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Light golden *chapatti* from durum wheat - nutritionally superior and better shelf life

Abstract

Present study was planned to prepare better quality of unleavened flat bread (*chapatti*) from Durum wheat. Percent retention of flour obtained by grinding with laboratory stone grinder (Chakki) was more for PDW 291 than that of PBW 175 and percent of passing of flour through sieve was more for PBW 175 as compared to PDW 291. *Chapatti* quality of flour of durum wheat obtained by grinding with Magnum mill was excellent in quality and comparable with *chapatti* quality of bread wheat on the basis of laboratory test and sensory evaluation. It was concluded that fresh chapatti of durum wheat (PDW 291) is as good as that of bread wheat (PBW 175) and even after 6 hrs of storage it is very soft, tastier and appealing to the palate. So that durum wheat needs different grinding methods than that bread wheat for excellent quality of *chapatti* making.

Keywords: *chapatti*, hardness, retention, wheat flour

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Uppal SK,[1] Suresh Bhise[2]

[1]Department of Chemistry, Punjab Agricultural University, India
[2]Department of Horticulture, Anand Agricultural University, India

Correspondence: Uppal SK, Department of Chemistry, Punjab Agricultural University, Ludhiana-141004, Punjab, India, Email satinderuppal11@yahoo.co.in

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Introduction

Currently, about 95 percent of wheat grown worldwide is hexaploid bread wheat, with most of the remaining 5 percent being tetraploid durum wheat. Durum wheat is also called pasta wheat to reflect its major end-use. Durum kernels are amber colored and larger than those of other wheat classes' best in grain appearance and very attractive. Durum wheat is also nutritionally superior due to its higher levels of carotenoids contents which give pasta its unique golden hue. Durum wheat varieties are also known for their disease resistance and a yield potential comparable to that of bread wheat. Cultivation of durum wheat in Punjab state is very rare because marketing and processing facilities for pasta products like noodles, macroni and vermicelli etc. are not available in the state. Instead unleavened flat bread (*chapatti*) is the major end product and about 80-85 percent wheat is consumed in Punjab State and North Western Zone. Even the consumption of *chapatti* is spreading to non-traditional areas in eastern, southern India and other countries. It can also be popularized in the area where the disease incidence likes yellow rust, brown rust, Karnal bunt and loose smut diseases are more. Because durum wheat is known for its resistance against these diseases as compared to bread wheat. In order to promote the area under durum wheat and its consumption, the present study was planned with the objectives to explore the possibility of its better *chapatti* making quality through differently milled whole wheat flour (atta) of durum wheat (PDW 291), to compare its *chapatti* making quality with bread wheat (PBW 175) known for good *chapatti* making on the basis of *chapatti* score, to find the overall acceptability of the *chapatti* on the basis of sensory evaluation by panelists and to study the shelf life of *chapatti* prepared

Materials and methods

Raw materials

The durum wheat variety PDW 291 and bread wheat variety PBW 175, known for good unleavened flat bread (*chapatti*) making were chosen for the study. They were procured from Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana.

Wheat grinding and sieve analysis

Fine whole wheat flour is produced from grinding the full wheat berry (Kernel) by using laboratory stone grinder (chakki) and Magnum Magnetic Stoneless Flour mill (Milcent Appliances Pvt. Ltd.). All parts of the wheat berry of both types of wheat were used in the flour including bran, germ and endosperm. Sieve analysis was done by using laboratory test sieves (Retsch 5657 Haan W. Germany).

Grain quality characteristics

Grain appearance score

It was evaluated subjectively out of a maximum Score of ten giving due weight age to the grain size, shape, colour and luster.

Test Weight **(kg/hl)**

This was determined using the apparatus developed by the Directorate of Wheat Research, Karnal, which employs a standard container of 100ml capacity.[1] The grains were weighed and the test Weight expressed in kg/hl.

Grain hardness (kg/grain)

The grain hardness was measured by using the grain hardness tester supplied by M/S Ogawa Seiki Co. Ltd., Japan by crushing ten grains one by one selected randomly from the lot. The mean force (kg) required to crush the grain was recorded.

Phenol test

The phenol reaction of the wheat genotypes was determined by soaking 15-20 grains of each sample in distilled water for 15-16 hours in Petri plates. After that the water was drained off and 1 per cent solution of phenol was added to the grains so that only three fourth of the grain is covered by the solution. The Petri plates are covered and kept for 4 hour. After 4 hours the phenol solution is also drained off and the grains are dried of filter paper for 30 minutes. A subjective score (out of 10) is given to each variety based on the color after drying. Higher score will be given to the grains with darker intensity of the color.

