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Research Article

# Effect of Handling, Milling Process and Storage on the Quality of Wheat and Flour in Egypt: [2] Rhological Properties of Wheat Kernals and Their Flours

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## Abstract

Five imported wheat kernels (Australian, Argentine, Ukrainian, American and Germany), and local wheat cultivars Egyptian wheat (Gamaza7) were subjected to rheological properties. Result, indicated that the Germany wheat grains had higher total physical defects. Flour yields were about 70% for all tested wheat samples except for the American soft red winter wheat and Ukrainian hard red wheat, which were as low as 65.0%. A wide range of protein content (9.60 - 11.50%) of flours was recorded. The Argentine soft red winter wheat flour had the highest protein content and the Australian stander white wheat flour was the lowest in protein content. wet, dry gluten, hydration ratio and gluten index contents of wheat flour samples were consistent with their protein contents which ranged from (18.3 to 25.3%), (8.1 to 12.7%), (1.57 to 2.12%) and (57.5 to 84.5%) receptivity. Rheological evaluation data indicated that Australian and Argentine flours had very good quality and very strong wheat which were more suitable properties for bread-making than the American and Egyptian flours. From the different tested wheat flours indicated that those made from Australian wheat, and Argentine wheat flours were superior.

**Keywords:** Wheat; Flour; Rheological Properties; Handling; Milling; Storage

## Abbreviations

NFE: Nitrogen Free Extracts; M.C: Moisture Content; Arw: Argentine Soft Red Winter Wheat; Gew: Germany Soft Red Wheat; Auw: Australian Stander White Wheat; Amw: American Soft Red Winter Wheat; Ukw: Ukrainian Hard Red Wheat; ESW: Egyptian Soft White Wheat (Gamaza 7)

