

Standardization and Sensory Evaluation of High Fibre Oatmeal (*Avena sativa*) Cookies

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Abstract:- Cookies are a popular snack food due to their variety in taste, crispiness, and digestibility. A study was conducted to develop and evaluate the sensory and physical characteristics of cookies made from oats (*Avena sativa*) and wheat flour (*Triticum aestivum* L.). Wheat flour has a better binding ability and would be ideal for making nutritious high fibre oatmeal cookies. The sensory analyses revealed that the cookies enriched with 19.01 percent oatmeal had acceptable organoleptic properties. Physical properties of the cookies with respect to spread ratio changed from 30.23 to 35.26 respectively. The wheat flour and oatmeal mixture in A₃ composition was successful in the formulation of high fibre cookies.

Keywords:- A₃ composition, cookies, oatmeal, organoleptic, sensory characteristics, etc.

I. INTRODUCTION

In India, the baking industry is regarded as one of the most successful segments of the food processing industry. Baked goods are becoming more popular as a result of their accessibility, ready-to-eat convenience, and long shelf life. Cookies are popular, and they are typically high in carbohydrates, fats, and fibre. Fortification of cookies has evolved in recent years to improve their nutritional and functional quality (Awoluet *et al.*, 2016). Nutrient availability, palatability, compactness, and convenience are all advantages of cookies (Vijaykumar M. *et al.*, 2013). Using such ingredients to add value to existing foods is a simple and practical way to improve the nutritional value of foods and, as a result, the health benefits. Conventional foods, fortified or enhanced foods, and dietary supplements are all examples (Handa C. *et al.*, 2012). Sugars, spices, chocolate, butter, peanut butter, nuts, and dried fruits are among the ingredients used to make cookies in a variety of styles. The softness of the cookies may be affected by the amount of time they are baked. They're easy to transport, tasty to eat, cholesterol-free, and cost-effective. Oats are a good source of dietary fibre, specifically β -glucan fibre (Bornareet *et al.*, 2015).

The goal of the study was to make cookies with the right amount of wheat flour, assess the correct ratio of rolled oats, and determine the cookies' physical properties through sensory evaluation.

II. MATERIALS AND METHODOLOGY

A. Collection of raw materials

The ingredients for the cookies, such as rolled oats and wheat, as well as butter, baking soda, and sugar, were purchased from the Indore local market.

B. Standardization of different combinations

The rolled oats were roasted on low flame for 4-5min and then were mixed with wheat flour at the substitution level of 19.35%, 19.35%, 16.98%, and 19.01% (Table 1). The percentage was calculated on the basis of the weight of ingredients.

Sr. No.	Mixture ID	Rolled Oats (%)	Whole Wheat Flour (%)	Refined Wheat Flour (%)
1	A ₀	19.35%	19.35%	0%
2	A ₁	19.35%	19.35%	0%
3	A ₂	16.98%	8.49%	8.49%
4	A ₃	19.01%	11.88%	5.94%

Table 1: Various combinations of oatmeal and wheat flour for cookies preparation

C. Preparation of cookies

Rolled oats at levels of 19.35 %, 19.35 %, 16.98 %, and 19.01 % were used to develop oat cookies for various combinations (A₀, A₁, A₂ and A₃). Sugar 30 gms, butter 25 gms, baking soda 2 gms, vanilla essence 2-3 drops and cinnamon powder 4 gms were kept constant in the oat cookies for all combinations. The dry ingredients were sieved in a bowl, followed by the addition of butter, and finally, the shortening and dry mass of sugar was creamed together with wheat flour. The baking soda and cinnamon powder was mixed with the homogeneous mixture. Later, rolled oats and milk were added to the batter, which was properly assimilated to prepare the combination A₀ (Table 2). Combinations A₁, A₂ and A₃ were made with the concentrations of ingredients listed in the tables below (Table 3, 4, 5). Combinations A₀, A₁, A₂ and A₃, were further refrigerated for 15, 20, 25, and 30 minutes respectively before baking.

