Development of Biscuit with the Addition of Various Levels of Wheat Bran from Selected Hard Wheat Varieties

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Abstract

The present study was conducted to study the development of biscuits with the addition of various levels of wheat bran from selected hard wheat varieties during the year 2022-23 at the laboratory of the Institute of Food Sciences and Technology, Sindh Agriculture University, Tandojam. This study aimed to analyze the wheat grain quality of selected hard wheat varieties V1: TJ-83 (Tandojam-83-83), V2: Mehran-89, and V3: IV-2 (Imadad variety) collected from the wheat research centre in Tandojam. The whole wheat grains were processed by cleaning and removal of debris and contaminated material. The sample of wheat grains was subjected to chemical analysis by using an Inframatic grain analyser machine. The results were recorded for maximum moisture observed in V2, 10.2%, protein observed in V3, 11.9%, zeleny observed in V3, 46%, starch observed in V1, 72.6%, and hardness observed in V2, 48.3%.The grains of three hard wheat varieties were separately passed through a machine to achieve the maximum % of flour and bran. The result for maximum flour 80% in V1 and bran 23 % was found statistically in V3. The wheat flour and bran of all varieties were used to prepare bran-rich biscuits. The biscuit samples were prepared with the addition of flour 100g, 95g, 90g and 85g and bran % 0 g, 5g, 10g, and 15 g with other ingredients, respectively.

The results regarding physical properties of bran biscuit showed statistically maximum weight observed in T1, 13.8g of all bran biscuit, width observed in T3, 1.4cm of all bran biscuit, and diameter observed 4.9cm, in T3 all bran biscuit. The results regarding sensory properties of hard variety biscuit, maximum colour score 8.2, were observed in V1 T1, taste score 8.1, aroma score 8, texture score 8.3, overall acceptability score 8.4. It is concluded from the study that the TJ-83 contain low protein compared to Mehran-89 and IV-2. It is suitable for biscuit preparation, and also the biscuit of T1 TJ-83: 95g hard wheat variety flour + 05g wheat bran results better in physical and sensory properties. Results are best for colour score, flavor score, texture score, and taste score for overall acceptability. It is concluded from research that the hard wheat variety TJ-83 is suitable for biscuit preparation compared to Iv-2 and Mehran-89. The bran biscuit prepared with the hard wheat variety TJ-83 is a good source of wheat bran that maintains the health of the consumer. The wheat flour and bran of all varieties were used to prepare bran-rich biscuits. The biscuit samples were prepared with the addition of flour 100g, 95g, 90g and 85g and bran % 0 g, 5g, 10g, and 15 g with other ingredients, respectively. Physical analysis showed that the highest biscuit weight (13.8g) was observed in T1, while the greatest width (1.4 cm) and largest diameter (4.9 cm) were recorded in T3 among all bran biscuits. The results regarding sensory properties of hard variety biscuit, maximum colour score 8.2, were observed in V1 T1, taste score 8.1, aroma score 8, texture score 8.3, and overall acceptability score 8.4. It is concluded from the study that the TJ-83 contains low protein as compared to Mehran-89 and IV-2. It is suitable for biscuit preparation, and also the biscuit of T1 TJ-83: 95g hard wheat variety flour +05g wheat bran gives better results in terms of physical and sensory properties. Results are best for colour score, flavor score, texture score, and taste score for overall acceptability. It is concluded from research that the hard wheat variety TJ-83 is suitable for biscuit preparation compared to Iv-2 and Mehran-89. The bran biscuits prepared with the hard wheat varieties TJ-83 are a good source of wheat bran that maintains the health of consumers.