## Introduction

Most wheat varieties presently cultivated are grouped under the broad category of common or bread wheat' (Triticum aestivum), which accounts for approximately 95% of world production, and durum wheat (Triticum durum) used for pasta production (Peressini et al., 1999). In Egypt, 10.9 million tons of different wheat varieties are milled per year (2003 data). Millers buy wheat with a wide range of quality characteristics. About 4057234 tons (37.2%) of imported wheats and 6844692 tons (62.8%) of local wheats were used during the season of 2003 (FAO, 2005). The bread wheats encompass a wide range of different types classified largely by their growth habit and functionality. The various classes are combinations of winter or spring growth habit with white or red kernels and hard- or soft-textured kernels. For example, both spring and winter wheats include types with hard or soft and red or white kernels. These impart elasticity to the dough during baking so that large loaves of bread can be produced. This profile is generally indicated by a farinograph, which displays such important factors as protein (gluten) levels, ash content (a measure of extensibility, related to fiber), and falling number. Each of these elements plays an important role in the overall baking process, and each farinograph number tells the baker what type of results to expect. The baker's knowledge of the specific flour's profile dictates how much water to add, how long to knead the dough, and how long the fermentation time should be. Identity preserved (IP) wheat has also attracted interest. Franklin, (2003). Grain yield and quality of a crop variety is the end result of interactions between the variety and the environment. Wheat quality depends upon the genetic factors but environmental. conditions, growth locations; agronomic practices prevailing during different wheat growth stages greatly alter the wheat quality attributes. Generally wheat quality refers to its suitability for a particular end-use based on physical, chemical and nutritional properties of wheat grain. Protein content is a key quality factor that determines the suitability of wheat for a particular type of product as it affects other factors including mixing tolerance, loaf volume and water absorption capacity (Shah et al., 2008). Wheat flour is the major ingredient in many products and consequently it exerts a major effect on their quality. It is also a complex biological entity and, as such, varies significantly with the source of the wheat. As a complex system, and because it is obtained from a plant, wheat flour contains a multitude of compounds found in any living tissue. These include: moisture 14%, proteins 7-15% (albumins, globulins, prolamin, glutelin), starch 63-72% (amylopectin, amylose), no starchy polysaccharides 4.5-5.0% (pentosans and beta glucans), lipids 1%, as well as vitamins (thiamin, riboflavin, niacin) and minerals (iron, sodium, potassium, calcium, magnesium, copper, zinc). The most of these components play an important role in the way of how the flour-based and other product constituents will behave during processing or how the final product meets the consumer's requirements Katarina and Dušanka (2008). The flour yield and flour properties, among other things, are strongly related to wheat kernel properties, especially to the mechanical properties. Beside the mechanical properties, also others, such as kernel colour, virtuousness, mass, shape, test weight, density, size and size uniformity, are taken into consideration during wheat milling value evaluation. These properties depend on many factors, such as genetic heritage, agro-technical methods or Agroenvironmental conditions. On the basis on these properties we can also conclude about the end use of wheat. Studies concerning the relations between the wheat kernel physical properties and the milling properties have been carried out since the beginning of the cereal processing industry. (Shuler et al. 1995) The rheological properties of the HR W ASW wheat flour blend had higher farinograph absorption and slightly stronger curve than HRW - WW wheat flour blend. No significant differences were observed in pasting properties between HRW-WW and HRW-ASW wheat flour blends by amylograph Shin and Kim (1993). The rheological characteristics of the dough are usually studied using the farinograph and mixograph. In general, the farinograph stability time is affected by material flour wet gluten, protein content, protein compositions, the type of high molecular weight glutenin subunits (HMW-GS), and so on. In addition, it is significantly correlated with the processing quality such as bread making and steamed bread making, indicating that the dough stability time is one of the important quality indexes for classifying wheat and determining their end use. It is known that the stability time of bread-making flour was determined to be 12±1.5 min in some countries such as USA and Canada. According to GB/T17982-1999 of China (The State Administration of Grain Reserve, Ministry of Agriculture of China 1999), the stability time of the first-class strong gluten wheat is longer than or equal to 10 min; and wheats having stability time longer than or equal to 7 min were considered to be second-class strong gluten, whereas wheat having stability time shorter than 1.5 min were considered to be weak gluten wheat (TIAN *et al.* 2007).

The aim of research to evaluate the most common imported wheats (Australian, Argentine, Ukrainian, American and Germany), as well as a local wheat cultivars Egyptian wheat (Gamaza7) for bread - making. -The physical, chemical, rheological as well as the manufactured bread quality characteristics were examined.

## Materials and Methods

### Wheat samples

Five imported wheat grains (*Triticum aestivum*) were obtained from Argentin, Germany, Ukrainian, Australia and U.S.A which were obtained from five locations (Alexandria, Domiata, El-Suwas, El-Skhna and Cairo) and Egyptian wheat grains (gamaza 7) were obtained from El-Ghrbia. They were taken from six different Companies since 2009.

### Preparation of wheat flours

A twenty kg of each wheat sample used in this investigation was stored 90 days at temperature 25°c and relative humidity less than 62% and taken samples from stored wheat at different time (0, 7, 14, 21, 30, 36, 42, 49, 60, 66, 72, 84 and 90) According to the methods described in U.S. Department of Agriculture (1995 A). At the end of stored wheat sample was cleaned mechanically to remove dirt, dockage, imparters and other strange grains by Carter Dockage Tester According to the methods described in U.S. Department of Agriculture (2002 B). the wheat samples were tempered to 16.5% moisture and allowed to conditioning for 24 hours, than milled by Laboratory mill CD1 auto Chopin According to the methods described in AACC method (2000 A). the extraction rate of any flour sample was adjusted to recurred rate (72% extraction).

### Analytical methods

### Physical properties

A thousand kernel weight was determined by counting the kernels in a 10 g wheat sample AACC method (2000 B). Wet and dry gluten, and falling number were determined according to A.O.AC. (2005)

### Chemical properties

Moisture, crude protein, ash, crude fiber, fat were determined according to A.O.AC. (2005) and U.S. Department of Agriculture (1999 C). The nitrogen free extract (N.F.E) was calculated by difference.

