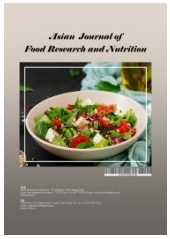

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Development & Sensory Evaluation of Vegan Edible Basket by Using Multi Grains & Nori Sheet

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The shelf life and material containment of food products are currently being challenged by advancements in food packaging and preservation technology. The uses of eatable cone have advanced significantly during the last few years. The vegan cone is eco friendly and biodegradable, and the greatest option in place of paper cutlery. A vegan eatable cone was developed in this study using rice flour, bajra, and whole wheat flour with nori sheets. 20% rice flour, 5% bajra, 5% whole wheat flour, 30% refined flour, 20% multigrains, 10% corn starch and 10% nori sheet were used to completely replace refined wheat flour while making a cereal-based cone. Cereals are known for being more nutrient-dense foods that include protein, fats, and minerals, and for being connected with greater diet quality. The sensory panel was used to determine the texture, rated according to hardness, crispness and overall acceptability. The panel lists rated the overall acceptability of the

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cones formulations, which scored better (9) and (8.9) respectively compared to the control (9) in consumer approval, using a hedonic scale for sensory evaluation (9=Like extremely; 1=Dislike severely). When paired with cereal and multi grains, this sheet generated a healthy amount of nutrients, texture, and colors. Given their continued requirement and usage, when combined with cereal and multi grains. Because complete eradication is impractical, but a better solution could cut down on paper usage. So it would be ideal if the basket was made of plant-based materials like Nori sheet, bajra, rice flour, and wheat flour. Can cut down on paper usage. Therefore, a basket composed of plant-based materials such Nori sheet, bajra, rice flour, and wheat flour would be preferable. The edible cone is the best substitute for paper cutlery because it is both environmentally friendly and biodegradable. The edible basket reduces paper waste because users can first enjoy the murmura before also indulging in the deliciously flavorful basket.

Keywords: Multigrains; Nori sheet; edible basket; Bajra; sensory evaluation.

1. INTRODUCTION

Consumers today are pickier, more demanding, more informed about food. They need items that are secure, affordable, and of a high sensory calibre [1]. Therefore, it is crucial for a food production process to understand consumer preferences and impressions of the sensory features of texture. Both sensory and instrumental techniques can be used to measure texture. According to research on the growth of sorghum cones, the sorghum cone's overall acceptance was most highly connected with appearance (r = 0.856) and texture (r = 0.806) and overall acceptability were found. According to these findings, (P 0.05). Future research on the development of cones should emphasise optimising the basket development's appearance and texture must be optimised for later studies. When describing, according to these findings. Consumers emphasise the crispness of an ice cream cone's texture of a product, consumers emphasise how sharp the basket feels.most [2]. Although its exact meaning is unclear and inconsistent, it is acknowledged that crunchy foods are mechanically fragile and break with a familiar sound [3-5]. ThisIn order to improve the texture of the sorghum cones, this study used sensory analysis to differentiate betweenidentify differences in product texture (hardness, sharpness,crispness, and generaloverall acceptability) brought aboutcaused by changesmodifications in the formulation. For the analysis, a trained panel was utilized [5]. “Estimated that 6–8 million Indians had celiac disease; however, only a fraction of them have been identified. They stated that while the number of celiac disease patients is increasing, the country’s preparedness for its emerging epidemic is minimal. Most pressing concerns is the industrial manufacturing of reliable and inexpensive gluten-free foods” [6,7]. The primary ingredients for baking edible basket are flour, sugar, nori sheet, while minor ones include salt, dry mango powder, Maggie masala, water, oil, baking soda.

Some ancient crops such as wheat flour, rice flour, bajra flour, refined flour, multigrains, corn starch. Although they are abundant in vitamins and phytonutrients and have historically been a staple diet in many cultures, they are currently underutilised [8]. “Their high dietary fibre content is additionally linked to therapeutic health benefits such enhanced gut health, intestinal regularity, decreased blood sugar, and decreased cholesterol” [9]. Nori offers one of the broadest range of nutrients of any food, including many found in human blood.