Keywords: Wheat, wheat bran biscuit; dietary fiber; sensory analysis; nutritional quality

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Introduction

Wheat is one of the most important staples of about two billion people, 36% of the world population. Wheat provides nearly 55% of the carbohydrates and 20% of the food calories consumed globally. Besides being a rich source of carbohydrates, wheat contains protein, essential amino acids except lysine, minerals such as phosphorus, magnesium, iron, copper and zinc and thiamine, riboflavin, niacin and vitamin E (Mladenov et al., 2001). Wheat bran is one of the most important dietary fibre sources used in the baking industry. It is a by-product of the wheat. Wheat bran is a potential source of protein and thereby decreasing the incidence of diverticular diseases. Wheat bran's dietary fibre level is 44%, and its soluble fibre concentration is 2.1%, making it an effective faecal bulking agent. Wheat bran is a good source of water-insoluble fibre, which may be helpful in the prevention and management of several disorders of the intestinal tract. The composition of whole wheat bran is as follows: protein 15%, fat 4.08%, carbohydrate 28.1%, total ash 4.99%, total dietary fibre 45.6%, insoluble fibre 42.8% and 2.8% soluble fibre (Nandeesh et al., 2011). Consumption of high-carbohydrate biscuits is increasing, which contributes to weight gain. It contributes to increase risk of diabetes, heart disease and high cholesterol, here is need to increase the fiber quantity in the diet, by transforming into bran biscuit the increase fiber content level, to overcome health problems such as hypertension, diabetes, and colon cancer, among others (Sudha et al., 2007). The word biscuit, derived from the Latin word Biscotum, means twice-baked. Biscuits are one of the low-cost processed foods, which are most widely consumed. It, amongst many snack items, has certain advantages, such as being cheaper than the conventional snack items, easy to use at home or even during travel, easily being available in a massive variety of shapes, sizes, tastes, and packs, and appeals to all age groups. Apart from the good taste, these foods with substantial energy, having wholesome and nutritious qualities, are available at a reasonable price (Alam et al., 2015). They have a good shelf life at ambient temperature. Besides being a very palatable vehicle of nutrition and energy, these biscuits convey the goodness of flour, fat and sugar in most acceptable and economical terms (Ahmad et al., 2015). Consumption of biscuits and bread appears in the list of top ten daily consumed foods, and they are easily available and convenient to be enjoyed as a snack (Jauharah et al., 2014). Attempts were being made in recent days to improve the nutritional qualities and functionalities of cookies, due to competition in the market for healthier, natural and functional products (Masoodi, L. & Bashir, 2012). Biscuit requires a balanced nutritional value, which can be enhanced by fortification and supplementation with a wide variety of protein-rich cereals and pulses (Jauharah et al., 2014).

A baked food item made with flour is called a biscuit. Most countries have a hard, flat, unleavened biscuit as the norm. They can be created with sugar, chocolate, frosting, jam, ginger, or cinnamon and are often sweet. They can also have a salty flavour and resemble crackers. Sandwich biscuit, digestive biscuit, ginger biscuit, shortbread biscuit, chocolate chip cookies, marshmallow delights wrapped in chocolate, Anzac biscuit, biscotti, and specula are some of the several biscuit varieties. Most hard, sweet biscuits in North America are referred to as "cookies," whereas a soft, leavened fast bread resembling a scone is referred to as a

"biscuit" see biscuit bread. Biscuits are a prominent, ready-to-eat baked snack among people globally. The association of wheat consumption with such health problems as celiac disease makes it pertinent to utilize composite flour in biscuit manufacture (Kiin & Giami, 2015). Composite flour is desirable in this regard because it improves the nutritional value of food products such as bakery products, especially when blended with legumes such as pigeon pea. Biscuits have been suggested as a better use for composite flour than bread due to their ready-to-eat form, wide consumption, relatively long shelf life, and good eating quality (Ahmed et al., 2019).

Materials & Methods

Sample collection

Samples of hard wheat verities, namely TJ83 (Tandoajm-83, IV2 (Imdad varity) & Mehran 89 were collected from Wheat Research Center Tandojam, and other ingredient for biscuit preparation e.g butter, egg, salt, sugar, and vanilla flavor were purchased from local market of tandojam and brought at the laboratories of Institute of Food Sciences and Technology, Sindh Agriculture University, Tandojam during, 2022-23.