### Rheological properties

All samples were tested by macro Farinograph, alveograph and Mixolab. (in Regional Center for Food and Feed, Agri. Res. Center, Cairo, Egypt.) to determine the rheological properties of the different types of flour according to the methods described by AA.C.C.(2000A).

### Statistical analysis

Data of three replicates were computed for the analysis of standard division (S.D) among the means were determined by Duncan's multiple range test using SAS programs (SAS, 1999).

## Results and Discussion

### Physical and chemical properties of wheat kernels and their flours

Chemical composition of different wheat kernels used in these study is given in Table 1 that wheat moisture content of different varieties ranged from (8.6 to 9.8) for all studied samples. Australian stander white wheat had the highest value while Egyptian soft white wheat had lowest value among all samples. As regards protein content, Argentine soft red winter wheat had the highest protein (12.50%) followed by Egyptian soft white wheat (11.40%), while Australian stander white wheat (10.40%) had the lowest protein content. On other hand nitrogen free extracts (NFE)% rang from 71.17% (Argentine soft red winter wheat) to 74.41% (Australian stander white wheat). Additionally Ukrainian hard red wheat was lower fat (1.30) than other samples while Ukrainian hard red wheat was lower in Ash content (1.20) in completely in other wheat. Ash content of all wheat varieties was found quite close to each other. However, highest ash content was observed in Egyptian soft white wheat (2.20%).The ash content of flour is related to the amount of bran in the flour and therefore to flour yield. The results of fiber showed that Egyptian soft white wheat had significant highest value (3.54%) while Australian stander white wheat had lowest value (2.18).

| Wheat | ArW | GeW | UkW | AmW | AuW | ESW |
|---|---|---|---|---|---|---|
| M.C% | 9.0 ± 0.5 | 8.70 ± 0.1 | 9.40 ± 0.1 | 9.60 ± 0.1 | 9.80 ± 0.07 | 8.60 ± 0.1 |
| Protein% | 12.50 ± 0.1 | 11.0 ± 1.0 | 11.0 ± 1.0 | 10.90 ± 0.1 | 10.40 ± 0.1 | 11.40 ± 0.1 |
| Fat % | 1.74 ± 0.01 | 1.59 ± 0.01 | 1.30 ± 1.0 | 1.35 ± 0.01 | 1.77 ± 0.01 | 1.70 ± 0.01 |
| Ash% | 2.10 ± 0.1 | 1.60 ± 0.1 | 1.20 ± 0.1 | 2.10 ± 0.1 | 1.44 ± 0.1 | 2.20 ± 0.1 |
| Fiber% | 3.49 ± 0.01 | 3.16 ± 0.01 | 2.70 ± 0.1 | 2.93 ± 0.58 | 2.18 ± 0.01 | 3.54 ± 0.01 |
| NFE% | 71.17 ± 0.01 | 73.95 ± 0.01 | 74.40 ± 0.1 | 73.12 ± 0.01 | 74.41 ± 0.01 | 72.56 ± 0.01 |
| Total caloric values% | 358.14 ± 0.01 | 354.11 ± 0.01 | 353.3 ± 0.1 | 347.95 ± 0.01 | 355.17 ± 0.01 | 245.58 ± 0.01 |

**Table 1:** proximate analysis for six different wheat kernels.

**NFE =** Nitrogen free extracts, **ArW =**Argentine Soft Red winter Wheat**, GeW =**Germany Soft Red Wheat**, UkW** Ukrainian Hard Red Wheat, **AmW =**American Soft Red Winter Wheat, **AuW =**Australian Stander White Wheat, **ESW=**Egyptian soft White Wheat (gamaza 7).