Seaweed is good in regulating and purifying our blood because their chemical makeup is so similar to that of human blood plasma [10].

The best flour for aiding in the digestive process and minimising weight gain is refined flour. It is mostly utilised to create crispy and delicious foods like cones, baskets, and several fast food items. It has shown advantages for the digestive tract and lowers chronic inflammation.(4) Whole wheat atta contains a lot of nutrients. It is a staple food in most countries and offers more vegetable protein per serving than other cereals [11].

Bajra is a traditional Hindi name for the *Pennisetum glaucum* crop — also known as pearl millet. It is used because it is gluten free and have high phytochemicals, polyphenols, and other advantageous plant compounds that are all recognised to support good human health in various ways (15). Patients with type 2 diabetes should use it. B6 niacin, folate, iron, and zinc deficiencies could be avoided by include bajra in your diet on a regular basis.

The development of baskets uses wheat flour since it offers numerous additional benefits. Wheat helps to prevent diabetes, breast cancer, gallstones, and childhood asthma. Selenium, manganese, phosphorus, copper, and folate are among the vitamins and minerals that whole wheat may be a good source of. In India, wheat is a common food.

Adding more than two grains together results in multigrain goods. Increased nutrients are provided. In addition to providing more than what is typically provided by a single grain, they also make up for the nutrients that other grains lack [11].

“In many people's diets, maize starch serves as the primary source of a variety of nutrients as well as a strong source of energy. In addition to starch, they also provide fibre, calcium, iron, and B vitamins. Due to its crispiness and use as a thickener, it was used in the construction of baskets. In fact, nori has up to ten times the calcium of milk. Additionally, nori is loaded in vitamins. It provides vitamins A, B, C, D, E, and K as well as niacin, folic acid, and taurine. Additionally, because of the amount of vitamin C present, the substantial iron content of this food is more bioavailable” [12].

“In addition to the quantifiable amounts of polyphenols like carotenoids and flavonoids, nori also contains a variety of phytonutrients, such as alkaloids with antioxidant capabilities. Nori also contains chlorophyll (a pigment that makes plants green) which is a powerful, natural detoxifier that can help eliminate waste products from our body” [13]. Nori is also loaded with fibre and protein. In fact 30-50 percent of nori’s dry weight is protein, and much of the rest of it is digestible fibre.

“People rely on significant cereal crops like wheat, rice, and corn, which account for more than half of the calories consumed on the planet. However, although being an essential part of our diets, these grains lack crucial micronutrients. Micronutrient insufficiency is projected to impact around 2 billion individuals worldwide, posing several health risks [14]. Some ancient crops such as bajra, buckwheat, and millets rich in micronutrients or phytonutrients have traditionally played the role of staple food in many cultures but have been neglected currently. These grains are enriched with polyphenols, flavonoids, dietary fiber, amino acids, lignans, minerals, vitamins, antioxidants, and other essential components like fagopyritols” [8,9]. Nori offers one of the broadest range of nutrients of any food, including many found in human blood! Because the chemical composition of seaweed is so close to human blood plasma, they are excellent at regulating and purifying our blood. Refined flour is best in digestion aids as well as preventing weight gain it mainly used in making cone, basket, and so many fast food as well as crispy and tasty dishes. It reduced chronic disease , inflammation Additionally, it has demonstrated digestive system benefits. Atta made from whole wheat is nutrient-rich. In the majority of nations, it is a basic food. It has a higher level of vegetable protein than other cereals.