Equipment/apparatus

The equipment or apparatus that were used during this research study are mentioned as under:

Analytical balance

An analytical balance (Model number: AAA 2502, Adam) was used for weighing biscuit, sugar, butter, egg, and samples, etc. during the research study.

Quadrument junior semolina mill

A Quadrument junior semolina mill was used for grinding of wheat grains and separation of wheat bran from wheat flour for the preparation of biscuits.

Bran Duster machine

A bran duster machine was used for the separation of wheat bran from wheat flour for the preparation of biscuit.

Hand sieving

Hand sieving was used for the separation of wheat bran from wheat flour for the preparation of biscuits.

Veni-re caliper

The venire calliper was used to determine the height in cm and diameter in cm of the biscuit.

Electrical weighing machine

The weight g of the biscuit after baking was taken using the electrical weighing machine.

Hard wheat varieties: Biscuit Preparation

The grain of wheat was ground, and bran was separated from flour by the Quadrument junior semolina mill and the Bran Duster machine. Ingredients were mixed for the development of the biscuit. Biscuits were developed with the added bran in flour 100g, butter 05g, egg 30g, sugar 35g, salt 0.4g, Baking soda 1g, all ingredients were manually moulded. Dough was sheeted and was cut into different shapes same size, about 5mm thick and 50mm in diameter. Bake the cookies at 180°C for about 15 minutes and let them cool to room temperature.

Table 1. Information regarding ingredients used in different hard wheat varieties of biscuit

Treatment	Wheat flour	Wheat bran	Salt	Baking powder	Butter	Egg	Sugar
T_0	100g	0g	0.4g	1g	05g	30g	35g
T_1 V_1	95g	5g	0.4g	1g	05g	30g	35g
T_2 V_1	90g	10g	0.4g	1g	05g	30g	35g
T_3 V_1	85g	15g	0.4g	1g	05g	30g	35g
T_1 V_2	95g	5g	0.4g	1g	05g	30g	35g
T_2 V_2	90g	10g	0.4g	1g	05g	30g	35g
T_3 V_2	85g	15g	0.4g	1g	05g	30g	35g
T_1 V_3	95g	5g	0.4g	1g	05g	30g	35g
T_2 V_3	90g	10g	0.4g	1g	05g	30g	35g
T_3 V_3	85g	15g	0.4g	1g	05g	30g	35g

Grain quality analysis of hard wheat varieties

The grain quality analysis of wheat grain was performed by subAnalyserthe samples with the Perten Inframatic Grain Analyzer 9200 made in Germany.

Inframatic Grain Analyzer. Based on Near Infrared NIR specifically designed for determination of moisture content %, protein content %, zeleny content % and starch content %, with the wavelength 1100-1400 nm. Instruments work in either reflectance or transmittance mode. In both modes measurement recorded how much light is absorbed by the sample. The Inframatic 9200 meets international standards and recommendations such as AACC 2000 method 39-25.

Measurement of physical properties of hard wheat varieties for biscuit

Height (cm) and Diameter (cm)

Biscuit height cm, Diameter of samples was determined by using a vernier calliper.

Weight of biscuit g

The weight g of the biscuit after baking was taken using an electrical weighing machine.

Sensory analysis of biscuits prepared with different treatments of hard wheat varieties.

The sensorial attributes samples, i.e., colour, flavor, texture, aroma and overall acceptability, were determined as per the method as described by O'Mahony (2017. The nine-point hedonic scale was used to determine the sensorial profile of the sample. The 9-point Hedonic scale has score points from 1 to 9. The score reveals desirability of the food products as per the judgment of panellists, like Extremely, Like Very Much, Like Moderately, Like Slightly, Neither Like nor Dislike, Dislike Slightly, Dislike Moderately, Dislike Very Much, Dislike Extremely, i.e., from 9 backwards to 1, respectively.

