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Towards Sustainable Bakery Practices: Experimental Research on Vegetable-Integrated Cookies

Mr. Vishal W Chawre[1], Mr. Bhanu Jaiswal[2], Mr. Jeetandra P. Kale[3], Mr. Amit R Nanda[4], Mr. Suraj K Hattimare[5]
[1, 2]*Tuli College of Hotel Management, Nagpur]*
[3]*AISSMS College of Hotel Management, Pune]*
[4]*G.H. Raisoni College of Hospitality Managemant, Nagpur*
[5]*S.B.Tirpude College of Hotel Management, Nagpur*

Abstract: ***The present study explores the formulation, development, and consumer acceptance of novel vegetable-based cookies produced in select bakeries in country. With growing health consciousness among consumers, the incorporation of vegetables into baked products offers a promising avenue to enhance nutritional profiles while maintaining palatability. This experimental research involved the preparation of cookies by integrating various locally available vegetables such as beetroot, spinach, and carrot. Organoleptic evaluation was conducted through sensory panels to assess parameters including taste, texture, color, aroma, and overall acceptability. Nutritional analysis was also performed to compare vegetable-based cookies with conventional varieties. Results indicated a significant improvement in dietary fiber, micronutrients, and antioxidant content in the vegetable-enriched cookies, with favorable consumer acceptance. The study highlights the potential for vegetable-based cookies to cater to health-oriented market demands, providing bakeries in Nagpur a novel product line that aligns with modern dietary trends. Further research could focus on shelf-life studies, cost analysis, and broader consumer surveys to optimize product development and marketing strategies.***

Keywords: ***Vegetable-based cookies, Nutritional enrichment, Healthy cookies, Sensory evaluation, Experimental research, Dietary fiber cookies.***

I. INTRODUCTION

The Bakery industry has long been synonymous with indulgence, offering a wide range of treats that satisfy sweet cravings. However, with the increasing consumer shift towards healthier and more sustainable eating habits, there has been a growing demand for innovative alternatives to traditional baked goods. One such innovation that has gained significant traction is vegetable-based cookies. These cookies not only offer a nutritious twist on conventional recipes but also cater to modern dietary preferences, including vegan, gluten- free, and low-sugar diets.

Vegetable-based cookies are a novel concept that incorporates vegetables like carrots, sweet potatoes, zucchini, spinach, and even beets into cookie recipes. These vegetables add both nutritional value and unique flavors to cookies, creating a new category of baked goods that appeal to health-conscious consumers. By blending the sweetness of vegetables with traditional cookie ingredients, bakeries can create delicious yet wholesome snacks that are rich in vitamins, minerals, fiber, and antioxidants.

The global food industry is witnessing a significant shift towards sustainable and health-conscious production practices, driven by growing consumer awareness of nutrition, environmental concerns, and the demand for functional foods. The bakery sector, traditionally associated with high-calorie and low-nutrient products, is now under pressure to innovate by developing healthier alternatives that align with sustainable food production goals. One promising approach is the incorporation of vegetables into baked goods, offering dual benefits of nutritional enhancement and the promotion of agricultural sustainability by utilizing seasonal and locally available produce.

Vegetables are rich sources of dietary fiber, essential vitamins, minerals, and bioactive compounds such as antioxidants. Integrating vegetables into bakery products, particularly cookies — one of the most widely consumed snack foods — can transform these traditionally indulgent products into functional foods with added health benefits. Furthermore, vegetable-based formulations contribute to sustainability by encouraging the use of surplus, imperfect, or locally sourced vegetables that might otherwise go to waste, thereby reducing the environmental footprint of bakery operations.

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Experimental research on vegetable-integrated cookies allows for the systematic evaluation of formulation strategies, sensory acceptability, nutritional value, and shelf-life stability. By adopting an experimental approach, this study aims to develop novel vegetable-based cookies that not only appeal to consumers' taste preferences but also address key aspects of sustainable food systems, including resource efficiency, waste reduction, and health promotion.

Through this experimental investigation, the study intends to provide insights into the feasibility and potential market acceptance of sustainable bakery products, offering practical implications for bakeries aiming to diversify their product lines and contribute to global sustainability efforts. This research underscores the critical intersection of health, sustainability, and innovation in modern food production and presents vegetable-based cookies as a scalable solution within the evolving bakery industry landscape.

A. Aim

"Towards Sustainable Bakery Practices: Experimental Research on Vegetable-Integrated Cookies"

B. Objectives

- To formulate and develop vegetable-integrated cookie variants by incorporating nutrient-rich vegetables such as carrot, beetroot, and spinach, aimed at enhancing the nutritional profile of traditional bakery products.
- To evaluate the sensory properties — including taste, texture, aroma, color, and overall acceptability — of the vegetable-based cookies through systematic organoleptic testing.
- To assess the sustainability potential of using vegetable fortification in cookies by promoting the utilization of local, seasonal, or surplus vegetables and reducing raw material waste in bakery production.

II. REVIEW OF LITRETURE

Origins of Cookies and Crackers

Cookies and crackers originated as simple mixtures of grain and water, evolving from Neolithic farmers' practices 10,000 years ago. Their techniques share similarities with cake and pastry making, forming a historic foundation for modern bakery products.

Evolution and Practical Role of Savory Crackers

Savory crackers were among the first convenience foods, valued for their durability and long shelf life. Early versions, like ship's biscuits, were essential for long journeys, prioritizing practicality over flavor.

Development of Sweet and Luxurious Bakery Items

In ancient Middle Eastern civilizations, cookies evolved into rich, sweet confections enhanced with eggs, butter, fruit, honey, and exotic spices. The introduction of sugar and the spread of Arabic culinary techniques through Europe diversified cookie varieties.

Cookies in Medieval and Renaissance Europe

By the 14th to 17th centuries, cookies became a staple across Europe. Street vendors in Paris sold filled wafers, and Renaissance cookbooks featured a variety of recipes, cementing cookies' popularity in everyday life.

Historical Roots of Vegetable-Based Cookies

The idea of using vegetables like carrots, beets, and spinach in cookies dates back centuries. Although modern vegetable cookies are a recent trend, ancient practices sought to combine nutrition and taste through vegetable incorporation.

innovation by Bakery Bites: Sun-Dried Vegetable Cookies

Bakery Bites has introduced a modern innovation by integrating sun-dried vegetables into cookies. Sun-drying preserves essential nutrients while intensifying natural sweetness, offering a healthier, flavorful alternative to traditional snacks.

Processing Techniques for Vegetable-Infused Cookies

Sun-dried vegetables are finely ground and blended into cookie dough, creating a nutrient-rich product. The method retains the cookies' soft, chewy texture while significantly boosting their nutritional profile.

Nutritional Advantages of Vegetable-Infused Cookies

Each serving of Bakery Bites' cookies delivers 40% of the daily recommended vegetable intake. This innovation addresses nutritional gaps, providing busy consumers with a healthy, convenient snack option.

Market Appeal of Healthy Cookies

Unlike traditional, high-sugar cookies, vegetable-infused cookies cater to health-conscious consumers seeking guilt-free indulgence. Their nutritional benefits and appealing taste can attract millennials, parents, and fitness-focused buyers.

Market Expansion and Future Potential

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Bakery Bites has the potential to revolutionize the snack market by expanding into major grocery chains and schools. If the company successfully combines taste with health benefits, vegetable cookies could become a new industry standard.