Protein content

The grain protein content was estimated using the whole grain analyzer infratec 1241 supplied by M/S Foss Analytical AB, Sweden, The instrument uses the near infrared light transmitted through the grains. The grain samples are scanned in the range of 850 to 1050nm with bandwidth of 7nm and there are 100 data points per scan. The results are displayed as percent protein content.

SDS sedimentation value

The SDS Sedimentation values of whole meal samples were determined by employing the method given by Axford et al.[2] A whole meal sample weight of 6g and a rest period of 20min were employed. On the basis of SDS Sedimentation values, the classification of wheat was done as given in Table 1.

Table 1 Classification of wheat on basis of sedimentation value

Sedimentation value (cc)	Wheat class
Below 48	Weak
48-68	Medium Strong
Above 68	Strong

Gluten content and index (%)

The gluten content and index values were evaluated using Glutomatic 2100 system supplied by M/S Perten, Germany. The instrument employs a 10g sample of whole meal using the AACC[3] method. The wet gluten content was calculated from the weight of the two fractions obtained after centrifuging for gluten index determination. The wet gluten was then dried in the Glutork gluten drier and the weight expressed as percent. The gluten index is expressed as the percent wet gluten retained inside the centrifuge cassette. On the basis of dry gluten content, the wheat samples were classified as given in Table 2.

Table 2 Classification of wheat on basis of dry gluten content

Dry Gluten content (%)	Class of wheat
7-9	Low gluten
>9	High gluten

Carotenoids

AACC[3] calorimetric method was used to determine the amount of carotenoids in the wheat flour for all the samples. Four gram wheat flour was taken in a 125ml reagent bottle and 20 ml of water saturated n-butanol was added to it. The contents were mixed properly and kept in dark for 16 hrs. The contents were then filtered and the extract transferred to standard test tubes. Light transmission of the extract was measured at 440nm using spectrophotometer and recorded as optical density (O.D).

Caroteniods (ppm) = [(O.D. × 23.5366) + 0.0105]

Chapatti preparation

Chapatti dough was prepared by mixing whole meal atta (50g , based on the moisture percent in the flour) and appropriate amount of water in Swason mixer (National Mfg. Co U.S.A.) for 2min. The dough was evaluated for stickiness while rounding it up manually and kept in the humidity cabinet maintained at 30° C and 80% R.H. for 30min. the dough was sheeted to 2mm thickness with the rolling pin and *chapatti*s of 15 cm diameter were cut using appropriate die. *Chapatti*s were baked on an automatic roti maker having thermostatically controlled constant temperature for 20 sec on one side and for 40sec on other side. Finally it was puffed for 10sec by turning the *chapatti* and bringing the upper plate of the rotimaker in contact with the *chapatti*s. *Chapatti*s were cooled to room temperature in the humidity cabinet.[4] For evaluation of *chapatti* quality score various parameters like water absorption, dough handling, *chapatti* appearance, colour, aroma, taste, puffing height and texture (Fresh, after 2hrs. and after 6hrs.) of *chapatti* making were considered and score was given out of 10.

Sensory evaluation of *Chapattis*

For Sensory evaluations whole wheat flour of PDW 291 and PBW 175 under the name Sample No. 1 and Sample No. 2 respectively were given to 12 different panelists along with proforma for sensory evaluation of fresh, 2 hrs storage and 6 hrs storage of *chapatti*s on the basis of color, appearance, taste and flavor by using hedonic scale. Sensory evaluation of *chapatti*s was done by a semi trained panel for, color, appearance, taste, flavor and overall acceptability using a 9-point hedonic scale[5] as per the proforma as given in Table 3.