Statistical analysis

The data was subjected to statistical analysis using STATISTICA 8.1 computer software Statix. 2006. Differences between treatments were compared by the LSD Least Significant Difference test., where needed (Dodge, 2008; Klein, 2013; Wheelan, 2014).

Results & Discussions

Wheat bran is one of the most important fibre sources in the baking industry. It is a by-product of the wheat. Wheat bran is a potential source of protein and thereby decreases the incidence of diverticular diseases (Nandeesh et al., 2011). Biscuit has a good shelf life at ambient temperature. Besides being a very palatable vehicle of nutrition and energy, these biscuits convey the goodness of flour, fat and sugar in most acceptable and economical terms (Ahmad et al., 2019).

Moisture (%) of hard wheat grain varieties

The maximum moisture of 10.2% was observed in Mehran-89 wheat variety; however, the minimum moisture of 9.2% was observed in variety TJ-83. And the IV-2 wheat grains' moisture percentage was observed to be 10.1%. These findings are consistent with those of (Cronin, K., & Preis, C., 2000) who found that the highest moisture water content was 11 % and the lowest was 8.7%. Similarly, (Ibidapo et al. 2017) found that maximum moisture ranged from 9 % to 11 %. Varied between 8% to 10%, with the wheat grains having the lowest value presented in Table 2. The differences in moisture contents in wheat varieties might be due to differences in genetic traits, the growing period, timing of harvest, grain harvesting and handling equipment, drying system, storage management practices, and transportation procedures. Although moisture content improvement has a correlation with nutritional significance but high moisture content may cause undesirable darkening in formulated dough, which can exert a negative impact on the quality of end products.

Table 2 Chemical analysis of hard wheat grains of different varieties.

Varieties	Moisture	Protein	Starch	Hardness	Zeleny

Mehran-89	10.2±0.0576	11.9±0.0244	71.7±0.0720	48.6±0.2722	46.0±0.1925
Iv-2	10.1±0.0576	11.0±0.0244	70.6±0.0720	44.0±0.2722	40.0±0.1925
Tandojam-83	09.2±0.0576	10.4±0.0244	70.5±0.0720	42.6±0.2722	32.0±0.1925

Protein (%) of hard wheat grain varieties

The maximum protein 11.9% was observed in IV-2 wheat variety however, the minimum protein 11% was observed in variety TJ-83. And the Mehran-89 wheat grain protein percentage was observed to be 10.4%. These findings are consistent with those of Hasmadi et al. 2014), who found that the highest protein content was 12 % and the lowest was 9.7%. Similarly, (Ghangro et al. 2015) found that maximum protein ranged from 9 % to 11 % presented in Table 2. The differences of protein contents in wheat varieties might be due to differences of genetic traits, the growing period, timing of harvest, grain harvesting and handling equipment, drying system, storage management practices, and transportation procedures Although, protein content improvement has correlation with nutritional significance but high protein content may cause undesirable properties of dough for biscuit which can exert negative impact on quality of biscuit.

Starch (%) of hard wheat grain varieties

The maximum starch, 71.7% observed in Mehran-89 wheat variety; however, the minimum starch, 70.5%, was observed in variety TJ-83. And the IV-2 wheat grain starch percentage was observed to be 70.6%. These findings are consistent with those of (Savi, G. D., et al. 2014), who found that the highest starch content was 72% and the lowest was 68 %. Similarly, (Menga, V., et al. 2023) found that maximum starch ranged from 73 % to 70 % varied between with the wheat grains having the lowest value presented in Table 2. The differences in starch content in wheat varieties might be due to different factors, such as soil fertility and temperature constraints. Although starch content i a genetic trait, the growing period, timing of harvest, grain harvesting and handling equipment, drying system, storage management practices, and transportation procedures improvement correlate with nutritional significance, but high starch content may cause diabetes and gastrointestinal diseases.