The process of vegetable drying

Selection of raw materials: Choose vegetable varieties with rich meat quality. Before dehydration, you should strictly select the best and remove the inferior, and remove the pests, rot, and shriveled parts. Vegetables should be at 80% maturity, and those that are overripe or underripe should also be selected. After vegetables are rinsed with clean water, then placed in a cool place to dry, but should not be exposed to the sun.

Cutting and blanching: Cut the cleaned raw materials into slices, silks, strips, and other shapes according to product requirements. When blanching, the temperature varies with different raw materials. The water temperature is generally above 150℃ and the general blanching time is 2 to 4 minutes. Leafy vegetables are best not blanched.

Cooling and draining: Blanched vegetables should be immediately cooled (usually rinsed with cold water) to quickly drop to room temperature. After cooling, the water could be drained by the vibrating water separator to shorten the drying time. Then spread the vegetables out and cooled for a while to prepare for drying.

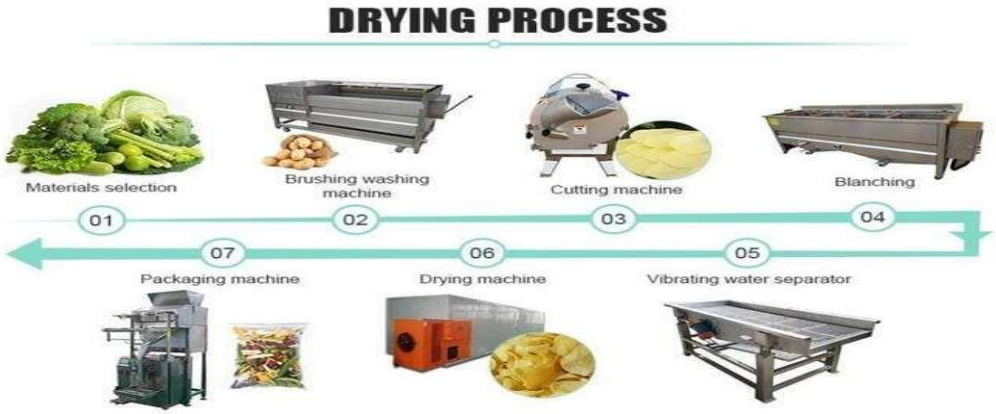


Fig.- Drying process.

- Drying: Different temperatures, time, color, and moisture content during drying should be determined according to different vegetable varieties. It is better to use an air energy heat pump dryer for drying. The heating of air energy is slowly increased, which can maximize the maintenance of the vegetables' original tissue fibers and nutrients. Put the vegetables into the material tray, insert the material tray into the material truck, push it into the drying room, close the sealed door, and start drying production. In the air energy heat pump drying process, when vegetables are in contact with air, a large amount of heat will be absorbed from the air energy. One part is used to increase the internal temperature of the vegetables, and the other part is used for the migration and evaporation of moisture in the vegetables. The process in which the air can continuously transfer heat to the vegetables and evaporate away from the moisture of the vegetables in the process of continuous drying. This process is divided into three stages: heating stage, constant-rate drying stage, and decelerating drying stage.
- Storage Stage: After the drying is finished, don't pack it immediately. It is best to wait until the vegetables have completely cooled down and consistent with the room temperature before starting to pack. The packed dried vegetables should be placed in a dry and cool place.

A. Sun dry Vegetables Process



Fig no.1.2 sun dry process

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The high sugar and acid content of fruits make them safe to dry out-of-doors when conditions are favorable for drying. Vegetables (with the exception of vine dried beans) and meats are not recommended for out-of- doors drying. Vegetables are low in sugar and acid. This increases the risks for food spoilage. Meats are high in protein, making them ideal for microbial growth when heat and humidity cannot be controlled. It is best to dry meats and vegetables indoors using controlled conditions of an oven or food dehydrator.

To dry fruits out-of-doors hot, dry, breezy days are best. A minimum temperature of 85ºF is needed with higher temperatures being better. It takes several days to dry foods out-of-doors. Because the weather is uncontrollable, drying fruits out-of-doors can be risky. If it rains in California while the grapes are drying, the entire supply of raisins can be destroyed.

High humidity in the South is a problem for drying fruits out-of-doors. A humidity below 60 percent is best. Often these ideal conditions are not available when the fruit ripens and other alternatives to dry the food are needed.

Fruits dried out-of-doors must be covered or brought under shelter at night. The cool night air condenses and could add moisture back to the food, thus slowing down the drying process

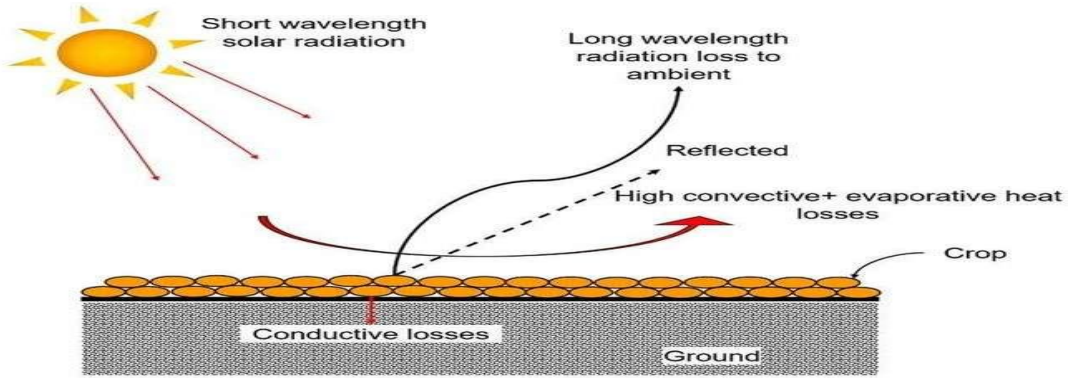


Fig no.1.3 sun dry process

B. Equipment



Fig no.1.4 sun dry process Equipment.

Racks or screens placed on blocks allow for better air movement around the food. Because the ground may be moist, it is best to place the racks or screens on a concrete driveway or if possible over a sheet of aluminum or tin. The reflection of the sun on the metal increases the drying temperature.

Screens need to be safe for contact with food. The best screens are stainless steel, Teflon-coated fiberglass and plastic. Avoid screens made from "hardware cloth." This is galvanized metal cloth that is coated with cadmium or zinc. These metals can oxidize, leaving harmful residues on the food. Also avoid copper and aluminum screening. Copper destroys vitamin C and increases oxidation. Aluminum tends to discolor and corrode. Because birds and insects are attracted to dried fruits, two screens are best for drying food. One screen act as a shelf and the other as a protective cover. Cheesecloth could also be used to cover the food.

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C. *Sun dry vegetable powder/ chunks and Benefits*

Beetroot



Fig no. 1.5 beetroot powder

Importance of Beetroot Powder

Beetroot powder serves as a highly functional and valuable ingredient when incorporated into cookie formulations, offering both **nutritional** and **technological** advantages. One of the primary benefits of beetroot powder is its **rich nutritional profile**. It is an excellent source of dietary fiber, essential minerals such as potassium, iron, and magnesium, and contains bioactive compounds including **betalains** and **nitrates**. Betalains are potent antioxidants and anti-inflammatory agents, which contribute to the enhancement of the health value of baked products. Including beetroot powder in cookies thus transforms them from being merely energy-dense snacks to **functional foods** with potential health benefits such as improved cardiovascular health, better digestion, and enhanced immunity

Spinach



Fig no.1.6 sun dry spinach

Importance of Spinach Powder

Spinach powder is a valuable ingredient for cookie formulations, offering significant **nutritional enhancement** and contributing to **functional and aesthetic qualities**. Spinach is rich in **iron, calcium, potassium, magnesium, dietary fiber, and vitamins A, C, E, and K**. When incorporated into cookies, spinach powder boosts the micronutrient profile, making cookies more nutritious compared to conventional versions. It is especially beneficial for improving iron and antioxidant intake, addressing common nutritional deficiencies like anemia and oxidative stress.