“Micronutrients and dietary fibers are abundant in composite flour foods” [10,11]. “Their high dietary fiber content is also linked to therapeutic health benefits such as gut health, bowel transition, blood glucose decrease, and cholesterol reduction” [12]. “Food products such as bread, noodles, biscuits have been successfully developed using flours of amaranth and buckwheat grains” [15–17]. “Similarly, the successful development of bread and flatbread (chapati) by substituting wheat flour with pearl millet (bajra) and finger millet (ragi) has also been reported” [18–20].

Millets are no longer a major food commodity in Europe and North America, their significance as a component of gluten-free and multigrain cereals products has been emphasized. However, millet is a common food ingredient in many parts of Africa and Asia. In particular, millet is used to make porridge, bread, and snacks for the poor in those countries [21,22]. “The presence of all the required nutrients in millets makes them suitable for large-scale utilization in the manufacture of food products such as baby foods, snack foods, and dietary food and, increasingly, more millet products have entered into the daily lives of people, including millet porridge, millet wine, and millet nutrition powder from both grain and flour form” [23,24]. “Scientific interventions in terms of the use of molecular biomarkers, sequence information, creation of mapping populations and mutant have led to the development and release of high yielding varieties of millets throughout the world” [25,26].

Seaweeds are rich in folic acid and magnesium, which help reduce homocysteine levels and help prevent heart diseases. Homocysteine is an amino acid that is found in the blood. Researchers suggest that a high level of

homocysteine is related to the development of heart diseases. In addition, adequate levels of folic acid in the diet are important to prevent birth defects. Detoxification and Purification Seaweeds are rich in chlorophyll, a green pigment, which is a potent detoxifier that dumps out wastes. A study from McGill University in Canada indicated that seaweeds help remove radiation by-products, heavy metals, and other environmental toxins from the body. They offer a broad range of detoxification. But make sure that the seaweed you use is from a reputable resource. They also have a high concentration of iodine, which is a component of the thyroid hormones thyroxine (T4) and triiodothyronine (T3). The thyroid gland needs iodine to synthesize these hormones. Iodine helps stimulate the thyroid gland and maintain a healthy metabolism. In addition, kelp or kombu contains the pigment called fucoxanthin, which may help metabolize your body fat for energy [4]. Fiber also helps reduce your blood cholesterol and benefits your heart function .Combine Probiotics to help improve your gut function and reduce the chronic inflammation in your body. Seaweeds have many more beneficial and healthy properties [27,28]. This study was focused on development and sensory evaluation of edible basket which was developed by multi grains, cereals, nori sheet.

2. MATERIALS AND METHODS

2.1 Materials

Refined wheat flour, whole wheat flour, rice flour, bajra flour (pearl millet), corn starch (lulu mall Lucknow) powdered sugar, baking powder (Local market Lucknow).lucknow) Nori sheet were purchased by the New Delhi Nature's Soul.

2.1.1 The methodology used in the study has been explained in various sections and sub sections

- **Locale of the study:** The study will be carried out in –
  - Food Science Analysis Laboratory, Department of Food and Nutrition, School of Home Science, BBAU, Lucknow.
  - University Sophisticated Instrumentation Centre Laboratory, BBAU, Lucknow.
- **Period of the study:** the present study will be conducted during the month of August 2022- 2023.
- **Study Design:** Experimental Research Design.
- **Sample:** Nori Sheet, Cereals, Multi Grains.

Process for basket manufacturing: This study prepared a vegan edible basket by Using multigrains, cereals and nori sheet. After various trials were conducted to optimize each constituent's development process and concentration for all formulations, any of the formulations was also analysed by organoleptic test. Fig. 1 depicts the process of makingof edible basket.

2.1.2 Preparation of refined wheat flour-based basket

Commercially available basket using refined wheat flour, potato and so many product were prepared and used as the control batch. But in this study refined flour, wheat and some multigrains were used. Table 1 list the amount of each ingredients used in the basket.

