Comparison of Different Wheat Varieties Grown in Punjab for Leavened Flat Bread (Naan) Production

Muhammad Amjad, Muhammad Naeem Safdar, Amer Mumtaz, Khalid Naseem, Saeeeda Raza and Samina Khalil
Food Quality and Nutrition Program, National Agricultural Research Centre, Islamabad, Pakistan

Abstract: Seven wheat varieties i.e. Inqulab 91, Bhakkar 2002, AS 2002, Shafaq 2006, Sehar 2006, Auqab 2000 and GA 2002 collected from different locations of Punjab were subjected to physicochemical, rheological, minerals (copper, manganese, iron, zinc) and sensory analyses to determine their suitability for leavened flat bread (naan) preparation. Naans were prepared from different wheat flours and evaluated for colour, taste, flavor, texture, chewing ability, folding ability and overall acceptability. It was observed that Shafaq 2006 had the highest test weight (81.50 kg/hl), thousand kernel weight (41.20 g), zinc (8.50 mg kg⁻¹) and lowest broken/shrunken grains (0.79%), insect damaged grains (0.45%), moisture (12.92%) and dough stability (4.11%), Bhakkar 2002 had the maximum broken/shrunken grains (1.61%), ash (0.61%), falling number (432) and minimum water absorption (54.05%), dough development time (2.21 min) and manganese (5.29 mg kg⁻¹), whereas Sehar–2006 had the highest protein (10.84%), wet gluten (27.56%), dry gluten (9.35%), dough development time (4.12 min), copper (4.68 mg kg⁻¹) and lowest edible foreign matter (0.42%), tolerance index (35.00 BU) and iron (14.80 mg kg⁻¹). Naans prepared from Auqab 2000 were ranked highest and more acceptable than others.

Key words: Punjab, wheat varieties, physicochemical, farinographic properties, sensory evaluation, naan

INTRODUCTION
Wheat (Triticum aestivum L.) is the largest grain crop and staple food of Pakistan. It occupies a central position in agriculture and economy (Shuaib et al., 2007). It contributes 13.1% to the agricultural value addition and 2.8% to GDP. Total wheat production during 2008-09 touched 23.4 million tons (GOP, 2009). 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 vitamins like thiamin, riboflavin, niacin and vitamin E (Khan and Zeb, 2007).

The term wheat quality is a complex of many factors depending on milling, chemical, baking and rheological dough properties. Wheat quality reflects suitability for a particular purpose or intended use. The major factors influencing wheat quality are cultivar, climatic conditions, cropping year, process of harvest and storage conditions (Pasha, 2006).

Wheat is unique among cereals since its milled product "flour" is capable of forming the dough due to its gluten content. The unique characteristics of wheat can be attributed to the ability of its proteins gliadin and glutenin, which upon hydration form viscoelastic network gluten: the actual substance that imparts gas retention property to dough (Shah et al., 2008). In Pakistan, the most commonly consumed and least expensive product of wheat flour is flat bread like chapattis, rotis and naan. Furthermore, wheat is used for various other bakery products like bread, cookies, cakes, buns, pastries etc. In Punjab and Sindh provinces chapatti and roti doughs are unleavened while in Baluchistan and NWFP provinces fermented rotis are prepared. Naan is flat leavened bread prepared from flour, water, salt and yeast (Aidoo et al., 2006). Fermented dough is used for making naan. Therefore, naan is made from finer granulation flour than that used for chapattis because finer the granulation, the more rapid is the process of fermentation (Qarooni, 1998). It has better digestibility and greater storage life than chapattis. It is mostly consumed at breakfast, while it is also available at lunch and dinner with specific dishes (Farooq et al., 2001).

The present study was designed to evaluate wheat varieties grown in Punjab for various physico-chemical and rheological characteristics in order to assess their suitability for the production of leavened flat bread (naan).