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Tomato



Fig no. 1.7 sun dry Tomato.

Importance of tomato powder

Tomato powder enriches cookies with valuable nutrients like lycopene, vitamin C, potassium, and antioxidants, enhancing their health benefits. It provides a natural reddish color and a subtle tangy flavor, adding uniqueness without artificial additives. Tomato powder improves the functional properties of cookies by boosting antioxidant activity and supporting heart health. Its use also promotes sustainability by utilizing surplus tomatoes, meeting modern consumer demands for healthier, clean-label, and eco-friendly bakery products.

Bitter Ground



Fig no.1.8 sun dry bitter ground.

Importance of bitter ground powder

Bitter gourd powder enhances cookies with significant health benefits, being rich in antioxidants, vitamin C, iron, and bioactive compounds like charantin, which help regulate blood sugar levels. Its incorporation transforms traditional cookies into functional foods, supporting diabetes management and boosting immunity. Bitter gourd powder adds a subtle earthy bitterness, offering a unique flavor profile. Additionally, using it in cookies promotes sustainability by utilizing surplus produce and meeting the rising demand for healthier, wellness-focused bakery products.

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Carrot



Fig no.1.9 sun dry Carrot.

Importance of carrot powder

Carrot powder enhances cookies by adding essential nutrients such as beta-carotene (pro-vitamin A), fiber, potassium, and antioxidants. It naturally imparts a warm orange color and a mildly sweet flavor, reducing the need for artificial additives. Carrot powder improves the nutritional profile by boosting eye health and immunity. Additionally, it supports moisture retention and shelf stability. Utilizing carrot powder promotes sustainability by reducing agricultural waste, aligning with consumer preferences for healthier, functional, and eco-friendly bakery products.

Nutritional Fact Chart of Sun-Dried Vegetables (per 100g)

Nutrients	**Sun-Dried Beetroot**	**Sun-Dried Spinach**	**Sun-Dried Carrot**	**Sun-Dried Tomato**	**Sun-Dried Bitter Gourd**
Energy (kcal)	330 kcal	290 kcal	340 kcal	258 kcal	240 kcal
Protein (g)	10.5 g	29.0 g	8.5 g	14.1 g	15.0 g
Total Fat (g)	1.2 g	4.4 g	1.4 g	3.0 g	1.1 g
Carbohydrates (g)	72.0 g	41.0 g	78.0 g	55.8 g	65.0 g
Dietary Fiber (g)	18.0 g	10.3 g	19.0 g	12.3 g	9.5 g
Sugars (g)	36.0 g	3.5 g	35.0 g	37.6 g	3.0 g
Vitamin A (IU)	45,000 IU	26,000 IU	28,000 IU	3,200 IU	2,000 IU
Vitamin C (mg)	7.4 mg	130 mg	5.9 mg	39.2 mg	85.0 mg
Iron (mg)	2.7 mg	14.0 mg	2.2 mg	9.1 mg	3.4 mg
Potassium (mg)	1,300 mg	2,350 mg	1,100 mg	3,430 mg	1,200 mg
Calcium (mg)	110 mg	980 mg	160 mg	110 mg	200 mg
Magnesium (mg)	70 mg	400 mg	35 mg	210 mg	90 mg
Lycopene (mg)	—	—	—	45.0 mg	—
Beta-Carotene (mg)	5.8 mg	7.0 mg	8.3 mg	0.5 mg	0.2 mg

D. Benefits of Vegetable based cookies

- Increased Nutrition: Vegetable cookies are a great way to increase your daily intake of essential vitamins and minerals. Vegetables like carrots, beets, and spinach are rich in vitamins A, C, and K, as well as minerals like potassium and iron.
- Unique Flavor: Vegetable cookies offer a unique and delicious flavor profile that is different from traditional cookies. The natural sweetness of the Vegetables pairs well with the spices and herbs used in the cookie dough, creating a flavor that is both sweet and savory.
- Gluten-Free: Many vegetable cookies are gluten-free, making them a great option for those with gluten intolerance or sensitivity. The use of vegetable powders and grated vegetables instead of wheat flour makes these cookies a great alternative to traditional cookies.
- Vegan: Many vegetable cookies are vegan, making them a great option for those who follow a plant- based diet. The use of plant-based ingredients like coconut sugar, maple syrup, and almond milk makes these cookies a great option for vegans.
- Sustainable: Vegetable cookies are a sustainable option as they use vegetables that might otherwise go to waste. The use of vegetable powders and grated vegetables reduces food waste and supports sustainable agriculture.

III. RESEARCH METHODOLOGY

A. Research

"Towards Sustainable Bakery Practices: Experimental Research on Vegetable-Integrated Cookies"

B. Collection Of Data

- Primary Data: The primary data consist of information collected through feedback forms. The feedback form consists of basic information about topic and survey done on it.
- Secondary data: The secondary dada consists of individual information gathered by the researcher through text book, internals and article

C. Analysis Of Data

Data collected from the feedback is presented in the form of tables and graphs and is the result

1) Recipe of beetroot cookies

Ingredient

- All-purpose flour 180g
- Butter 125g
- Granulated sugar 90g
- Baking powder 2.4g
- Vanilla extract 4.2g
- Salt to teste
- Beetroot powder 60g

outcome count of cookies-30no(approx.)



Fig no.10, beetroot cookie.

Method

In a large bowl, whisk together the flour, beetroot powder and baking powder, Add softened butter, granulated sugar and vanilla extract to the bowl. Mix until a dough forms, roll out the dough on a floured surface to about ¼ inch thickness cut into desired shapes using a cookies cutter, bake for 15-20 minutes, cool on the baking sheet for 5 minutes, then transfer them to a wire rack to cool completely.

Carrot Cookies Costing

Ingredient	Quantity	Cost
Refined Flour	180g	10
Butter	125g	84
Sugar	90g	4
Beetroot powder	60g	30
	Outcome-30	Total=128
	One cookies rate	4.26 Rs (approx.)

2) Recipe of Tomato cookies

Ingredient

- All-purpose flour 180g
- Butter 125g
- Granulated sugar 90g
- Baking powder 2.4g
- Vanilla extract 4.2g
- Salt to teste
- Tomato powder 60g

outcome count of cookies- 30no (approx.)



Fig no.12, tomato cookie.

Method

In a large bowl, whisk together the flour, Tomato powder and baking powder, Add softened butter, granulated sugar and vanilla extract to the bowl. Mix until a dough forms, roll out the dough on a floured surface to about ¼ inch thickness cut into desired shapes using a cookies cutter, bake for 15-20 minutes, cool on the baking sheet for 5 minutes, then transfer them to a wire rack to cool completely.

3) Tomato Cookies Costing

Ingredient	Quantity	Cost
Refined Flour	180g	10
Butter	125g	84
Sugar	90g	4
Tomato powder	60g	10
	Outcome-30	Total=108
	One cookies rate	3.6 Rs (approx.)

