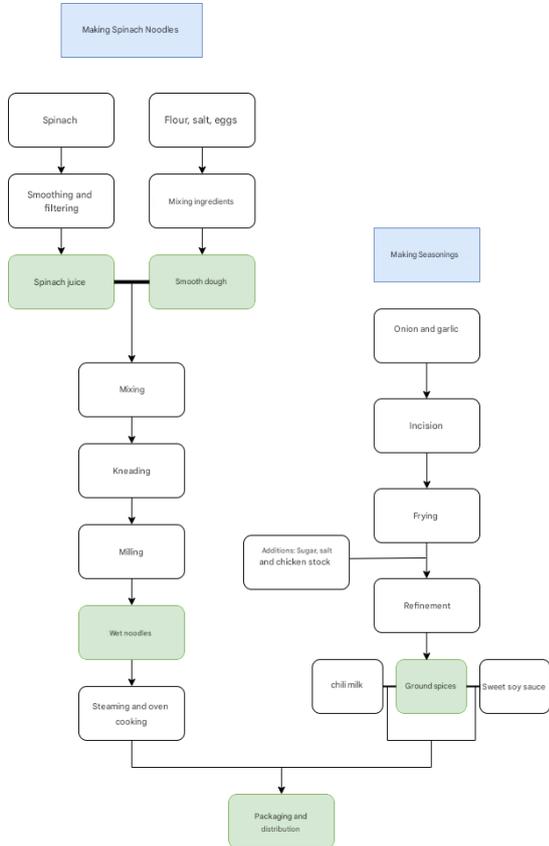
3   RESULT

The final result of a cooked spinach noodle product that is ready to be served. The visual appearance of spinach noodles with its attractive green color, complemented by the addition of fresh vegetables and eggs, and the arrangement in the bowl creates an appetizing impression. The innovation of spinach as a raw material for noodles successfully disguises the shape and texture of vegetables that are often disliked, while still maintaining its nutritional and fiber content. Thus, this product not only meets the aspects of visual and taste enjoyment, but also

serves as a fun nutritional education medium for all ages.

Figure 1. spinach noodle modification

Based on the results of the organoleptic test carried out on the spinach noodle sample as seen in the image above, it can be explained with the sensory characteristics of the product below.

Percentage Results of Organoleptic Test of Spinach Noodles
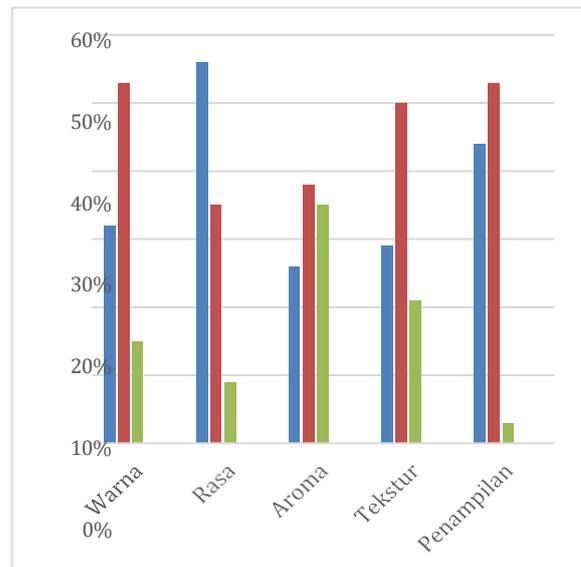

Figure 1Percentage of Organoleptic Test of Spinach Noodles

Based on the results of organoleptic tests conducted on 34 respondents, the spinach noodle innovation demonstrated a very high level of acceptance (83.2%). These results not only

demonstrate the product's popularity but also offer significant potential as a strategy to increase vegetable consumption, particularly among children. Overall, no respondents rated the product as either "disliked" or "somewhat disliked" across all organoleptic aspects (color, taste, aroma, texture, and appearance). This indicates that this innovation has successfully delivered a product that is acceptable to the general public.