2.1.3 Preparation of base ingredients for composite flour basket

Prior to creating a composite flour basket, individual flour baskets were created. The gluten-free flours used in the baskets included rice flour, bajra flour, wheat flour, refined wheat flour and corn starch. Because rice and maize act as a binding agent when building a basket, they are both gluten-free together with bajra flour and corn starch. The ideal dough for constructing the basket was optimised after a number of tests. The gluten-free flour formulas are all shown in Table 2 for your convenience. The process shown in Fig 1 was used to create edible baskets utilising individual gluten-free flour [29-31].

2.1.4 Development of composite flour edible basket

On composite flour, basket prepared with bajra flour, rice flour, refined wheat flour, whole wheat flour, corn starch were tested for moisture content, basket holding time, and sensory evaluation. In this investigation, the quality was assessed by contrasting how long the baskets held their contents of moisture and these flours' holding power. The composite flour edible basket contained a mixture of 30% refined flour, 20% multigrain, 5% bajra, 20% whole wheat, 20% rice flour and 20% corn starch. Fig. 1 depicts a flowchart of the preparation of a composite edible basket from start to finish, while Table 3 lists the edible basket's ingredient concentration.

Dry Ingredients

Mix all the ingredients

Prepare a dough

Make a roti

Give a shape of basket

Dough to shapen: Dry Ingrdients

Mix all the ingredients

Prepare a dough

Make a roti

Give a shape of basket

Deep fry in oil with utensils

Remove utensils

Fig. 1. Flow chart of preparation of edible basket

2.2 Sensory Evaluation

A ten-person trained panel evaluated the sensory quality of the samples using the nine-point hedonic scale method. The samples were offered in cups at 25°C, room temperature. In order to evaluate the product, we looked at its appearance, texture, taste, mouth feel, flavour, and general acceptability.

All of the panellists had experience in the field of food technology and were knowledgeable with standard sensory techniques. Nine-point hedonic scales [1–8,14] were used for the sensory well versed in typical sensory procedures.

2.3 Sensory Analysis

Sensory analysis was conducted using nine-point hedonic scales [1–8,14].

2.3.1 The percentages yield of basket

The percentages yield for every time was calculated using the initial weight of the batter and the batter and the final weight of the basket formed. The formula for percentage yield is-

Percentages yield (%) **=** Weight of edible basket×100/ weight of dough

2.3.2 Determination of baking time

Each basket baking time, including the control time, basket formed using individual flours, and the composite flour baskets were calculated. Baking time was determined in minutes.

3. RESULTS AND DISCUSSION

3.1 Development of Edible Basket

The refined wheat flour- based edible basket iswas successfully developed, as shown in Fig. 2. The ingredients used to make these cones included composite flour, multigrain, grains, nori sheet, a few spices, and butter.

Percentage yield: The percentage yield of all the formulations, including the control batch ,individual basket and the composite flour basket, as shown in Table 4, was calculated using the percentage yield formula [32-34].

Baking time: The baking time of all the formulation is shown in Table 4. The baking performance of edible basket depends upon dough tightness influenced by flour characteristics and added salts. Hence every basket formulation showed quite different baking time.

On composite flour, edible basket prepared bajra, rice, multi grains, were tested for moisture content, edible basket holding time, and sensory evaluation. The quality was determined by comparing these flours' moisture content and basket holding time duration to the control batch(specific heat).

List 1. Formulation of multi grains, cereals based edible basket

Ingredients	Making edible basket
Refined wheat flour	22.4%
Powdered sugar	5.2%
Multi grains	20.4%
Baking powder	0.9%
Wheat flour	10.5
spices	1.5%

Table 1. Formulation of multigrains, cereals based edible basket (control batch)

Ingredients	Control batch
Refined wheat flour	22.40%
Powdered sugar	5.20%
Salt	0.50%
Baking powder	0.90%
Melted butter	10.5
spices	1.50%