4) Recipe of Spinach Cookies

Ingredient

- All-purpose flour 180g
- Butter 125g
- Granulated sugar 90g
- Baking powder 2.4g
- Vanilla extract 4.2g
- Salt to teste
- Spinach powder 60g

outcome count of cookies30no(approx.)



Fig no.13, spinach cookies.

Method

In a large bowl, whisk together the flour, spinach powder and baking powder, Add softened butter, granulated sugar and vanilla extract to the bowl. Mix until a dough forms, Roll out the dough on a floured surface to about ¼ inch thickness cut into desired shapes using a cookies cutter, Bake for 15-20 minutes, cool on the baking sheet for 5 minutes, then transfer them to a wire rack to cool completely

Spinach cookies costing

Ingredient	Quantity	Cost
Refined Flour	180g	10
Butter	125g	84
Sugar	90g	4
Spinach powder	60g	10
	Outcome-30	Total=108
	One cookies rate	3.6 Rs (approx.)

5) Recipe of Bitter gourd cookies

Ingredient

- All-purpose flour 180g
- Butter 125g
- Granulated sugar 90g
- Baking powder 2.4g
- Vanilla extract 4.2g
- Salt to teste
- Bitter gourd powder 60g

outcome count of cookies- 30 no (approx.)



Fig no.14 bitter gourd cookies

Method

In a large bowl, whisk together the flour, spinach powder and baking powder, Add softened butter, granulated sugar and vanilla extract to the bowl. Mix until a dough forms, roll out the dough on a floured surface to about ¼ inch thickness cut into desired shapes using a cookies cutter, bake for 15-20 minutes, cool on the baking sheet for 5 minutes, then transfer them to a wire rack to cool completely.

Bitter gourd cookies costing

Ingredient	**Quantity**	**Cost**
Refined Flour	180g	10
Butter	125g	84
Sugar	90g	4
Bitter gourd powder	60g	30
	Outcome-30	Total=128
	One cookies rate	4.26 Rs (approx.)

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6) Recipe of Carrot cookies



Fig no.15 Carrot cookies.

Ingredient

- All-purpose flour 180g
- Butter 125g
- Granulated sugar 90g
- Baking powder 2.4g
- Vanilla extract 4.2g
- Salt to teste
- Carrot powder 60g

outcome count of cookies- 30 no (approx.)

Carrot cookies costing

Ingredient	Quantity	Cost
Refined Flour	180g	10
Butter	125g	84
Sugar	90g	4
Carrot powder	60g	10
	Outcome-30	Total=108
	One cookies rate	3.6 Rs (approx.)

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Beetroot cookies

Date 04 feb 2025	Time	Texture	Taste	Colour
8 feb 25	6:00pm	ok	ok	ok
15 feb 25	11:00 am	ok	ok	ok
20 feb 25	4:00 pm	ok	Slides change	ok
26 feb 25	6:00 pm	ok	Butter taste	ok
4 march 25	7:00 pm	ok	ok	ok
8 march 25	6:00 pm	ok	ok	ok
17 march 25	6:00 pm	Soft	ok	ok
31 march 25	6:00 pm	more soft	ok	ok
12 march 25	6:00 pm	more soft	ok	ok
21 march 25	6:00 pm	more soft	totaly change	ok

Rate it as, Bad-1, Regular-2, Good-3, Very good-4, Excellent

Tomato cookies

Date 04 feb 2025	Time	Texture	Taste	Colour
8 feb 25	6:00 pm	ok	ok	ok
15 feb 25	11:00 am	ok	Slides change	ok
20 feb 25	4:00 pm	ok	—11—	ok
26 feb 25	6:00 pm	ok	—11—	ok
4 march 25	7:00pm	ok	—11—	ok
8 march 25	6:00 pm	ok	—11—	ok
17 march 25	6:00pm	ok	—11—	ok
31 march 25	6:00pm	ok	—11—	ok
12 march 25	6:00 pm	ok	—11—	ok
21 march 25	7:00pm	Light Soft	—11—	ok

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Carrot cookies

Date 04 feb 2025	Time	Texture	Taste	Colour
8 feb 25	6:00 pm	ok	ok	ok
15 feb 25	11:00 pm	ok	Little change	ok
20 feb 25	4:00 pm	ok	—11—	ok
26 feb 25	6:00 pm	ok	—11—	ok
4 march 25	7:00 pm	ok	—11—	ok
8 march 25	6:00 pm	ok	—11—	ok
17 march 25	6:00 pm	ok	—11—	ok
31 march 25	6:00 pm	ok	—11—	ok
12 march 25	6:00 pm	OK	—11—	ok
21 march 25	6:00 pm	Light soft	—11—	Little change

Bitter gourd cookies

Date 04 feb 2024	Time	Texture	Taste	Colour
8 feb 25	6:00 pm	ok	ok	ok
15 feb 25	11:00 pm	ok	ok	ok
20 feb 25	4:00 pm	ok	ok	ok
26 feb 25	6:00 pm	ok	ok	ok
4 march 25	7:00 pm	ok	ok	ok
8 march 25	6:00 pm	ok	ok	ok
17 march 25	6:00 pm	ok	ok	ok
31 march 25	6:00 pm	ok	ok	ok
12 march 25	6:00 pm	ok	ok	ok
21 march 25	7:00 pm	Light soft	Little change	ok

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Spinach cookies

Date 04 feb 2025	Time	Texture	Taste	Colour
8feb25	6:00 pm	ok	ok	ok
15feb25	11:00pm	ok	ok	ok
20feb25	4:00pm	ok	ok	ok
26feb25	6:00pm	ok	ok	ok
4 march25	7:00pm	ok	ok	ok
8 march 25	6:00pm	ok	ok	ok
17march25	6:00 pm	ok	ok	ok
31 march 25	6:00pm	ok	ok	ok
12 march25	6:06pm	ok	ok	ok
21 march 25	7:00pm	Little Soft	Little change	Little change.

IV. RESULT&DISCUSSION

Table:1
HOW WAS THE OVER ALL BEETROOT COOKIES TASTES

Sr. NO	Particular	Response
1	Excellent	54.2%
2	Very good	29.2%
3	Good	16.7%
4	Regular	0
5	Average	0

From the above data it is observed that the Overall beetroot cookies tastes is rated very-good by 29.2% followed by 16.7% Good and 54.2% response excellent for the taste.

Overall taste

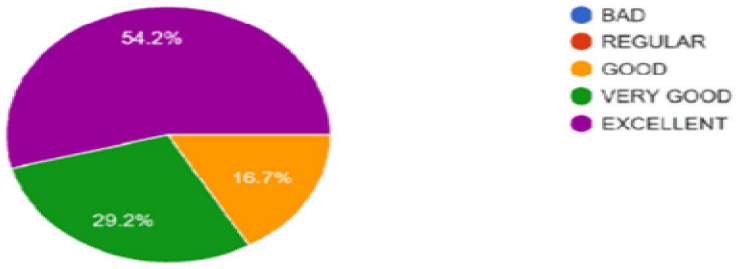


Fig.1.1 overall taste of beetroot cookies

Table: 2
HOW WAS THE OVER ALL CARROT COOKIES TASTE

Sr. NO	Particular	Response
1	Excellent	62.5%
2	Very good	20.8%
3	Good	0
4	Regular	8.3%
5	Average	0

From the above data it is observed that the Overall Carrot cookies tastes is rated very-good by 20,8% followed by 8.3% Regular for the overall taste.

