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Evaluation of phenol colour reaction, sedimentation value and water absorption in grain and flour of different wheat varieties

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Abstract
The present investigation reports their variability in kernel and flour characteristics. The physical characteristics such as phenol colour reaction differed significantly among the wheat varieties. The chemical parameters such as Sedimentation value, water absorption, colour of dough and appearances of dough differed significantly for straight grade flour among different wheat varieties. In present investigation all wheat varieties did not show any marked change in phenol colour reaction during both years of experimentation. Sedimentation value of wheat varieties varied it ranges from 41.40 to 70.10 ml in first year while 41.40 to 69.50 ml in second year. Value of water absorption in the different varieties of wheat ranged from 41.40 to 66.40 per cent and 41.40 to 65.50 per cent during first year and second year respectively. Colour is important factor which affected the quality of chapatti. The colour did not show any marked change during both the years. Colour of dough was found Creamish, whitish, light radish and dull whitish in this experiment.

Keywords: Phenol colour reaction, sedimentation value, water absorption and dough colour

Introduction
Wheat is the most widely cultivated cereal crop in the world and mainly used for milling and baking. Some wheat varieties (*Tritium aestivum* L.) are suitable for bread making while others are suitable for biscuits and cooking making (Sapirstein *et al.*, 2007).The major factor for the suitability of wheat varieties for making different types of bakery products is the ability to form gluten network. Gluten, the protein component of flour which gives the dough elasticity and strength, can be defined as the rubbery mass that remains when wheat dough is washed to remove starch granules and water soluble constituents (Kaushik *et al*., 2013) [11]. Wheat bran is the outer layer of wheat grain making up about 13 % of weight of whole grain and a good source of proteins and minerals apart from being a rich source of dietary fiber. The fiber in wheat bran is mainly of insoluble type. (Yadav *et al*., 2009 Dhingra *et al*., 2012) [18, 7]. Carbohydrates is the most abundant constituents of wheat kernel, forming about 83 per cent of the dry matter. Starch, a major constituent of wheat endosperm plays an important role in determining wheat quality. Characterization of genes encoding starch biosynthetic enzymes along with better understanding of structure and properties of starch will help in manipulating starch functionality of different end-use products and nutritional quality. Sweetness of the product is related to simple sugars whereas nature of starch depicts the cooking quality (Labuschange *et al*., 2009) [13]. Protein quality and composition, wet and dry gluten content present in wheat flour, water absorption capacity of whole-wheat flour play a role in overall acceptability of chapatti.
Chapatti is generally prepared and consumed fresh in households as well as in restaurants. Chapatti form a cheap, primary source of protein and calories (Rehman *et al*., 2006) [16] and staple diet common to Pakistan, India, and some parts of Africa (Nandini and Salimath, 2001) [6]. A chapatti consists mainly of crust; with little crumb (Srivastava *et al.*, 2002) [1]. The desired quality characteristics in a chapatti are greater pliability, puffability, and soft texture, and light Creamish brown color, slight chewiness with baked wheat aroma (Gujral *et al.*, 2008) [8]. Ideally, the chapatti is creamy in color when baked with minimum of small brown spots and fully puffed so that two distinct layers are present.

Materials and Methods

Present investigation was conducted during 2018-19 and 2019-20 under the lab experiment in the laboratories of the Department of Agricultural Biochemistry at Chandra Shekhar Azad University of Agriculture & Technology, Kanpur - 208002 (Uttar Pradesh). Different twenty wheat varieties given in (Table A) used in the study were collected from the EBR Section of Chandra Shekhar Azad University of Agriculture & Technology, Kanpur. 200g grains of each variety were grinded with grinder mixer for wheat flour preparation. Representative samples of different varieties prepared for physico-chemical analysis and dough characteristics studies combined to make a composite sample of variety per year.

Table A: Name of the wheat varieties

S. N.	Varietal Code	Nick Name	Year of release
1	K-1317	Munna Bhaiya	2018
2	K-1006	Atal	2000
3	K-402	Mahi	2009
4	K-0307	Shatabdti	2006
5	K-9107	Deva	1996
6	K-607	Mamta	2011
7	K-7903	Halana	2002
8	K-9423	Unnathalana	2004
9	K-9162	Gangotri	2002
10	K-9533	Naina	2006
11	K-8027	Maghar	1989
12	K-9351	Mandakani	2006
13	K-9465	Gomti	1997
14	K-8962	Indra	1995
15	K-8434	Prasad	2006
16	HD-2733	VSM	2008
17	HD-2967	-	2011
18	DBW-187	Karan vandana	2019
19	K-68	-	-
20	PBW-343	-	1996

Physical properties

Phenol Colour Reaction

Phenol colour reaction was determined by the method described by Abrol *et al.* (1971) [2]. Few wheat grains were soaked separately in small beaker for 24 hours, 8 to 10 soaked seeds were taken in a Petri dish with filter paper on the base, 3 ml of 1 per cent phenol solution was added and the Petri dish were covered to prevent the evaporation of phenol. The Petri dishes were then kept for four hours. The changes in colour of seeds were noted thereafter.