Sr. No.	Ingredients	Quantity (%)
1	Whole wheat flour	19.35 %
2	Rolled oats	19.35 %
3	Powdered sugar	19.35 %
4	Butter	16.12 %
5	Milk	20.03 %
6	Cinnamon Powder	1.30 %
7	Vanilla Essence	1.30 %
8	Choco chips	3.20 %

Table 2: Combination A₀ (Baking temperature and time - 180°C for 15 mins)

Sr. No.	Ingredients	Quantity (%)
1	Whole wheat flour	19.35 %
2	Rolled oats	19.35 %
3	Powdered sugar	19.35 %
4	Butter	16.12 %
5	Milk	20.03 %
6	Cinnamon Powder	1.30 %
7	Vanilla Essence	1.30 %
8	Choco chips	3.20 %

Table 3: Combination A₁ (Baking temperature and time - 160°C for 12 mins)

Sr. No.	Ingredients	Quantity (%)
1	Whole wheat flour	8.49%
2	Refined wheat flour	8.49%
3	Rolled oats	16.98%
4	Powdered sugar	16.98%
5	Butter	14.15%
6	Milk	11.72%
7	Cinnamon Powder	2.26%
8	Vanilla Essence	1.13%
9	Choco chips	2.82%
10	Chocolate	16.98%

Table 4: Combination A₂ (Baking temperature and time - 180°C for 8 mins)

Sr. No.	Ingredients	Quantity (%)
1	Whole wheat flour	11.88%
2	Refined wheat flour	5.94%
3	Rolled oats	19.01%
4	Powdered sugar	17.82%
5	Butter	14.84%
6	Milk	6.18%
7	Cinnamon Powder	2.37%
8	Vanilla Essence	1.18%
9	Choco chips	2.96%
10	Chocolate	17.82%

Table 5: Combination A₃ (Baking temperature and time - 180°C for 7 mins)

After baking, the cookies were kept for cooling at ambient temperature.

D. Sensory evaluation of the cookies

We assessed the sensory qualities such as flavor, color, texture, appearance, and overall acceptability. The degree of like and dislike for the cookies presented in the study was assessed using a 10-point hedonic scale (Table 6).

E. Physical evaluation of the cookies

The physical properties of cookies, such as weight, width, thickness, and spread factor, were measured using the method described in (Zarina M.*et al.*, 2010).

- **Weight (W):** Weight was calculated using an electronic weighing balance.

- **Diameter (D):** The diameter of cookies was measured by placing 5 cookies horizontally (edge to edge).

- **Thickness (T):** The thickness of cookies was determined by stacking five cookies on top of one another.

- **Spread Ratio (SR):** The spread ratio is defined as a diameter-to-thickness ratio and was calculated using the formula.

$$SR = (\text{diameter/thickness} \times CF) \times 10$$

- Where **CF**= correction factor at constant atmospheric pressure (1.0 in this case).