Hardness (%) of hard wheat grain varieties

The maximum hardness of 48.6% was observed in the Mehran-89 wheat variety; however, the minimum hardness of 42.6% was observed in the variety TJ-83. And the IV-2 variety wheat grains' hardness percentage was observed to be 44%, presented in Table 2. These findings are consistent with those of (Goel, S et al. 2019), who found that the highest hardness content was 50% and the lowest was 37%. Similarly, (Ghangro et al. 2015) found that maximum hardness ranged from 48% to 36 %. The differences of hardness contents in wheat varieties might be due to differences of genetic traits, the growing period, timing of harvest, grain harvesting and handling equipment, drying system, storage management practices, and transportation procedures Although, hardness content improvement correlates with nutritional significance Increased gluten level through wheat flour, increased the cohesive property of the dough but high hardness content may cause undesirable properties of dough for biscuit which can exert negative impact on quality of biscuit.

Zeleny (%) of hard wheat grain varieties

The maximum zeleny 46% was observed in Mehran-89 wheat variety however, the minimum zeleny 42.6% was observed in variety TJ-83. And the IV-2 variety wheat grains zeleny percentage observed was 44% presented in Table 2. These findings are consistent with those of (Goel et al. 2019), who found that the highest zeleny content was 50% and the

lowest was 37%. Similarly, (Ghangro et al. 2015) found that maximum zeleny hardness ranged from 48% to 36 %. The differences in zeleny contents in wheat varieties might be due to differences in genetic traits, the growing period, timing of harvest, grain harvesting and handling equipment, drying system, storage management practices, and transportation procedures. Although zeleny content improvement correlates with nutritional significance, increased gluten level through wheat flour increased the cohesive property of the dough, but high hardness content may cause undesirable properties of the dough for biscuit, which can exert a negative impact on the quality of biscuit.

Weight (g) of biscuit prepared with different treatments of hard wheat varieties.

The weight 14g observed in the biscuit with T1V1: 95g hard wheat variety flour + 05g hard wheat variety bran, T1V2: 95g hard wheat variety flour + 05g hard wheat variety bran and T1V3: 95g hard wheat variety flour + 05g hard wheat variety bran showed same weight 13.8. The biscuit with T2V1: 95g hard wheat variety flour + 05g hard wheat variety bran, T2V2: 95g hard wheat variety flour + 05g hard wheat variety bran and T2V3: 95g hard wheat variety flour + 05g hard wheat variety bran showed the same weight of 13.6. The biscuit with T1V1: 95g hard wheat variety flour + 05g hard wheat variety bran, T3V2: 95g hard wheat variety flour + 05g hard wheat variety bran and T3V3: 95g hard wheat variety flour + 05g hard wheat variety bran showed same weight 13.4 results presented in table 3. These findings are consistent with those of (Nandeesh, K et al. 2011) who found that the greatest starting weight, 10g and the lowest initial weight, 15g, were recorded. (Ertaş, N. 2015). Who reported that the weight of the biscuit before baking ranged from 10.3 g to 14.1 g. The variation may be due to dietary fibre and temperature.

Table 3. Physical analysis of biscuits prepared with the use of hard wheat varieties.

Wheat varieties	Weight (g)	Width	Diameter
Tandojam-83	13.8±0.0654	1.4±	4.7±0.0446
Mehran-89	13.6±0.0654	1.4±	4.8±0.0446
Iv-2	4.7±0.0654	1.4±	7.9±0.0446

Width (cm) of biscuit prepared with different treatments of hard wheat varieties.

The width of the biscuit compared to T_0: control 100g wheat flour 1.3cm. The biscuit with T_1V1: 95g hard wheat variety flour + 05g hard wheat variety bran, T_1V2: 95g hard wheat variety flour + 05g hard wheat variety bran and T_1V3: 95g hard wheat variety flour + 05g hard wheat variety bran showed the same width of 1.3 cm. The width of biscuit compared to T_0: control 100g wheat flour 1.3cm variety bran showed same width 1.4 cm however, the minimum width 1.4cm in T; 2 95g hard wheat variety flour and 05g wheat bran was observed and lowest initial width 1.3cm These findings are consistent with (Mishra, N., & Chandra, R. 2012) which stated that the highest biscuit width was 1.32 cm and the lowest biscuit width was 1.24cm. According to (Sozer et al. 2014), the maximum biscuit width was 1.35cm and the lowest biscuit width was 1.28 cm, respectively. The variation may be due to hydrophilic fibre added from by-products. However, an increase in the biscuit width might indicate a lack of interaction between the water, fibre and carbohydrate networks in the biscuit.