Results in Table 2 showed that 1000 kernels wheat ranged from 33.5 to 45.2 gm. Argentine soft red winter wheat have highest value (45.2gm) while Ukrainian hard red wheat have lowest value(33.5gm). foraddition the kernel colour in all samples are red wheat whereas Australian stander white wheat and Egyptian soft white wheat are white wheat. Additionally it showed that wet, dry gluten, hydration ratio and gluten index ranged from (18.3 to 25.3%), (8.1 to 12.7%), (1.57 to 2.12%) and (57.5 to 84.5%) receptivity. From same table thesis results showed that the highest wet and dry gluten was observed in Australian stander white wheat (33.1% and 12.7%) whereas lowest value was observed in Egyptian soft white wheat (gamaza7) samples. On the other hand American soft red winter wheat have highest gluten index moreover the other samples are different between that Australian stander white wheat and American soft red winter for the gluten properties. Falling which indicted enzyme activity of Alfa amylase. In case of falling number, Australian stander white wheat highest falling number (445 sec.) and lowest enzyme activity. From Table (2) it can be concluded that Australian stander white wheat have the good quality for physical properties in all different wheat samples followed by Argentine soft red winter wheat, American soft red winter wheat, Ukrainian hard red wheat and Germany hard red wheat.

Chemical composition of wheat flour prepared from different wheat kernels are showing from Table 3. Result indicted that chemical composition of flour are different in all investigated samples. Moisture content are ranged from 13.5% (American soft red winter wheat flour) to 13.85% (Argentine soft red winter wheat flour) while Argentine soft red winter wheat flour contain highest protein (13.34%) and lower nitrogen free extract (70.29%) than other samples, however Australian stander white wheat flour showed that have highest fat content compared with other studied samples. On other hand the American soft red winter wheat flour have a lower sample in ash.

The data in Table 4 showed that the highest starch damage was in American soft red winter wheat flour (4.59%) while Germany hard red wheat was lowest (5.6%). The rheological properties wheat flour dough were tested by farinograph, alveograph and mixolab and the results shown wet and dry gluten and hydration ratio of different flour samples are given in Table (4). Results from Tables (3) and (4) indicated the increases in protein content wasn't accompanied by an increase in wet and dry gluten contents .the Australian stander white wheat flour showed protein content of 9.60% have higher wet , dry gluten and hydration ratio than other samples 30, 9.60 and 213% respectively, while it had the lower protein content 9.6 than other samples. Additionally, all samples investigated have a good characteristics to production of bread except the Australian stander white wheat flour and Egyptian soft white wheat flour, while Australian stander white wheat flour it can be used for produce pasta and bread ,but the Egyptian soft white wheat flour it can be used for biscuits and breakfast food . The same table reviewed that the falling number values were ranged from 154 to 442 sec. Argentine soft red winter wheat flour had the highest value (442sec.) and the Egyptian soft white wheat flour had lower values (154sec). Economic European community recommended that the falling number of flour should exceed than 230sec (Milatovie and Mondelli, 1991). Egyptian stander no. 1419/2006 of white flour for production of bread has the following requirement:

protein content not less than 10.2% Ash content not exceed than 0.9% And the falling number showed exceed than 200 Sce. Also, Egyptian stander no. 1649/2004 for durum wheat has obligation that protein content of durum wheat not less than 10.5% and ash content not exceed than 1.3%. From same Table (4) it can be concluded that the percentage of sediment ranged from 15 to 40%. Australian stander white wheat flour was highest sediment ratio which had good characteristics for produce bread. At the end of the Table (4) it showed that white variety of wheat had the highest value of whiteness colour for flour colour (Egyptian soft white wheat flour and Australian stander white wheat flour) 39.9 and 38.5% than the red variety wheat which is less whiteness. Starch damaged are ranged from 4.59 to 5.6%. Germany hard red wheat flour had the highest value while American Soft Red Winter Wheat flour had the lowest value.