Table 2. Edible basket formulation from different flour

Ingredients	Bajra	Rice flour	Refined flour	Whole wheat flour
Flour	11.4%	17.4%	18.4%	15.4%
Powdered sugar	10.5%	11.6%	11.6	10.7
Salt	0.6%	0.5%	0.6%	0.8%
Corn starch	2.5%	2.5%	2.5%	2.6%
Melted butter	8.7%	7.5%	7.0%	8.2%
Baking powder	0.6%	0.5%	0.5%	0.5%
Spices	1.5%	1.5%	1.5%	1.5%

Table 3. Concentration of ingredients for composite flour edible basket

Ingredients	Concentration
Composite flour	25.4%
Powdered sugar	10.4%
Salt	0.5%
Corn starch	15.5%
Melted butter	10.5%
Baking powder	1%
Rice flour	10.8%
Bajra flour	2.2%
Multigrains	8.5%

Table 4. Percentage yield of all edible basket

Ingredients	(%) yield	Baking time (min: sec)
Control	52.53±0.29	02:00±0.04ª
Bajra	60.85±0.56ĉ	02:33±0.034ĉ
Composite flour	80.3±0.18è	03:00±0.044đ
Rice flour	55.5±0.45ĉ	02:00±0.02ь

**Mean values with standard deviation are expressed in the table. Mean in the same columns with different alphabetical letters is significantly different (p<0.05)*

Sensory evaluation: Sensory evaluation was performed for all the formulation for appearance, texture, taste, mouth feel, taste, flavour, and overall acceptability of edible basket.

Refined wheat flour-based basket were rated high because it can easily made and gave smooth texture with amazing mouth feel, flavour, and overall acceptability Table 5. Due to the presence of the gluten, the control batch is rated higher for overall texture individual and composite flour. Among the formulations prepared using individual flours, rice flour, multigrain were rated higher to flavour compared to the other formulation of dough. Overall when we using these ingredients together the final edible basket taste, mouth feel, texture and overall acceptability is amazing and extraordinary [35-37].

The edible basket was evaluated by 5 expert panel members on following characteristics:

- Appearance
- Flavour/ taste
- Aroma
- Texture
- Overall acceptability (7)

Table 5. Average scores of all five sensory evaluation test

S. No.	Parameters	Average Score	Percentage
1	Appearance	8.8	39.5
2	Flavour/ taste	9	39.9
3	Aroma	8.2	37.85
4	Texture	8.6	39
5	Overall Acceptability	8.8	39.9