Color

Overall, the na respondents. As many as 85% of respondents expressed liking or strongly liking the color aspect of spinach noodles, indicating the successful integration of spinach into the product. The resulting green color not only creates a strong visual appeal but also conveys a psychological message of the freshness and naturalness of the product. This is fully in line with (Siregar & Pulungan, 2023) which confirms that natural pigments such as chlorophyll and carotenoids in spinach not only function as safe colorants but also significantly enhance the aesthetic value of food products. Research (Lamusu, 2018) proves that natural colors derived from vegetables effectively increase the sensory appeal of food products, especially for children who typically prefer bright and natural colors.

Flavor

Taste has proven to be the strongest parameter in this spinach noodle product, with a consumer acceptance rate of 91%. Taste is the primary determining factor in a person's decision to accept or reject a product. If the taste of a food product does not match preferences, it will be rejected, even if

other quality parameters have been met properly (Rahardjo, 2016). This success stems not only from the innovative noodle dough formulation that combines high-protein wheat flour with spinach extract in the right proportions, but also from the excellence of the specially blended seasoning. The seasoning, prepared in- house, successfully creates a complex and harmonious flavor profile, where the addition of spinach provides a distinctive savory dimension without leaving a bitter or unpleasant *aftertaste* . This innovative seasoning includes the use of garlic and shallots, fried until fragrant and then ground together with other ingredients such as salt, sugar, and chicken stock powder. Other additions include chili sauce and sweet soy sauce, resulting in a taste that consumers love.

Aroma

Aroma was the parameter with the lowest acceptance rate, although responses to aroma were still predominantly positive, with 64% of

respondents reporting liking to strongly liking it. The characteristic spinach aroma was still detectable but not overpowering and blended well with the other aromas of the noodle ingredients. As in the study (Wadhani et al., 2021) , aroma assessment is a highly subjective process and depends heavily on individual sensitivity and previous sensory experience. Processing processes involving steaming and drying in an oven, as implemented in the production of these spinach noodles, have been shown to be effective in reducing compounds that cause unpleasant aromas. Previous research on the production of dry green noodles with natural spinach dye also

supports these findings. The steaming and drying processes have been shown not only to improve organoleptic acceptability but also to produce a product with a lower moisture content and better stability. Thus, this processing approach is effective in controlling *unpleasant aromas* and improving the overall quality of spinach noodles (Hiyah, 2021) .

Texture

The product's chewy, soft, and unbreakable texture successfully met consumer expectations, with 79% of respondents giving it a positive rating. This success is inseparable from the optimal kneading process and the addition of tapioca flour in the formulation, which contributed to the formation of the desired noodle structure. Research (Nurlaila et al., 2017) concluded that texture is a critical indicator and one of the most important parameters in assessing the quality of noodle products. The oven-drying process, as implemented in this innovation, also plays a role in stabilizing the texture and preventing the product from becoming mushy, a finding also supported by (Afifah et al., 2023).

Appearance

The visual appearance of spinach noodles e noodles look neat, have a uniform green color, and overall give the impression of a well-made and hygiene. product. (Sugiyarti, 2019) emphasized that visual appearance is the primary factor influencing consumer perceptions of quality and purchasing intention. Food products with natural colors and a consistent and attractive appearance can significantly increase purchasing interest and consumption

intentions, especially for consumers who are increasingly aware of the health and naturalness of products.

4 CONCLUSIONS

The functional food innovation, healthy spinach noodles, received a very high acceptance rate (83.2%) from 34 respondents based on organoleptic testing. Every sensory aspect of the product received positive feedback. Flavor was the strongest (91% liked or liked very much), followed by appearance (97%), color (85%), texture (79%), and aroma (64%). No respondents gave a negative rating ("disliked" or "somewhat disliked") for any parameter. This indicates the product's significant popularity and market potential.

Further research is recommended, including children as panelists, to obtain more accurate acceptability data. Additionally, additional testing of shelf life, packaging, and product stability is needed to ensure product quality. Despite acceptance, the aroma aspect still received the lowest score. It is recommended to explore alternative processing techniques or the addition of specific spices that can enhance aroma without compromising nutritional value.

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