### Rheological properties different wheat flour samples

Farinograph studies were conducted to determine the rheological properties of wheat flour for different wheat varieties Table 5 and Figure 1. Highest water absorption (57.50%) was observed in Egyptian soft white wheat flour followed by Argentine soft red winter wheat flour (57.0%) while American soft red winter wheat flour had the lowest water absorption (49.5%). Water absorption is considered to be an important characteristic of flour. Stronger wheat flours have the ability to absorb and retain more water as compared to weak flours. Higher water absorption is required for good bread characteristics which remain soft for a longer time. In considering the Farinograph mixing properties for the samples, it was found that arrivel time ranged from 1.0 to 1.25 min. Germany hard red wheat flour and Australian stander white wheat flour had the highest arrival time among all samples and Argentine soft red winter wheat flour, Ukrainian hard red wheat flour, American soft red winter wheat flour and Egyptian soft white wheat flour had lowest . As regards the Dough Development Time (mixing time), the time in minutes need to mix flour and water to form dough of suitable consistency was ranged from 1.5 to 3.0 min and the Australian stander white wheat flour had the highest value of Dough Development Time and Egyptian soft white wheat flour had lowest value. Higher Dough Development Time reflects strong flour while its lower value is an indication of weak flour. Usually the decrease of Dough Development Time is associated with weaker gluten, regarding dough stability which indicates dough strength and it's resistance for mechanical action and degree of weakening , it was found that Australian stander white wheat flour showed long period of dough stability was 18.0 min with low value of dough weakening 50.0 B.U. ,on the other hand the Egyptian soft white wheat flour had lowest period of dough stability 2.5min and the highest value of dough weakening 240 B.U. In case of Mixing Tolerance Index (TI), highest value (140 BU) was observed in Egyptian soft white wheat flour followed by American soft red winter wheat flour (110 BU). stander white wheat flour had the lowest mixing tolerance index value(30BU.) Generally, higher mixing tolerance index value, weaker is the flour. For softening of dough (SD), Australian stander white wheat flour had the lowest value (20 BU), which indicates strong flour since flours that have lower softening of dough SD are stronger and the ones having higher softening of dough SD values are weaker. Differences in farinographic characteristics among different wheat flour varieties may be due to variations in protein quantity and quality. Results in (table 5) for different wheat flour varieties were comparable to the earlier findings of (Rehman *et al*., 2001), (Huma (2004) and (Raman *et al*.,2000).