Sr.No	Sensory Attributes	Explanation	Score Range
1	COLOR	Brown ranging from light to very dark.	
	1)Light Brown	Brown Light Provide a consistent light brown color.	10
	2)Medium Brown	Light and Dark brown Patches	7-9
	3)Brown	Brown Uniform color.	4-6
	4)Dark Brown	Intense dark brown color	1-3
2	APPEARANCE	Uniform surface to severe damage (1 to 10)	
	1)Even Surface	No breaks, consistent shape and no damage.	9-10
	2)Slightly Un Even Surface	Barely visible, breakage but no damage, and shape irregularities.	8-6
	3)Uneven	Breakage visible, the shape is irregular and severe damage.	5-1
3	TEXTURE	Crispiness to hardness (1 to 10)	
	1)Crisp	A small amount of force causes the cookie to break suddenly.	10
	2)Crumbly	The cookie crumbles easily in the mouth, forming loose fragments.	7-9
	3)Tender	Chewing the cookie breaks it down easily.	4-6
	4)Hard Cookie	Withstands considerable force during the initial bite.	1-3
4	MOUThFEEL	Crunchy to teeth clogging (1 to 10)	
	1)Crunchy	The cookie requires repeated chewing to break down, and a crunching sound can be heard.	10
	2)Granular	Chewing a cookie reveals the presence of small particles.	7-9
	3)Flaky	Upon chewing, a coarse paste containing large irregular pieces is formed.	4-6
	4)Teeth clogging	When the paste is swallowed, particles adhere to the mouth.	1-3
5	TASTE	Very pleasant to off-taste (1 to 10)	
	1)Very pleasant	Cookies have a flavor that is notably pleasant.	10
	2)Pleasant	Cookies have a pleasant taste to them.	7-9
	3) Unpleasant	Cookies have an uncharacteristic flavour.	4-6
	4) Off taste	After eating, it gives off a distinct flavour.	1-3
6	OVERALL ACCEPTABILITY	Outstanding to Unacceptable (1 -10)	
	1)Outstanding	-	10
	2)Acceptable	-	7-9
	3) Marginal	-	4-6
	4) Unacceptable	-	1-3

Table 6: Sensory parameters scored in sensory assessment of cookies

III. RESULTS AND DISCUSSIONS

A. Sensory Evaluation of Oatmeal Cookies

The influence of rolled oats on the sensory properties of cookies, including colour, appearance, texture, mouthfeel, flavour, and overall acceptability, is presented in Table 7. The cookies made with 19.01 % rolled oats received an overall acceptability rating of 9. The A3 cookies were

highly acceptable, according to the sensory evaluation, with an overall score of 9. However, the colour and flavour of A3 were satisfactory. The sensory score indicates that 19.01 % of rolled oats are acceptable in terms of flavour, mouthfeel, colour, and texture. In 2012, Shazi Saeed *et al.* also observed similar findings in the sensory evaluation of cookies made with different composite flour treatments.

Combination	Colour	Appearance	Texture	Mouthfeel	Taste	Overall Acceptability
A ₀	2	2	3	2	1	2
A ₁	4	5	4	4	5	4
A ₂	6	5	6	7	8	7
A ₃	7	9	9	8	8	9