Overall taste

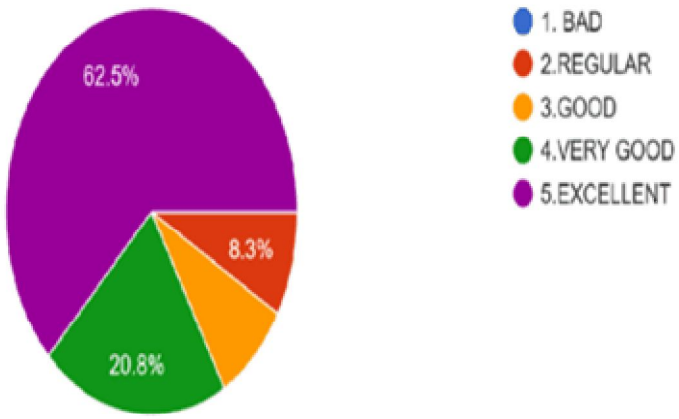


Fig.1.2 overall taste of carrot cookies

Table:3
HOW WAS THE OVER ALL TOMATO COOKIES TASTES

Sr. NO	Particular	Response
1	Excellent	50%
2	Very good	33.3%
3	Good	0
4	Regular	8.3%
5	Average	0

From the above data it is observed that the Overall Tomato cookies tastes is rated Regular by8.3% followed by Very good and 50% response excellent for the overall taste.

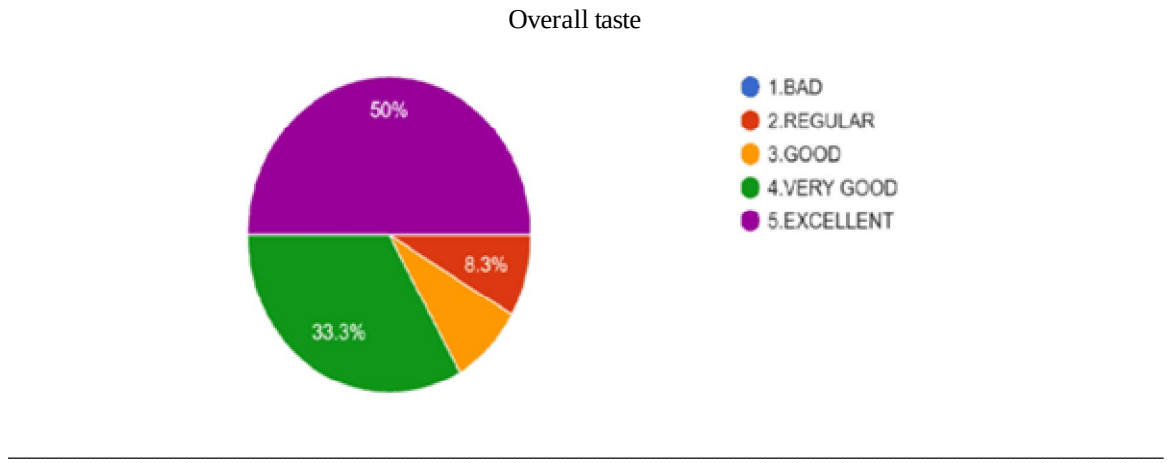


Fig.1.3 overall taste of tomato cookies

Table:4
HOW WAS THE OVER ALL SPINACH COOKIES TASTES

Sr. NO	Particular	Response
1	Excellent	37.5%
2	Very good	50%
3	Good	12.5%
4	Regular	0
5	Average	0

From the above data it is observed that the Overall beetroot cookies tastes is rated followed by Very good 50% Good 12.5% response excellent 37.5% for the overall taste.

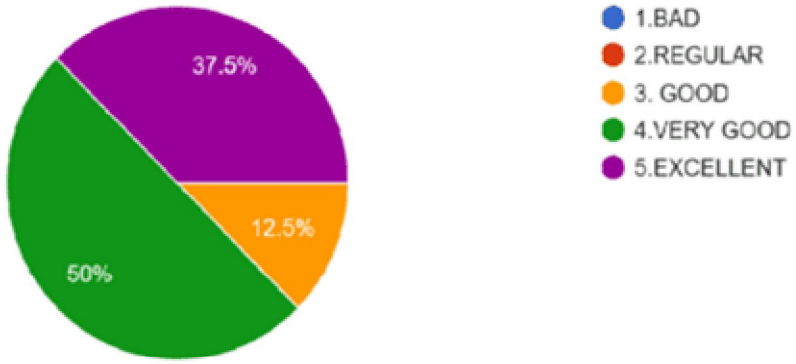


Fig.1.4 overall taste of spinach cookies

Table:5
HOW WAS THE OVER ALL BITTER GOURD COOKIES TASTES

Sr. NO	Particular	Response
1	Excellent	33.3%
2	Very good	37.5%
3	Good	20.8%
4	Regular	0
5	Average	0

From the above data it is observed that the Overall beetroot cookies tastes is rated very-good by 37.5% followed by 20.8% Good and 33.3% response excellent for the taste.

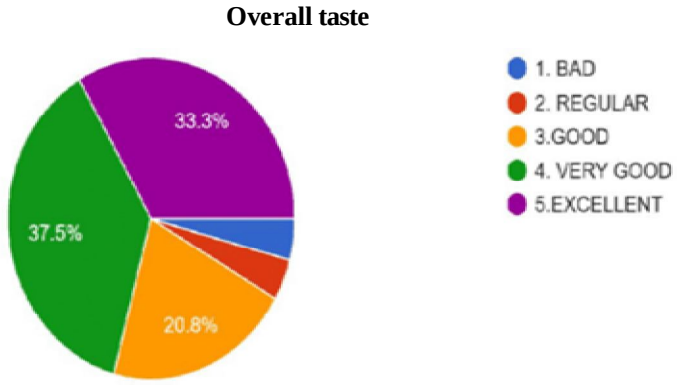


Fig.1.4 overall taste of tomato cookies

V. SUMMARY

Novel vegetable-based cookies are an innovative and health-conscious approach to traditional bakery products. These cookies incorporate various vegetables like carrots, bitter gourd, carrot, spinach, and beets into their ingredients, offering a unique twist on classic recipes. The addition of vegetables not only enhances the nutritional value by providing essential vitamins, minerals, and fiber but also introduces exciting new flavors and textures. These cookies can be a great option for those looking for healthier snacks without compromising on taste. Using vegetables in cookies also appeals to consumers who follow plant-based, gluten-free, or low-sugar diets. By substituting traditional ingredients with vegetable-based alternatives, bakers can create cookies that cater to a wide range of dietary preferences and restrictions. Moreover, vegetables like carrots and pumpkins can add natural sweetness, reducing the need for added sugars and making these cookies more appealing to health-conscious individuals.

Incorporating vegetables into baked goods also supports sustainability by reducing food waste.

Surplus vegetables that may not be suitable for traditional sale can be repurposed in baking. Overall, vegetable-based cookies offer a fun, nutritious, and innovative solution to the growing demand for healthier and more sustainable food options in the bakery industry.