Diameter (cm) of biscuit prepared with different treatments of hard wheat varieties.

The diameter of the biscuit compared to T_0: control 100g wheat flour 4.7 cm. The

biscuit with T_1V1: 95g hard wheat variety flour + 05g hard wheat variety bran, T_1V2: 95g hard wheat variety flour + 05g hard wheat variety bran and T_1V3: 95g hard wheat variety flour + 05g hard wheat variety bran showed same diameter 4.7cm presented in table 3. The diameter t of the biscuit compared to T_0: control 100g wheat flour 4.7 cm. The biscuit with T_2V1: 90g hard wheat variety flour + 10g hard wheat variety bran, T_2V2: 90g hard wheat variety flour + 1 g hard wheat variety bran and T_2V3: 90g hard wheat variety flour + 10g hard wheat variety bran showed the same diameter of 4.8 cm.

The diameter of the biscuit compared to T_0: control 100g wheat flour 4.7 cm. The biscuit with T_3V1: 85g hard wheat variety flour + 15g hard wheat variety bran, T_3V2: 95g hard wheat variety flour + 05g hard wheat variety bran and T_3V3: 85g hard wheat variety flour + 15g hard wheat variety bran showed same diameter 4.9 however, the minimum width 4.7cm in T;2 95g hard wheat variety flour and 05g wheat bran was observed and lowest initial diameter 1.3cm and width. According to (Kamal, T et al. 2015), the maximum biscuit diameter ranged from 3.25-4.90cm. (Ma, F., Lee, Y. Y., Palmquist, D. E., & Baik, B. K. 2019) Revealed that the diameter of the biscuit ranged from 4.00 cm to 4.32 cm. The variation may be due maximum biscuit weight.

Colour (Score) of biscuit prepared with different treatments of hard wheat varieties.

The colour score of biscuit compared to T_0: control, 100g wheat flour, 8.3 colour score. The biscuit color score with T_1V1: 95g hard wheat variety flour + 05g hard wheat variety bran showed maximum color score 8.2 followed by T_1V2: 95g hard wheat variety flour + 05g hard wheat variety bran 7.9 while minimum color 7.4 was observed in T_1V3: 95g hard wheat variety flour + 05g hard wheat variety bran. The colour score of biscuit compared to T_0: control 100g wheat flour 8.3. The biscuit with T_2V1: 90g hard wheat variety flour + 10g hard wheat variety bran showed maximum color score 7.8 followed by T_2V2: 90g hard wheat variety flour + 10g hard wheat variety bran 7.7 while minimum color score 7.2 was observed in T_2V3: 90g hard wheat variety flour + 10g hard wheat variety bran. The colour score of biscuit compared to T_0: control 100g wheat flour 8.3.

The biscuit with T_3V1: 85g hard wheat variety flour + 15g hard wheat variety bran showed maximum color score 7.7 followed by T_3V2: 85g hard wheat variety flour + 15g hard wheat variety bran 7.4 while Minimum color score 6.8 was observed in T_3V3: 85g hard wheat variety flour + 15g hard wheat variety bran was observed. According to (Tiwari, et al. 2019), the maximum biscuit colour score ranged from 6.4 to 8.1 (Gamal A, E.S., et al. 2012) revealed that the colour score of biscuit ranged from 6.2 to 7.7. The variation may be due to bran quantity, baking time and temperature, biscuit colour score.