Table 7: Sensory Evaluation of Oatmeal Cookies

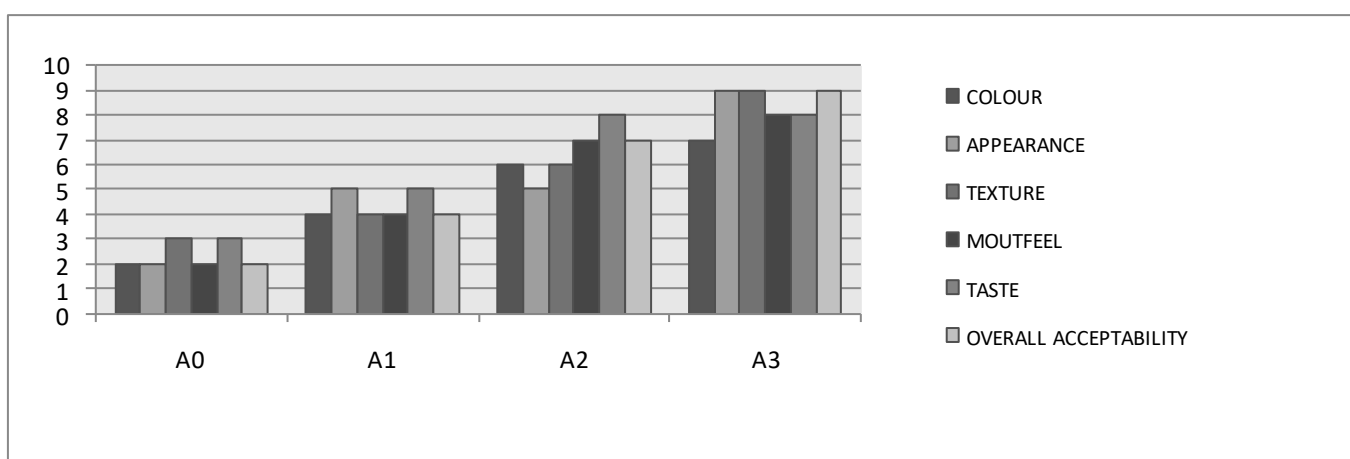


Fig. 1 Graphical Representation of Sensory Evaluation of Oatmeal Cookies

B. Physical Evaluation of Oatmeal Cookies

Physical evaluations, such as thickness, width, and spread ratio, were impacted by the rise in rolled oats (Table 8). The average weight of cookie A₃ was 26.5 gms, while the average weight of other cookies ranged from 21.2-27.4 gms. The average diameter of cookie A₃ was 5.10 cms, while that of other cookies ranges between 5.08 and 5.36 cms. The average

thickness of A₃ was 1.82 cms, while the thickness of the cookies ranged from 1.52 - 1.74 cms (Fig. 2). Changes in cookie diameter and thickness are reflected in the spread ratio, which was calculated by dividing cookie diameter by cookie thickness. The spread ratio of A₃ cookies was 28.02, whereas the increased level of other samples varied between 30.23 - 35.26 (Fig. 3).



Fig. 2: Physical Evaluation of Oatmeal Cookies on different temperatures

Combinations	Weight (gm)	Diameter (cm)	Thickness (cm)	Spread Ratio
A ₀	21.2	5.08	1.52	32.15
A ₁	24	5.14	1.74	30.23
A ₂	27	5.36	1.52	35.26
A ₃	26	5.1	1.82	28.02

Table 8: Physical Evaluation of Oatmeal Cookies

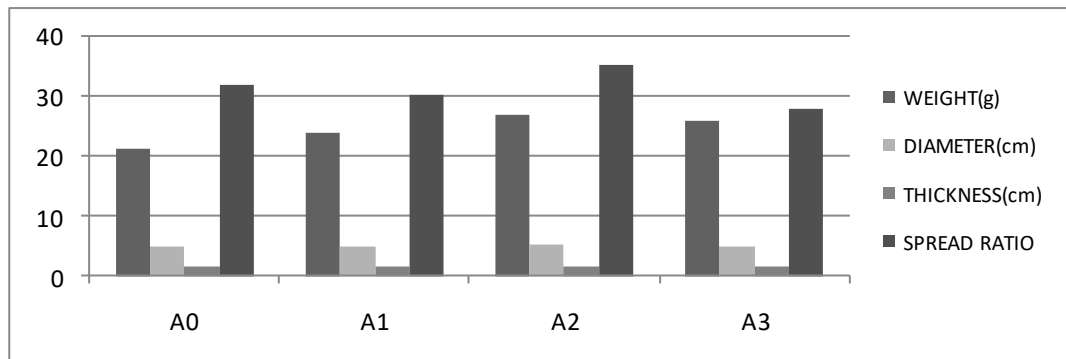


Fig. 3: Graphical Representation of Physical Parameters of Oatmeal Cookies

IV. CONCLUSION

The result of the study revealed that the oatmeal contains a very rich amount of proteins, fibers, and carbohydrate content. Hence, a combination with wheat flour for cookie production would be nutritionally superior. The wheat flour-based cookies supplemented with 19.01% rolled oats were highly favorable in terms of all the combinations. This could lead to the development of high-fiber cookies. The proportion A₃ baked at 180°C for 7 minutes gives a nutritionally rich and acceptable sensory attributes. Although the sensory attributes decreased with increase in time and duration of baking temperature (180°C for 15 minutes). Oatmeal is one incredibly nutritious food with important vitamins, minerals, and antioxidants. In addition, they are high in fiber and protein compared to other grains. A mixture of oatmeal and wheat flour could make a protein-rich baking product with increased economic value. The result granted could be valuable in decision-making for industries to take nutritional advantage of oatmeal. This could be useful in the manufacturing of highly nutritious cookies.

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