MATERIALS AND METHODS
Collection of raw materials: Seventy-eight wheat samples were collected randomly from nine regions of Northern, Central and Southern Punjab during 2008. Samples were drawn directly from farmers field. Wheat samples were packed airtight in polyethylene bags and
taken to Food Quality and Nutrition Program (FQNP) Lab.
National Agricultural Research Centre (NARC).
Representative samples of each variety were prepared
for physico-chemical analysis, farinographic studies and
naan preparation by combining individual variety
samples from different regions. Physico-chemical,
farinographic analysis of composite samples and
sensory evaluation of prepared naan were done in
triple.

Physical characteristics of wheat: Wheat samples
were uniformly divided through Boerner Divider and
analyzed for physical quality characteristics such as
thousand kernel weight, test weight, foreign matter,
broken/shrunken grains and damaged grains according
to standard procedures as described in AACC (2000).

Milling of wheat: Wheat grains were tempered and then
milling was done using Quadrature Senior Mill
according to standard method (AACC, 2000). Four
products were obtained i.e. reduction flour, break flour,
shorts and bran. Reduction flour and break flour were
mixed to get straight grade flour for further studies.

Chemical/general characteristics of wheat flour:
Wheat flour of different varieties was subjected to
determine its chemical/general characteristics such as
moisture, ash, crude protein (N x 5.7), wet and dry gluten
and falling number according to standard procedures of
AACC (2000). Perten Glutomatic was used to determine
wet and dry gluten whereas Falling Number system
(Perten 1500) was used for the determination of alpha
amylose activity in wheat flour. Trace elements (copper,
manganese, iron, zinc) were analyzed using a Varian
SpectRAA 220FS Atomic Absorption Spectrometer. The
samples were prepared according to the standard

Farinographic studies: Rheological behaviour of
different wheat varieties flour was evaluated by running
flour samples through Brabender Farinograph equipped
with a bowl of 50 g capacity. The dough characteristics
such as water absorption, dough development time,
dough stability, tolerance index and softening of dough
were determined according to standard procedure of
AACC (2000).

Preparation of leavened flat bread (naans): Leavened
Flat Bread (Naans) were prepared by taking 250 g
straight grade flour, mixed with 50 g yoghurt and water
for 10 min, kept in an incubator at 35°C overnight
covered with wet cloth. It was then mixed with 750 g flour,
15 g sugar, 5 g salt, 5 g sodium bicarbonate and water
(quantity as determined by farinograph water absorption)
for dough preparation. Dough balls of 100 g each were
made and sheeted into a disk of 7 inch diameter with
rolling pins, pressed with fingertips in the centre and
allowed to proof for 30 min. Then naans were prepared
by baking in an oven at 315°C for 3 min.

Sensory evaluation: Sensory evaluation of naans was
carried out by a panel of judges for colour, taste, flavour,
texture, chewing ability and folding ability. Samples were
presented in succession and panelists were asked to
rate evaluation variables according to 9-point Hedonic
scale as described by Land and Shepherd (1988).

Statistical analysis: The data obtained for each
parameter was subjected to statistical analysis using
Statistica 6.0 software according to methods described
by Steel et al. (1996).

RESULTS AND DISCUSSION
Seven wheat varieties collected from different regions of
Punjab were evaluated for physicochemical, rheological
and sensory characteristics for leavened flat bread
preparation.