Table 4 Sensory analysis of biscuits prepared with the use of hard wheat varieties

Wheat varieties	Color	Aroma	Taste	Texture	Overall acceptability
Tandojam-83	8.2±0.7654	8.1.±0.8765	8.1±0.0546	8.3±0.0564	8.4±0.3452
Mehran-89	7.8±0.7654	7.8±0.8765	7.8±0.0546	7.7±0.0564	7.9±0.3452
Iv-2	7.7±0.7654	7.5±0.8765	7.4±0.0546	7.5±0.0564	7.6±0.3452

Aroma (Score) of biscuit prepared with different treatments of hard wheat varieties.

The aroma score of biscuit compared to T_0: control, 100g wheat flour, 8.4 aroma

score. The biscuit aroma score with T_1V1: 95g hard wheat variety flour + 05g hard wheat variety bran showed maximum aroma score 8.1 followed by T_1V2: 95g hard wheat variety flour + 05g hard wheat variety bran 7.6 while minimum aroma 7.3 was observed in T_1V3: 95g hard wheat variety flour + 05g hard wheat variety bran. The aroma score of biscuit compared to T_0: control 100g wheat flour 8.4. The biscuit with T_2V1: 90g hard wheat variety flour + 10g hard wheat variety bran showed maximum c aroma score 7.8 followed by T_2V2: 90g hard wheat variety flour + 10g hard wheat variety bran 7.4 while minimum aroma scores 7.1 was observed in T_2V3: 90g hard wheat variety flour + 10g hard wheat variety bran.

The aroma score of biscuit compared to T_0: control, 100g wheat flour, 8.4 aroma score.

The biscuit with T_3V1: 85g hard wheat variety flour + 15g hard wheat variety bran showed maximum aroma score 7.5 followed by T_3V2: 85g hard wheat variety flour + 15g hard wheat variety bran 7.2 while minimum aroma scores 6.6 was observed in T_3V3: 85g hard wheat variety flour + 15g hard wheat variety bran was observed. According to Ertaş (Pojić, 2013), the maximum biscuit aroma score ranged from 6.5 to 8.3 (Alam et al., 2014) revealed that the aroma score of biscuit ranged from 6.1 to 7.8. The variation may be due to bran quantity, baking time and temperature.

Taste (Score) of biscuit prepared with different treatments of hard wheat varieties.

The biscuit taste score with T_1V1: 95g hard wheat variety flour + 05g hard wheat variety bran showed maximum taste score 8.2 followed by T_1V2: 95g hard wheat variety flour + 05g hard wheat variety bran 7.9 while minimum taste 7.4 was observed in T_1V3: 95g hard wheat variety flour + 05g hard wheat variety bran. The taste score of biscuit compared to T_0: control 100g wheat flour 8.3 taste score presented in Table 2. The biscuit with T_2V1: 90g hard wheat variety flour + 10g hard wheat variety bran showed maximum taste score 7.8 followed by T_2V2: 90g hard wheat variety flour + 10g hard wheat variety bran 7.7 while minimum color score 7.2 was observed in T_2V3: 90g hard wheat variety flour + 10g hard wheat variety bran.

The taste score of biscuit compared to T_0: control, 100g wheat flour, 8.3 taste score. The biscuit with T_3V1: 85g hard wheat variety flour + 15g hard wheat variety bran showed maximum taste score 7.7 followed by T_3V2: 85g hard wheat variety flour + 15g hard wheat variety bran 7.4 while minimum taste score 6.8 was observed in T_3V3: 85g hard wheat variety flour + 15g hard wheat variety bran was observed. According to Khalil et al. 2015), the maximum biscuit taste score ranged from 6.23 to 8.35. Alam et al. 2014) revealed that the taste score of biscuits ranged from 6.15 to 8.42. The variation may be due to bran quantity, baking time and temperature.

Texture (Score) of biscuit prepared with different treatments of hard wheat varieties.