Table 3 Proforma for sensory evaluation of *chapattis*

NAME OF THE PANELIST: DATE:

NAME OF THE PRODUCT: TIME:

Sr. No.	Color	Appearance	Taste	Flavor	Overall acceptability	Comment (If Any)
Sample 1						
Sample 2						

Scores to be given as follows:

Liked extremely – 9	Liked slightly – 6	Disliked moderately – 3
Liked very much – 8	Neither liked nor disliked – 5	Disliked very much – 2
Liked moderately –7	Disliked slightly – 4	Disliked extremely – 1

Citation: Uppal SK, Bhise S. Light golden *chapatti* from durum wheat - nutritionally superior and better shelf life. *MOJ Curr Res & Rev.* 2018;1(3):143–146. DOI: 10.15406/mojcrr.2018.01.00022

Statistical analysis

Data obtained was analyzed statistically using techniques of analysis of variance (ANOVA).[6]

Results and discussion

Grain quality of durum and bread wheat

Grain appearance score for PDW 291 and PBW 175 were 7.6 and 6.8, respectively. Test weight for PDW 291 and PBW 175 were 79.0 and 76.5Kg/hl, respectively. Grain hardness for PDW 291 and PBW 175 were 11.90 and 11.02Kg, respectively. Protein content of PDW 291 and PBW 175 were 11.78 and 11.67 percent, respectively. Phenol reaction score for PDW 291 and PBW 175 were 0.0 and 1.70, respectively (Table 4).

Granularity (sieve analysis) of whole wheat flour

For sieve analysis of flour of PDW 291 and PBW 175, 425µm and 300µm size sieves were used. Percent retention on 425µm sieve for PDW 291 and PBW 175 were 0.45 and 1.04, respectively. Percent retention on 300 µm sieve for PDW 291 and PBW 175 were 1.49 and 1.79, respectively. Percent pass of flour particles on 300µm sieve for PDW 291 and PBW 175 were 98.06 and 97.17, respectively in the case of flour obtained from magnetic stoneless flour mill (magnum mill) (Table 5). But in case flour obtained by grinding with laboratory stone grinder (chakki), Percent retention on 425 on sieve for PDW 291 and PBW 175 were 5.75 and 4.83, respectively. Percent retention on 300µm sieve for PDW 291 and PBW 175 were 10.02 and 7.56, respectively. Percent pass of flour particles on 300µm sieve for PDW 291 and PBW 175 were 84.22 and 87.61, respectively. The data showed that trend of sieve analysis of flour of two varieties was in reverse order under different grinding methods. Flour obtained by using magnum mill from durum wheat was finer.

Chapatti score of durum and bread wheat

Unleavened flat bread (*Chapatti*) dough was prepared from flour of both varieties obtained with grinding by chakki and magnum mill. Water absorption capacity of flour obtained from magnum magnetic stone less flour mill was 80% for PDW 291 and 78% for PBW 175. Water absorption capacity of flour obtained from laboratory stone grinder (chakki) was 66% for PDW 291 and 75% for PBW 175. These variations in water absorption capacity of flour with two varieties obtained with two grinding methods may be due to variations in particle size as shown in Table 6. *Chapattis* were prepared from flour. For evaluation of *chapatti* quality score various parameters like water absorption, dough handling, *chapatti* appearance, color, aroma, taste, puffing height and loss of water (just after and after 2hrs. and after 6hrs. of *chapatti* making were considered and score was given out of 10 (Table 6). PDW 291 was given a *chapatti* scores 7.26, 8.48 for fresh *chapatti*, 6.95, 8.46 for 2hrs stored *chapatti* and 6.33, 7.95 for 6hrs stored *chapatti* under two grinding methods chakki and magnum mill, respectively. PBW 175 was given *chapatti* scores of 8.21, 8.40 for fresh *chapatti*, 8.09, 8.35 for 2 hrs stored *chapatti* and 7.61, 7.72 for 6hrs stored *chapatti* under two grinding methods chakki and magnum mill, respectively. Perusal of data showed that *chapatti* quality of bread wheat obtained by two grinding method was of excellent quality as *chapatti* score ≥8 was considered as good in quality (Table 6). But *chapatti* quality of flour of durum wheat obtained by grinding with Magnum mill was excellent in quality and comparable with *chapatti* quality of bread wheat. *Chapatti* quality of four durum wheat obtained with chakki was inferior in quality relatively. So durum wheat needs different grinding methods than that of bread wheat. On *chapatti* storage the decrease in quality was least in case of flour obtained by magnum mill because of higher water holding capacity. It is due to particle size of flour which results in different water absorption. On the basis of laboratory study it was concluded that *chapatti* quality of flour of durum wheat (PDW 291) obtained by grinding with magnum mill was excellent in quality therefore more flour of durum wheat and bread wheat was prepared with magnum mill for studying its comparative quality characteristics and sensory evaluations.