Physical characteristics: Data regarding physical
parameters of wheat grains reveals that Shafaq-2006
variety had the highest test weight (81.50 kg/ha) whereas
AS 2002 samples possessed the lowest test weight
(76.80 kg/ha) (Table 1). Test weight is considered as one
of the important tool in wheat grading system (Pasha,
2006). It is imperative in the grain trade because most
grains are sold at a certain test weight. Highest
thousand kernel weight (41.20 g) was observed in
Shafaq 2006 wheat and lowest value was recorded in
Inqulab 91 (36.60 g). Thousand kernel weight as well as
test weight is useful index for potential milling yield. The
differences observed in test weight and thousand kernel
weight among wheat varieties may partly be due to the
differences in the genetic make up of the varieties and
partly attributed due to different growing and
environmental conditions prevailed during growing
periods (Randhawa et al., 2002).
In case of foreign matter, wheat grains of GA 2002 had
the highest (1.19%) and Aqab 2000 had the lowest
(0.25%) non-edible foreign matter. AS 2002 possessed
the highest (1.29%) and Sehar-2006 had the lowest
(0.42%) edible foreign matter. The differences in foreign
matter may be due to varied climatic conditions of
different locations, harvesting and threshing operations
as well as planting time (Anjum et al., 2003). Maximum
broken/shrunken grains was observed in Bhakkar 2002
(1.61%) followed by Inqulab 91 (1.38%) samples
whereas, Shafaq 2006 had the minimum (0.70%)
broken/shrunken grains. As regards damaged grains,
AS 2002 had the lowest (0.45%) and Inqulab-91 had the
highest (0.92%) insect damaged grains, whereas GA
2002 had the lowest (0.54%) and Aqab-2000 had the
highest (0.87%) other damaged grains (fungus/black
tipped, heat damaged, immature grains etc).
Table 1: Physical characteristics of wheat grains

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Test weight (kg/ha)</th>
<th>Thousand kernel weight (g)</th>
<th>Foreign matter (%)</th>
<th>Broken/shrunken grains (%)</th>
<th>Insect damaged grains (%)</th>
<th>Other damaged grains (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inqulab 91</td>
<td>77.5±0.13</td>
<td>36.6±0.86</td>
<td>0.79±0.21</td>
<td>1.0±0.19</td>
<td>1.8±0.43</td>
<td>0.9±0.25</td>
</tr>
<tr>
<td>Bhakkar 2002</td>
<td>78.2±0.12</td>
<td>38.5±0.67</td>
<td>0.80±0.29</td>
<td>0.7±0.15</td>
<td>1.6±0.32</td>
<td>0.7±0.14</td>
</tr>
<tr>
<td>AS 2002</td>
<td>78.8±0.95</td>
<td>37.1±0.74</td>
<td>0.48±0.17</td>
<td>1.3±0.32</td>
<td>1.0±0.25</td>
<td>0.5±0.09</td>
</tr>
<tr>
<td>Shafq 2006</td>
<td>81.5±0.73</td>
<td>41.2±0.57</td>
<td>0.37±0.13</td>
<td>0.6±0.17</td>
<td>0.7±0.15</td>
<td>0.4±0.08</td>
</tr>
<tr>
<td>Sehar 2006</td>
<td>79.3±0.66</td>
<td>39.0±0.78</td>
<td>0.54±0.16</td>
<td>0.4±0.09</td>
<td>0.6±0.27</td>
<td>0.5±0.13</td>
</tr>
<tr>
<td>Auqab 2000</td>
<td>78.6±0.67</td>
<td>38.0±0.51</td>
<td>0.25±0.10</td>
<td>0.8±0.21</td>
<td>1.1±0.28</td>
<td>0.5±0.10</td>
</tr>
<tr>
<td>GA 2002</td>
<td>80.0±0.54</td>
<td>40.0±0.65</td>
<td>1.19±0.24</td>
<td>1.1±0.28</td>
<td>1.3±0.19</td>
<td>0.7±0.17</td>
</tr>
</tbody>
</table>