VI. CONCLUSION

In conclusion, novel vegetable-based cookies represent an exciting and innovative trend in the bakery industry, offering a healthier alternative to traditional sweet treats. By incorporating nutrient-rich vegetables, these cookies not only provide essential vitamins, minerals, and fiber but also cater to a variety of dietary preferences, including plant-based, gluten-free, and low-sugar diets. The use of vegetables enhances the flavor, texture, and nutritional profile of cookies, making them an appealing choice for health-conscious consumers. Additionally, this approach supports sustainability by reducing food waste, as surplus vegetables can be creatively repurposed in baking. As demand for healthier, more sustainable food options grows, vegetable-based cookies are poised to become a popular and long-lasting trend in the bakery market, benefiting both consumers and the environment.

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VII. SUGGESTIONS

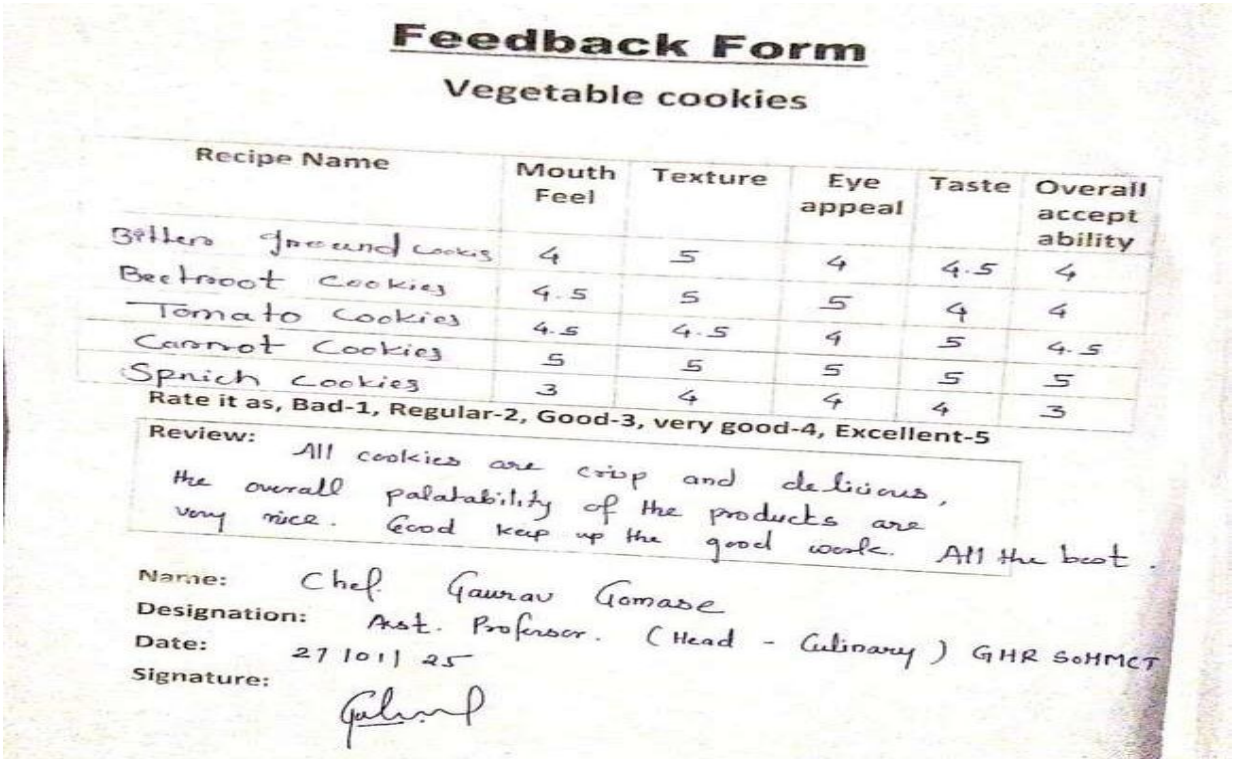
1) Increased Nutritional Value: Vegetable-infused baked goods can provide essential vitamins, minerals, and antioxidants.
2) Improved Consumer Acceptance: The study suggests that consumers are open to trying vegetable-infused baked goods, paving the way for innovative products.
3) Potential Health Benefits: The incorporation of vegetables into baked goods may help reduce the risk of chronic diseases, such as heart disease and diabetes.
4) Implications for the Bakery Industry: The study's findings have significant implications for the bakery industry, as they suggest that vegetable- infused baked goods can:
5) Enhance Product Offerings: Bakeries can develop innovative products that cater to the growing demand for healthier options.
6) Increase Consumer Appeal: By incorporating vegetables into baked goods, bakeries can attract health-conscious consumers.
7) Support Sustainable Practices: Using vegetables in baking can reduce food waste and promote sustainable agriculture

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[3] Reference Study Title Choices for Achieving Adequate Calcium with a Vegetarian Diet Authors Weaver, C. M., et al. Year 2016 Journal American Journal of Clinical Nutrition Volume and Issue 104(3) Pages 694-703.
[4] Article Title Fiber and Prebiotics: Mechanisms and Health Benefits Author Slavin, J. L. Year2013 Journal Nutrients Volume and Issue 5(4) Pages 1417-1435
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ANNEXURE