Chemical analysis

The whole meal wheat flour and straight grade flour of each wheat variety were tested for chemical characteristics as described below**.**

Sedimentation value

Preparation of solution

Sedimentation test was done accordingly to the procedure given by Zenely (1947) and Pinckney *et al*. (1957) [15]. 100 mesh sieve passed 3.2g flour was taken in a 100 ml glass stoppered graduated cylinder. 50 ml of distilled water containing bromo-phenol blue (4 ppm) was added and the timing was noted by a stop watch. Flour and water were mixed thoroughly by moving the stoppered cylinder horizontally lengthwise, alternately right and left twelve times in each direction in five seconds.

At the end of first two minutes, the content was mixed for 30 seconds in the following manner. The cylinder was inverted completely, then upright as if it was pivoted at the centre. This action was performed exactly 18 times in 30 seconds and it was made to stand for one minute and 30 seconds. 25 ml of the isopropyl alcohol - lactic acid reagent (prepared by diluting 250 ml of 85% lactic acid to one liter water. 180 ml of this prepared solution was then mixed to 200 ml of 99-100% isopropyl alcohol and volume was made up to 1 liter. Diluted acid was allowed to stand for 28 hours before use) was added. Contents of the cylinder were mixed by inverting the cylinder and returning it to the upright position 4 times and allowed to stand for 1 minute and 45 seconds. Again the contents were mixed for 30 seconds and kept for 1 minute and 30 seconds. Finally, for 15 seconds contents were mixed once again and allowed to stand for exactly 5 minutes. After 5 minutes of interval, the volume of solid phase of the material in graduated cylinder was recorded. This is uncorrelated sedimentation value (12% moisture basis factor 0.98) multiply the incorrect sedimentation value by factor 0.98.

Water absorption

10 g of flour sample was weighed and measured quantity of water was added to make dough of normal consistency. The amount of water absorbed by the flour to give dough of normal consistency was recorded as water absorption percentage after multiplying the value by 10. Percentage of water absorption capacity = amount of water absorbed / amount of sample x 100 Colour, and appearance of dough properties were determined by visual observation of the dough and rating was done according to the following gradations as given by Austin and Ram (1971) [4].

Dough colour and appearance

Colour of dough

Dull whitish (DW), Whitish (W), Creamy whitish (CW), Light reddish (LR) and Reddish (R)

Appearance of dough

Homogenous (HM) and Heterogenous (HE).

Statistical analysis
All sample extracts were prepared and analysis done using a complete randomized design at 5% level of critical difference. Analysis of variance (ANOVA) for the design was carried out to determine the significance of differences among different treatment**.**

Results and Discussion
In the present study, the comparative nutritional profile was carried out and the obtained results are presented**.**

Phenol colour reaction
Phenol colour reaction of all varieties of wheat (*Tritium aestivum* L.) is shown in (Table 1).In present investigation all wheat varieties did not show any marked change in phenol colour reaction in respect. Wheat varieties K-1317, K-1006, K-9107, K-607, K-7903, K-8027, K-8962, K-8434, DBW, 187, and K-68 were found most suitable for chapatti characters. Same results were found in during both years of experimentation. Reported that the phenol colour reaction of wheat gave suitability for chapatti making. Pieper (1922) and Later Hermann (1928) [14, 10]**.**

Sedimentation value
Sedimentation value wheat varieties varied it ranges from 41.40 to 70.10 ml in first year. During second year in wheat varieties it ranges from 41.40 to 69.50 ml given in (Table 1)**.** Significantly maximum sedimentation value were noted in varieties K-1317 (70.10ml) being statistically at par with DBW-187 (66.40ml), K-8027 (62.30ml) and HD-2967 (61.50ml) first year and while in second year highest value K-1317 (69.50ml), DBW-187 (65.50ml) and HD-2967 (62.40ml) and as compared to other varieties. On contrary of this the minimum values of these were noted during both first and second years in PBW-343 (41.40ml) and in K-9465 (41.40ml) respectively. Variety K-1317 appeared best in respect of sedimentation value ml in wheat flour. Similar variety variations in this were also reported by various researchers Behera *et al*. (2000) and Singh and Jain (2000) [5, 17].