*All values are means of three replications

Table 2: Chemical/general characteristics of wheat flour

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Moisture (%)</th>
<th>Ash (%)</th>
<th>Protein (%)</th>
<th>Wet gluten (%)</th>
<th>Dry gluten (%)</th>
<th>Falling No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inqulab 91</td>
<td>13.1±0.14</td>
<td>0.6±0.09</td>
<td>10.5±0.12</td>
<td>26.9±0.04</td>
<td>0.12±0.53</td>
<td>37±13.53</td>
</tr>
<tr>
<td>Bhakkar 2002</td>
<td>13.2±0.10</td>
<td>0.6±0.07</td>
<td>9.7±0.14</td>
<td>24.6±0.16</td>
<td>0.8±0.44</td>
<td>43±18.56</td>
</tr>
<tr>
<td>AS 2002</td>
<td>13.5±0.11</td>
<td>0.5±0.08</td>
<td>10.4±0.11</td>
<td>26.9±0.01</td>
<td>0.9±0.48</td>
<td>38±11.01</td>
</tr>
<tr>
<td>Shafq 2006</td>
<td>12.9±0.15</td>
<td>0.6±0.03</td>
<td>9.8±0.16</td>
<td>25.5±0.61</td>
<td>8.6±0.39</td>
<td>39±8.82</td>
</tr>
<tr>
<td>Sehar 2006</td>
<td>13.0±0.08</td>
<td>0.5±0.05</td>
<td>10.8±0.10</td>
<td>27.5±0.67</td>
<td>9.3±0.50</td>
<td>40±10.44</td>
</tr>
<tr>
<td>Auqab 2000</td>
<td>13.1±0.17</td>
<td>0.5±0.04</td>
<td>10.3±0.16</td>
<td>26.4±0.72</td>
<td>9.2±0.32</td>
<td>35±9.49</td>
</tr>
<tr>
<td>GA 2002</td>
<td>13.3±0.10</td>
<td>0.5±0.02</td>
<td>9.3±0.23</td>
<td>24.1±0.55</td>
<td>7.8±0.21</td>
<td>41±9.88</td>
</tr>
</tbody>
</table>

*All values are means of three replications

Chemical/general characteristics: It is evident from the data on chemical characteristics of wheat flour that mean moisture content of different varieties were quite close to each other due to tempering of wheat grains before milling. Highest moisture content was observed in GA 2002 (13.3%) while Shafq 2006 had the lowest moisture (12.92%) (Table 2). Moisture content is dependent on genetic makeup of wheat varieties and is largely influenced by agronomic and climatic conditions (Mahmood, 2004). In case of ash, highest value was observed in Bhakkar 2002 (0.61%) while lowest ash was recorded in AS 2002 (0.52%) samples. The ash content of flour is related to the amount of bran in the flour and therefore to flour yield.

As regards protein content, Sehar-2006 had the highest protein (10.84%) followed by Inqulab-91 (10.57%), while GA 2002 (9.52%) had the lowest protein content. The protein content is an important criterion while considering the wheat quality. Protein content is an inherent characteristic but the quantity of protein depends on the growing conditions (Kent and Evers, 1994). Variation in protein content among wheat varieties is due to differences in their genetic makeup as well as differences in environmental and production conditions prevailed during growth stages (Randhawa, 2001).

Highest wet and dry gluten content was observed in Sehar 2006 (27.56% and 9.35%) whereas lowest value was observed in GA 2002 (24.17% and 7.84%). The differences in gluten content among different samples may be ascribed to the variation in genetic makeup of wheat varieties, climatic conditions and differences in cultural practices and growth locations (Randhawa et al., 2002).

In case of falling number, Bhakkar 2002 had the highest falling number (432) and conversely lower alpha amylose activity while Auqab 2000 had lowest falling number (352) and therefore higher amylose activity. Alpha amylose activity depends on weather conditions, especially precipitation and mineral fertilizer (Gyiri and Sipos, 2006). Similar results were reported by Pasha (2006) during his study on fifty different wheat varieties during 2004-05.