Feedback Form

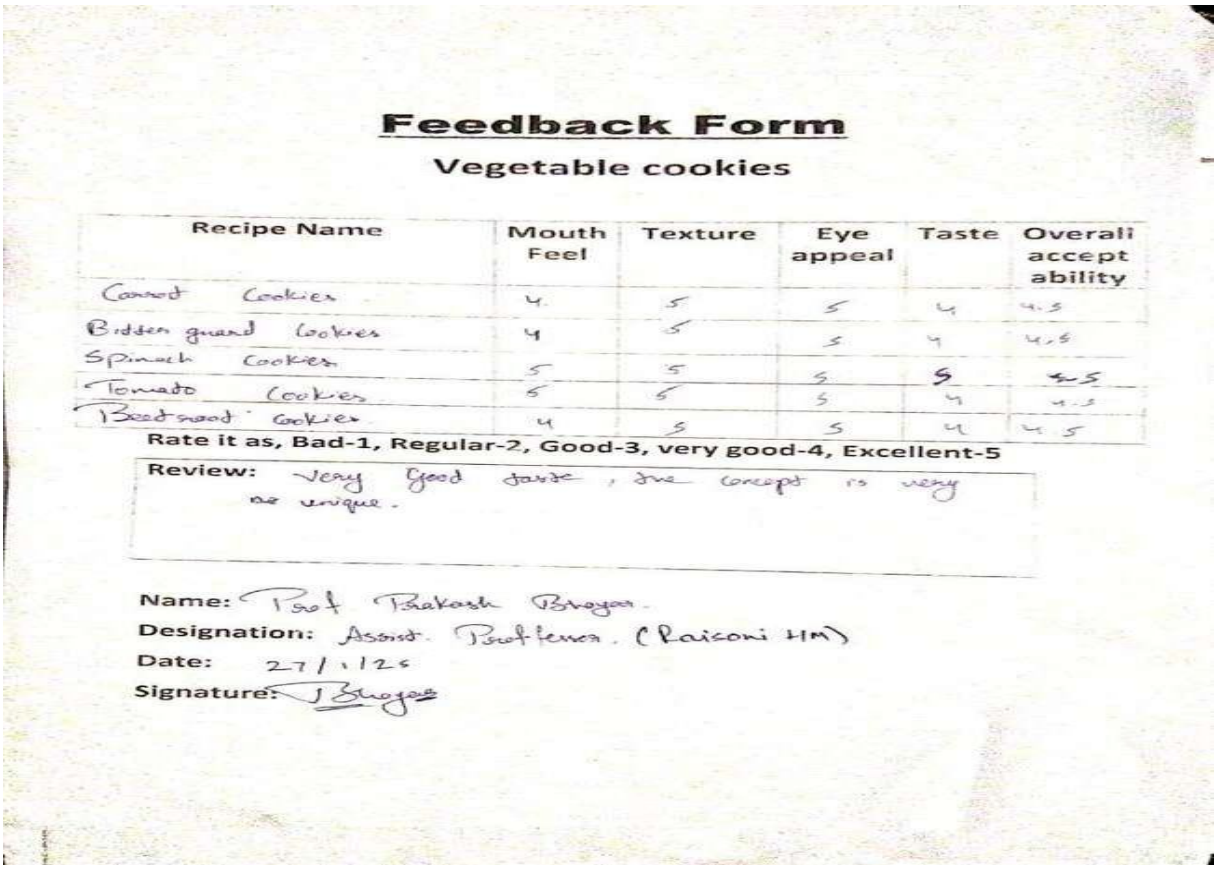
Vegetable cookies

Recipe Name	Mouth Feel	Texture	Eye appeal	Taste	Overall accept ability
Bitter ground cookies	4	5	4	4.5	4
Beetroot Cookies	4.5	5	5	4	4
Tomato Cookies	4.5	4.5	4	5	4.5
Carrot Cookies	5	5	5	5	5
Spnich Cookies	3	4	4	4	3

Rate it as, Bad-1, Regular-2, Good-3, very good-4, Excellent-5

Review: All cookies are crisp and delicious, the overall palatability of the products are very nice. Good keep up the good work. All the best.

Name: Chef Gaurav Gomase
Designation: Asst. Professor. (Head - Culinary) GHR SoHMCT
Date: 27/01/25
Signature:



Feedback Form

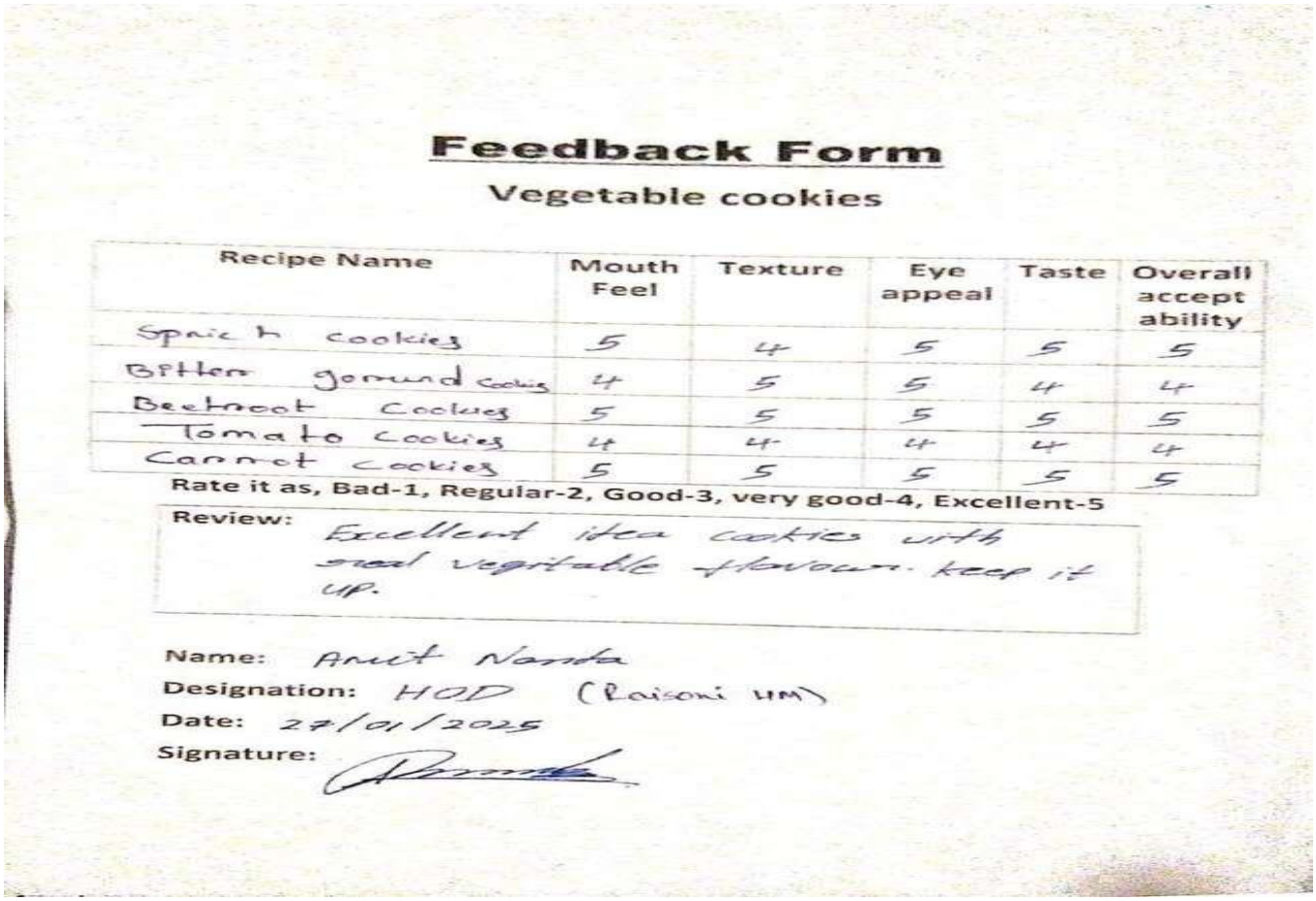
Vegetable cookies

Recipe Name	Mouth Feel	Texture	Eye appeal	Taste	Overall accept ability
Carrot Cookies	4	5	5	4	4.5
Bitter guard Cookies	4	5	5	4	4.5
Spinach Cookies	5	5	5	5	5
Tomato Cookies	5	5	5	4	4.5
Beetroot Cookies	4	5	5	4	4.5

Rate it as, Bad-1, Regular-2, Good-3, very good-4, Excellent-5

Review: Very good taste, the concept is very unique.

Name: Prof Prakash Bhoyar.
Designation: Assist. Professor. (Raisoni HM)
Date: 27/1/25
Signature:



Feedback Form

Vegetable cookies

Recipe Name	Mouth Feel	Texture	Eye appeal	Taste	Overall accept ability
Spinach cookies	5	4	5	5	5
Bitter gourd cookies	4	5	5	4	4
Beetroot Cookies	5	5	5	5	5
Tomato Cookies	4	4	4	4	4
Carrot Cookies	5	5	5	5	5