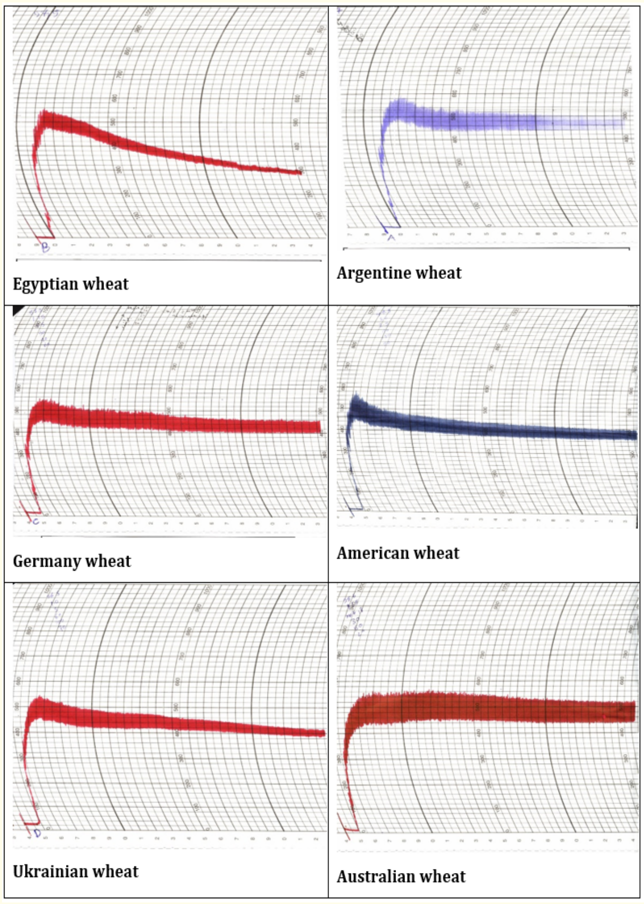


**Figure 1:** Farinograph Test.

Result in (Table 5) and Figure 2 showed that the Tenacity (P) were highly different values between all cultivars which ranged from 57mm to 117mm, Egyptian soft white wheat flour and Argentine Soft Red winter Wheat flour (117 mm H2O) had the highest value while American soft red winter wheat flour (57 mm H2O) was the lowest. For L, a value of 100 mm is generally regarded as good, but for some applications like biscuit making, it is the minimum accepted so that the Australian stander white wheat flour (116mm) was the highest value while Ukrainian hard red wheat flour (55mm) was the lowest value. G can be interpreted in the same way as L which ranged between (17.2 ml) to (23.9 ml). The P/L value is increasingly used in the wheat trade. A value of 0.50 corresponds either to resistant and very extensible dough or dough that is less resistant and only moderately extensible (the most common case). A value of 1.50 corresponds to very strong and moderately extensible dough. The milling industry requires balanced wheat, i.e. with a P/L in the 0.50–0.80 range so that the Egyptian soft white wheat and Argentine Soft Red winter Wheat (1.60%) had the highest value while Australian stander white wheat flour (0.64%) was the lowest. Baking strength (W) showed that the Egyptian soft white wheat flour (295 jol) and Argentine soft red winter wheat flour (295 jol) had the highest value while American soft red winter wheat flour (116 jol) was the lowest. The different alveograph curve measurements give information about the strength and extensibility of dough. The P values of standard wheats range from 60 to 80 mm $H_2O$ and of very good quality wheats from 80 to 100 mm $H_2O$; the values for extra strong wheats are higher than 100 mm $H_2O$. W is the most widely used characteristic because it summarises all the others. The very different shapes of the curves from 'extreme' individuals indicate the great variation in dough strength and extensibility present in the core collection. the relationships between grain characteristics, flour and dough properties and from resultes in Table 2, 3, 4 and 5.

Results of Mixolab of the different six wheat flour samples are given also in Table (5) and Figure 3. Data showed a variation in the absorption, mixing, gluten, viscosity, amylase, and retrogadation in among of the different samples. So that the absorption had medium