The texture score of biscuit compared to T_0: control, 100g wheat flour, 8.5 texture. The biscuit texture score with T_1V1: 95g hard wheat variety flour + 05g hard wheat variety bran showed maximum diameter 8.4 followed by T_1V2: 95g hard wheat variety flour + 05g hard wheat variety bran 7.8 while minimum texture 7.4 was observed in T_1V3: 95g hard wheat variety flour + 05g hard wheat variety bran presented in table 2. The texture score of biscuit compared to T_0: control 100g wheat flour 8.5. The biscuit with T_2V1: 90g hard wheat variety flour + 10g hard wheat variety bran showed maximum texture score 7.9 followed by T_2V2: 90g hard wheat variety flour + 10g hard wheat variety bran

7.5 while minimum texture score 7.2 was observed in T_2V3: 90g hard wheat variety flour + 10g hard wheat variety bran. The texture score of biscuit compared to T_0: control 100g wheat flour 8.5. The biscuit with T_3V1: 85g hard wheat variety flour + 15g hard wheat variety bran showed maximum texture score 7.6 followed by T_3V2: 85g hard wheat variety flour + 15g hard wheat variety bran 7.3 while minimum texture score 6.7 was observed in T_3V3: 85g hard wheat variety flour + 15g hard wheat variety bran was observed. According to (Gajula et al. 2008), the maximum biscuit texture score ranged from 6.00 to 8.1. Cheung et al. 2019) revealed that the texture score of biscuits ranged from 6.12 to 8.32. The variation may be due to bran quantity, baking time and temperature.

Overall acceptability (Score) of biscuits prepared with different treatments of hard wheat varieties.

The overall acceptability score of biscuit compared to T_0: control, 100g wheat flour, 8.5. The biscuit overall acceptability score with T_1V1: 95g hard wheat variety flour + 05g hard wheat variety bran showed maximum diameter 8.4 followed by T_1V2: 95g hard wheat variety flour + 05g hard wheat variety bran 7.8 while minimum overall acceptability 7.5 was observed in T_1V3: 95g hard wheat variety flour + 05g hard wheat variety bran presented in table 2. The overall acceptability score of biscuit compared to T_0: control, 100g wheat flour, 8.5. The biscuit with T_2V1: 90g hard wheat variety flour + 10g hard wheat variety bran showed maximum overall acceptability score 7.9 followed by T_2V2: 90g hard wheat variety flour + 10g hard wheat variety bran 7.5 while minimum overall acceptability score 7.2 was observed in T_2V3: 90g hard wheat variety flour + 10g hard wheat variety bran presented in table 2. The overall acceptability score of biscuit compared to T_0: control, 100g wheat flour, 8.5. The biscuit with T_3V1: 85g hard wheat variety flour + 15g hard wheat variety bran showed maximum overall acceptability score 7.6 followed by T_3V2: 85g hard wheat variety flour + 15g hard wheat variety bran 7.3 while minimum overall acceptability score 6.7 was observed in T_3V3: 85g hard wheat variety flour + 15g hard wheat variety bran was observed. According to (Agrawal, R. 2021), the maximum biscuit texture score ranged from 6.4 to 8.5(Kaur et al. 2012) revealed that the texture score of biscuit ranged from 6.7 to 8.4. The variation may be due to bran quantity, baking time and temperature.

Conclusion

It is concluded from the study that the grains of hard wheat varieties have physico-chemical properties. The maximum moisture 10.2%, starch 71.7%, hardness 48.6%, and zeleny 46% were observed in Mehran-89. The maximum protein, 11.9% observed in IV-2. Biscuit was prepared with the addition of wheat bran for sensory and physical analysis. The physical properties were observed same in all treatments. The biscuit prepared with T_1V1: 95g hard wheat variety flour + 05g hard wheat variety bran showed maximum colour score 8.2, aroma score 8.1, taste score 8.2, texture score 8.4. Overall acceptability score 8.4. It is concluded from the study that biscuits prepared with T_1 TJ-83: 95g hard wheat variety flour + 05g wheat bran result better in physical and sensory properties. Results best for colour score, flavor score, texture score, taste score by for overall acceptability have resulted in good for consumption.

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