Characteristics of whole wheat flour

SDS sedimentation values for PDW 291 and PBW 175 were 46 and 45, respectively. Carotenoids present in PDW 291 and PBW 175 were 8.04 and 4.24ppm, respectively. Carotenoids present in PDW 291 (8.04ppm) were almost 1.89 times more than that of PBW 175 (4.24ppm) thus durum wheat is nutritionally superior and having more golden color than that of bread wheat. Percent wet gluten content was more in PBW 175 (24.28%) as compared to PDW 291 (22.89%). Percent dry gluten content was more in PBW 175 (8.57%) as compared to PDW 291 (7.89%). Gluten index was more in PDW 291 (66.70) as compared to PBW 175 (62.30) (Table 7).

Table 4 Grain quality of durum wheat and bread wheat

Variety	Grain appearance score (Max 10) ±SD	Test weight (kg/hl) ±SD	Grain hardness (kg) ±SD	Protein (%)±SD	Phenol reaction score (Max 10) ±SD
PDW 291	7.6±0.58	79.0±0.85	11.90±0.15	11.78±0.38	0.0±0.00
PBW 175	6.8±0.23	76.5±0.13	11.02±0.24	11.67±0.56	1.70±0.09

Table 5 Granularity (sieve analysis) % of whole meal flour

Type of grinder	Variety	Granularity (Sieve analysis)%		
		425µm	300µm	
		Retained % ±SD	Retained % ±SD	Passed % ±SD
Chakki	PDW 291	5.75±0.28	10.02±0.78	84.22±1.23
	PBW 175	4.83±0.86	7.56±0.90	87.61±2.54
Magnum mill	PDW 291	0.45±0.07	1.49±0.17	98.06±2.37
	PBW 175	1.04±0.10	1.79±0.26	97.17±1.70

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Table 6 *Chapatti* score of durum wheat and bread wheat

Type of grinder	Variety	Fresh*±SD	Storage (2 hrs)* ±SD	Storage (6 hrs)* ±SD
Chakki	PDW 291	7.26±0.67	6.95±0.15	6.33±0.55
	PBW 175	8.21±0.33	8.09±0.24	7.61±0.36
Magnum mill	PDW 291	8.48±0.19	8.46±0.43	7.95±0.28
	PBW 175	8.40±0.54	8.35±0.88	7.72±0.19

*out of 10

Table 7 Whole meal flour (Atta) quality of durum wheat and bread wheat

Sample No.	Variety	SDS sedimentation value (cc) ±SD	Carotenoids (ppm) ±SD	Gluten content %		Gluten index±SD
				Wet ±SD	Dry±SD	
Sample 1	PDW 291	46±2.88	8.04±0.29	22.89±0.75	7.89±0.14	66.7±0.96
Sample 2	PBW 175	45±3.65	4.24±0.22	24.28±0.86	8.57±0.34	62.3±1.56

Sensory evaluation of durum and bread wheat *chapattis*

Whole wheat flour of both varieties PDW 291 and PBW 175 under the name Sample No. 1 and Sample No. 2 respectively were given to 12 different panelists along with proforma for sensory evaluation of fresh, 2 hrs storage and 6 hrs storage of *chapattis* on the basis of color, appearance, taste and flavor by using hedonic scale. On the basis of results, overall acceptability was calculated under each category of each proforma and its mean value was given in Table 8. On the basis of laboratory and sensory evaluation by 12 panelists, it was concluded that fresh *chapatti* of durum wheat (PDW 291) is as good as that of bread wheat (PBW 175) and even after 6 hrs of storage it is very soft, tastier and appealing to the palate. It may be due to its fine grinding leading to more uptake of water during dough making. It was also observed by some judges that no darkening of dough was observed in case of durum wheat PDW 291even after 48 hrs on keeping dough in refrigerator.

Table 8 Overall acceptability (mean value) of durum and bread wheat *chapattis* on the basis of sensory evaluation

Sample No.	Variety	Fresh ±SD	Storage (2 hrs.) ±SD	Storage (6 hrs.) ±SD
Sample 1	PDW 291	8.13±0.25	8.08±1.24	8.07±1.56
Sample 2	PBW 175	8.22±0.98	7.98±0.84	7.81±2.62

Conclusion

On the basis of studies it was concluded that *chapatti* of flour of durum wheat PBW 291 would be prepared excellent in quality if fine flour is prepared with Magnetic stone less flour mill.

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None.

Conflict of interest

Author declares that there is no conflict of interest.

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