Data regarding mineral composition of wheat reveals that the concentration of copper ranged from 2.61-4.68 mg kg⁻¹ (Table 3). Sehar-2006 had the highest value (4.68 mg kg⁻¹) whereas, GA 2002 possessed the lowest copper content (2.61 mg kg⁻¹). Highest iron content was observed in Inqulab 91 (21.37 mg kg⁻¹) and lowest value was observed in Sehar 2006 (14.80 mg kg⁻¹). The concentration of manganese and zinc among different varieties varied from 5.29-9.16 and 4.67-8.50 mg kg⁻¹ respectively. Highest manganese and zinc were detected in GA 2002 (9.16 mg kg⁻¹) and Shafq 2006 (8.50 mg kg⁻¹) respectively. Similar findings were reported by Araujo et al. (2008) in their studies on mineral composition of wheat flour consumed in Brazil.

Farinographic studies: Farinographic studies were conducted to determine the rheological properties of wheat flour (Table 4). Highest water absorption (57.38%) was observed in Inqulab 91 followed by Sehar 2006 (57.02%), while Bhakkar 2002 had the lowest water absorption (54.05%). DMR test for water absorption reveals that all wheat flour samples were significantly different from each other except Sehar 2006 and Auqab 2000 which had non-significant differences. Water absorption is considered to be an important characteristic of wheat. Stronger wheat flours have the ability to absorb and retain more water as compared to weak flours. Higher water absorption is required for good flat bread characteristics which remain soft for a longer time (Simon, 1987).
In case of Dough Development Time (DDT), Sehar 2006 had the highest value (4.12 min) whereas Bhakkar 2002 had the lowest time (2.21 min). Higher dough development time reflects strong flour while its lower value is an indication of weak flour. Dough stability of different wheat varieties flour varied from 4.11 min (Shafaq 2006) to 9.17 min (AS, 2002). DMR test for dough stability shows that wheat flours of all varieties were significantly different from each other. Dough stability is an indicator of flour strength. For Tolerance Index (TI), highest value was observed in GA 2002 (110 BU) whereas Sehar 2006 had the least tolerance index (35.00 BU). Generally, higher the tolerance index value, weaker is the flour. As regards Softening of Dough (SD), Auqab 2000 had the lowest value (46.67 BU) followed by Sehar 2006 (53.33 BU). Flours that have lower SD are stronger and the ones having higher SD values are weaker. Differences in fannographic characteristics among different wheat varieties may be due to variations in protein quantity and quality (Rehman et al., 2001).

**Sensory evaluation:** Naans prepared from different wheat varieties flour were subjected to sensory evaluation for colour, taste, flavour, texture, chewing ability and folding ability in triplicate and their scores were calculated (Table 5). Highest mean score for colour (8.07) was obtained by AS 2002 whereas Inqulab 91 got the lowest score (6.53). As regards taste, Auqab 2000 was at the top (7.80) followed by Sehar 2006 (7.60) and found to be least (6.27) for Bhakkar 2002. Maximum flavor score (7.93) was attained by Auqab 2000 whereas GA 2002 received the minimum score (6.60). The differences in colour, taste and flavour scores may be attributed to the differences in hardness/softness of wheat grains and other factors like wheat varieties and milling characteristics of wheat (Faroq, 2001). For texture, highest mean score (7.33) was obtained by Sehar 2006 and lowest (5.60) by Bhakkar 2002. In case of chewing ability, Auqab 2000 got the maximum score (7.80) and GA 2002 obtained the minimum score (5.67). For folding ability, Bhakkar 2002 obtained the least score (5.40) whereas AS 2002 received the highest score (6.73). With respect to overall acceptability of naans, highest score (7.38) was obtained by Auqab 2000 and thus regarded as more acceptable than other flour naans while lowest score (6.21) was obtained by Bhakkar 2002 thus considered least acceptable.

**Conclusion:** It was concluded that physico-chemical and rheological characteristics of wheat varieties affect the quality of the end product. Overall, quality of wheat varieties was good and comparable to International
standards. Wheat variety Auqab 2000 was ranked highest and most suitable for leavened flat bread (naan) preparation.

REFERENCES