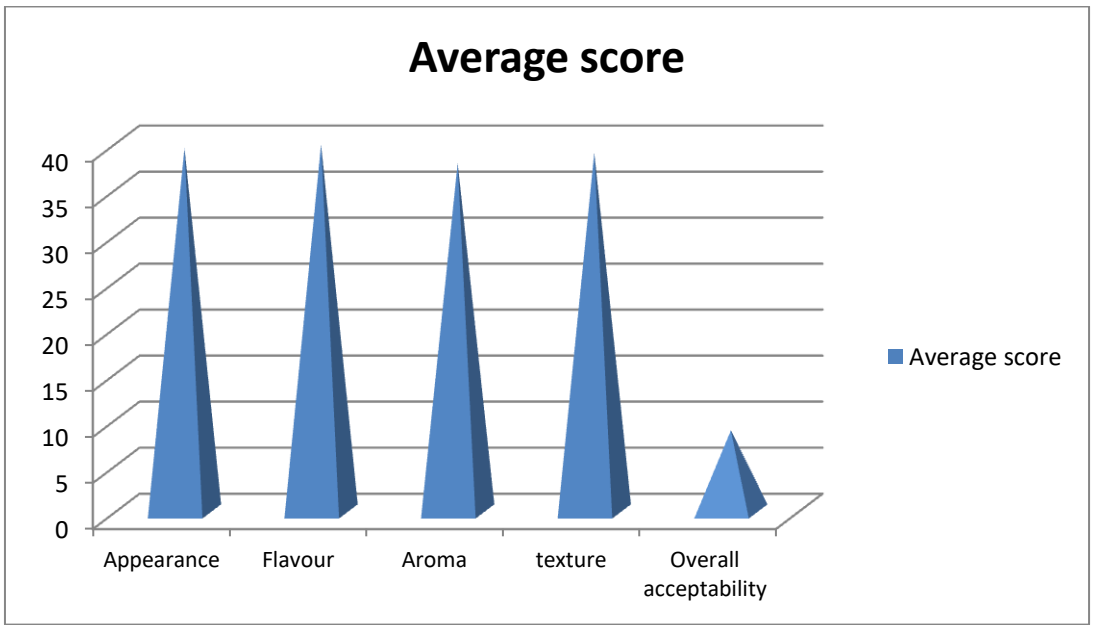

Fig. 2. Graph of the average scores of sensory analysis

Refined wheat flour-based basket received good marks for its ease of preparation, smooth texture, fantastic flavour, and general acceptability Table 5. The control batch is graded higher for overall texture in both individual and composite flour due to the presence of gluten. When compared to comparable dough formulations made with separate flours, rice flour and multigrain flour scored higher for flavour. Overall, the taste, mouthfeel, texture, and acceptability of the finished edible basket are astounding and outstanding when these elements are combined [38,39].

A basket made with refined wheat flour garnered high scores for its simplicity of preparation, smooth texture, wonderful flavour, and all-around acceptability Table 5. Due to the presence of gluten, the control batch receives a better score for overall texture in both individual and composite flour. Rice flour and multigrain flour performed better in the flavour department when compared to equivalent dough formulations created with individual flours. When these components are combined, the finished edible basket's taste, mouth feel, texture, and acceptance are stunning and excellent.

4. CONCLUSION

Plastic garbage disposal is the main source of worry in solid waste management. The proximal components of a spoon that is both edible and biodegradable were studied. The developed basket was found to be rich in fibre content 12.55%, whole wheat flour, corn starch, bajra are responsible for this high fibre content. Apart from this the basket contain a decent amount of vitamin C because of nori sheet (15.55 mg). The basket was also analysed for its organoleptic properties by hedonic rating and it was liked extremely in terms of flavor by all the panel members. The overall acceptability of the basket received an average score (8.8) which depicts that all over characteristics of developed basket were good. In this edible basket we are using wheat flour, refined flour, rice flour, bajra flour, corn starch. The current study offers a sustainable method of using throwaway basket. To compete with plastic cutlery in the market, more research must be done to develop biodegradable silverware which is cost-effective.

The edible basket received a good sensory rating on the 9 pointer hedonic scale. The highest average score was of flavour/ taste (9) which was liked extremely buy all five panel members followed by appearance and overall acceptability (8.8). Texture of basket is (8.6) the sensory attributes which received the lowest rating among all parameters was Aroma (8.2).

The primary concern in solid waste management is plastic garbage disposal, so the immediate parts of a basket that is both edible and biodegradable were researched. In order to optimise the texture of the nori sheet basket, this study conducted sensory analysis to identify differences in product texture (hardness, crispness, and overall acceptability) as a result of modifications in the formulation for the multi grains, cereals, and basket of nori sheets. The basket's sensory qualities were also evaluated by hedonic evaluation, and all of the panel lists gave it high marks for flavor. The basket's general acceptability obtained an average rating of 8.8, which shows that the overall characteristics of the designed basket were positive. We use wheat flour, refined flour, rice flour, bajra flour and corn starch to make this edible basket. A salty taste came up as the most frequent response, followed by a sweet taste. The current work offers a solution for employing disposable baskets that is sustainable. There needs to be more study done to create affordable biodegradable cutlery that can compete with plastic tableware on the market. According to the market, this basket has enormous potential because it is healthful and has no negative effects despite having highly attractive designs and outstanding holding capacity.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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