Table 1: Phenol colour reaction and Sedimentation value in various varieties of wheat grain and flour

Variety	Phenol colour reaction		Sedimentation value (ml)	
	2018-19	2019-20	2018-19	2019-20
K-1317	Slight brown	Slight brown	70.10	69.50
K-1006	Slight brown	Slight brown	42.50	43.40
K-402	Black	Black	50.40	49.50
K-307	Black	Black	55.50	56.20
K-9107	Slight brown	Slight brown	48.50	49.40
K-607	Slight brown	Slight brown	50.40	49.50
K-7903	Excellent or no colour	Excellent or no colour	52.40	51.40
K-9423	Black	Black	46.30	47.30
K-9162	Dark brown	Dark brown	48.30	49.50
K-9533	Dark brown	Dark brown	57.30	58.40
K-8027	Slight brown	Slight brown	62.30	61.40
K-9351	Slight brown	Slight brown	42.40	43.30
K-9465	Black	Black	42.30	41.40
K-8962	Light brown	Light brown	47.30	48.50
K-8434	Slight brown	Slight brown	52.40	53.40
HD-2733	Dark brown	Dark brown	52.20	51.40
HD-2967	Black	Black	61.50	62.40
DBW-187	Slight brown	Slight brown	66.40	65.50
K-68	Excellent or no colour	Excellent or no colour	45.30	46.60
PBW-343	Light brown	Light brown	41.40	42.40
S.E. (d) ±			0.38	0.45
C.D. (5%)			0.77	0.92

Water absorption
Water absorption capacity of flour is one of the important character for determining the softness and pliability of chapatti. A flour of poor water absorption capacity makes the chapatti stiff and these get dry too rapidly on keeping for an hour or so at room temperature. Water absorption in the different varieties of wheat in ranged from 41.40 to 66.40 per cent in first year. During second year in wheat varieties it ranges from 41.40 to 65.50 per cent presented in (Table 2)**.** Significantly maximum water absorption were noted in varieties DBW-187 (66.40%) followed by K- 8027 (62.30%), HD-2967 (61.50%) and K-9533 (57.30%) first year and while in second year highest value DBW-187 (65.50%), HD-2967(62.40%), K-8027 (61.40%) and K-9533 (58.40%) and as compared to other varieties. On contrary of this the minimum values of these were noted during both first and second years in PBW-343 (41.40%) and in K-9465 (41.40%) respectively. Variety DBW-187 appeared best in respect of water absorption per cent in wheat flour. Similar results of variety variations have been reported by. Hemalatha *et al.* (2007), Kulhomaki and Salovaara (1985) [9, 12].

Dough colour and appearance
Colour is important factor which affected the quality of chapatti. The colour did not show any marked changes with during both the years are presented in table-2. Colour of dough was found Creamish, whitish, light radish and dull whitish in this experiment. Wheat varieties K-1317(Creamish), K-9107(C), K-7903(C), K-8027(C), K-8962(C), and DBW-187(C) were observed to show the desirable colour Creamish respectively reported by (Anonymous, 1946) [3].

Table 2: Water absorption and Dough colour and appearance (%) in various varieties of wheat flour

Varieties	Water absorption (%)		Colour and appearance of dough	
	2018-19	2019-20	2018-19	2019-20
K-1317	50.40	51.50	C&H	C&H
K-1006	42.50	43.40	D W&H	D W&H
K-402	50.40	49.50	W&H	W&H
K-307	55.50	56.20	D W&H	D W&H
K-9107	48.50	49.40	C&H	C&H
K-607	50.40	49.50	D W&H	D W&H
K-7903	52.40	51.40	C&H	C&H
K-9423	46.30	47.30	D W&H	D W&H
K-9162	48.30	49.50	C W&H	C W&H
K-9533	57.30	58.40	D W&H	D W&H
K-8027	62.30	61.40	C&H	C&H
K-9351	42.30	43.30	L R&H	L R&H
K-9465	42.30	41.40	D W&H	D W&H
K-8962	47.30	48.50	C&H	C&H
K-8434	52.40	53.40	W&H	W&H
HD-2733	52.40	51.40	D W&H	D W&H
HD-2967	61.50	62.40	W&H	W&H
DBW-187	66.40	65.50	C&H	C&H
K-68	45.30	46.60	D W&H	D W&H
PBW-343	41.40	42.40	D W&H	D W&H
S.E. (d) ±	0.43	0.63		
C.D. (5%)	0.88	1.29		

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