Rate it as, Bad-1, Regular-2, Good-3, very good-4, Excellent-5

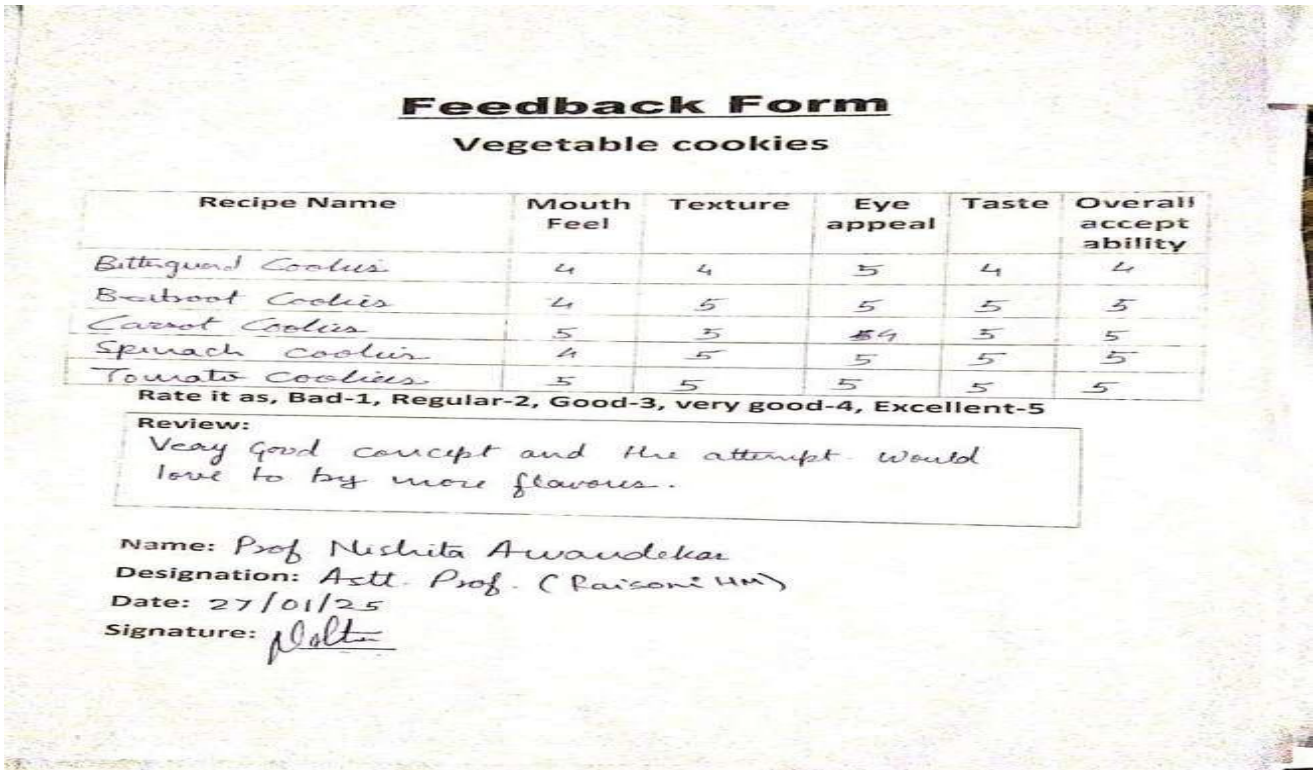
Review: Excellent idea cookies with real vegitable flavour. keep it up.

Name: Amit Nanda

Designation: HOD (Raisoni HM)

Date: 27/01/2025

Signature:



Feedback Form

Vegetable cookies

Recipe Name	Mouth Feel	Texture	Eye appeal	Taste	Overall accept ability
Bittergurd Cookies	4	4	5	4	4
Beetroot Cookies	4	5	5	5	5
Carrot Cookies	5	5	5	5	5
Spinach Cookies	4	5	5	5	5
Tomato Cookies	5	5	5	5	5

Rate it as, Bad-1, Regular-2, Good-3, very good-4, Excellent-5

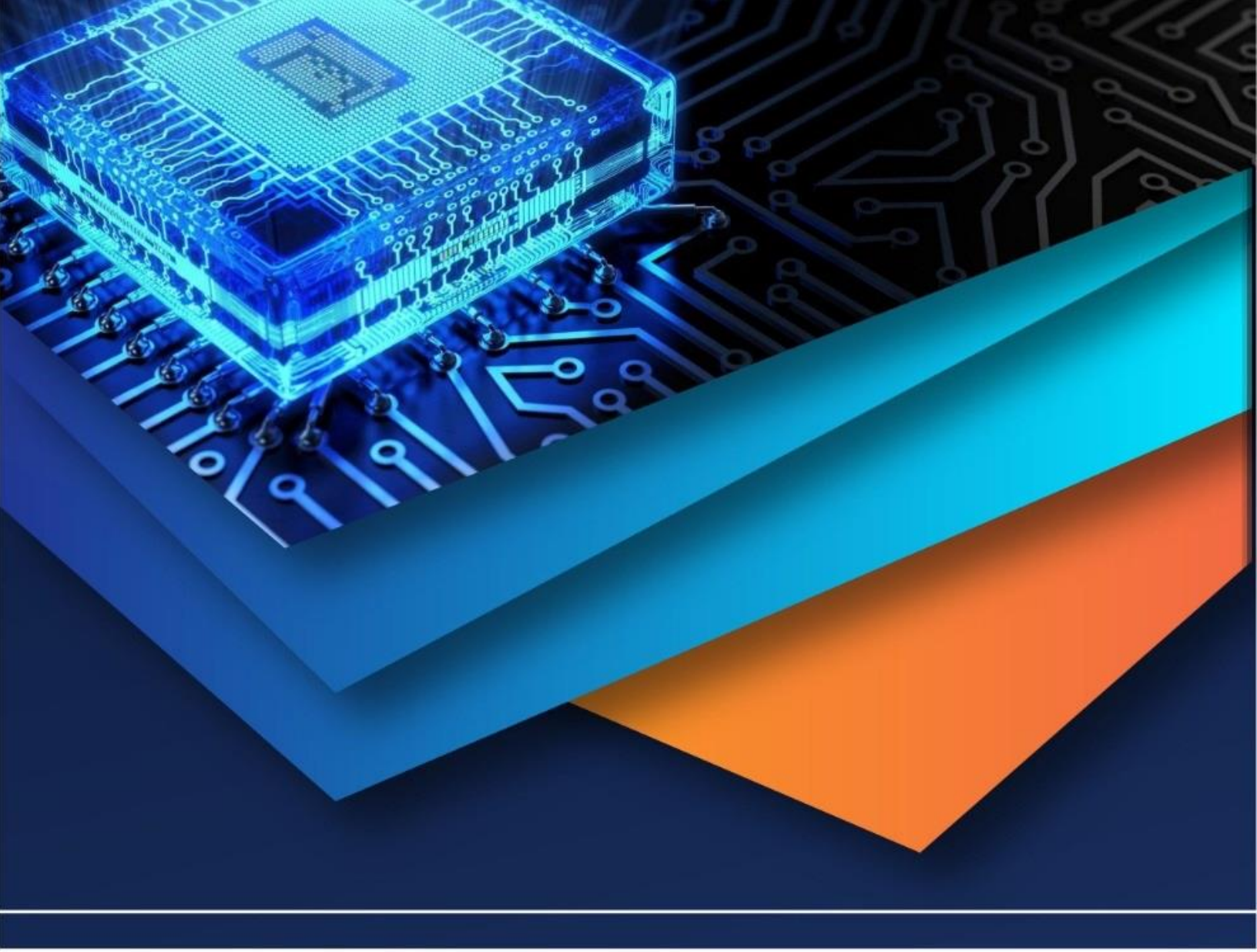
Review: Veary Good concept and the attempt would love to try more flavours.

Name: Prof Nishita Awandekar

Designation: Astt. Prof. (Raisoni HM)

Date: 27/01/25

Signature:



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