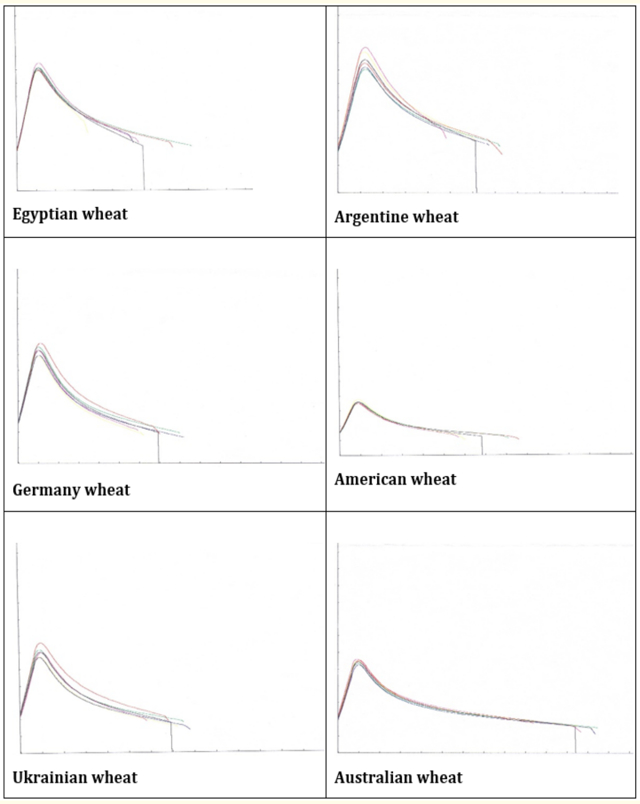


**Figure 2:** Alveograph Test.

| Wheat | ArW | GeW | UkW | AmW | AuW | ESW |
|---|---|---|---|---|---|---|
| Weigh per 1000 kernels gm | 45.20 ± 0.1 | 39.50 ± 0.1 | 33.50 ± 0.1 | 33.60 ± 0.1 | 42.50 ± 0.1 | 34.80 ± 0.1 |
| Hardness% | 60 ± 1.0 | 57 ± 1.0 | 61 ± 1.0 | 65 ± 1.0 | 57 ± 1.0 | 63 ± 1.0 |
| Colour | red | red | Red | red | white | white |
| Wet gluten % | 25.30 ± 0.1 | 27.80 ± 0.1 | 26.70 ± 0.1 | 23.70 ± 0.1 | 33.10 ± 0.1 | 18.30 ± 0.1 |
| Dry gluten % | 8.10 ± 0.1 | 10.80 ± 0.1 | 10.17 ± 0.1 | 10.10 ± 0.1 | 12.70 ± 0.1 | 4.42 ± 0.1 |
| Hydration ratio | 212 ± 0.1 | 157 ± 0.1 | 162 ± 0.1 | 134 ± 0.1 | 160 ± 0.1 | 314 ±0.1 |
| Gluten index % | 84.10 ± 0.1 | 59.70 ± 0.1 | 57.50 ± 0.1 | 95.50 ± 0.1 | 64.60 ± 0.1 | 70.50 ± 0.1 |
| Falling Number sec | 427 ± 1.0 | 376 ± 1.0 | 442 ± 1.0 | 400 ± 1.0 | 445 ± 1.0 | 198 ± 1.0 |

**Table 2:** physical properties of six different wheat kernels.

**ArW** =Argentine Soft Red winter Wheat, **GeW** =Germany Soft Red Wheat, **UkW** =Ukrainian Hard Red Wheat, **AmW** =American Soft Red Winter Wheat, **AuW** =Australian Stander White Wheat, **ESW**=Egyptian soft White Wheat (gamaza 7).

| Wheat Flour | ArW | GeW | UkW | AmW | AuW | ESW |
|---|---|---|---|---|---|---|
| M.C | 13.85 | 13.60 | 13.70 | 13.50 | 13.80 | 13.65 |
| Protein% | 13.34 ± 0.1 | 11.80 ± 0.1 | 11.35 ± 0.1 | 11.56 ± 1.0 | 11.13 ± 0.1 | 11.92 ± 0.1 |
| Fat % | 1.39 ± 0.1 | 1.15 ± 0.5 | 1.33 ± 0.01 | 1.15 ± 1.0 | 1.41 ± 0.01 | 1.27 ± 0.1 |
| Ash% | 0.98 ± 0.01 | 0.57 ± 0.1 | 0.59 ± 0.01 | 0.55 ± 0.01 | 0.68 ± 0.1 | 1.04 ± 0.1 |
| Fiber% | 0.15 ± 0.01 | 0.17 ± 0.01 | 0.13 ± 0.01 | 0.12 ± 0.01 | 0.18 ± 0.01 | 0.23 ± 0.1 |
| NFE% | 70.29 ± 0.3 | 72.71 ± 0.1 | 72.90 ± 0.01 | 73.12 ± 0.01 | 72.80 ± 0.16 | 71.89 ± 0.1 |
| Total caloric values% | 347.03 ± 0.01 | 348.39 ± 0.01 | 348.97 ± 0.01 | 349.07 ± 0.01 | 348.41 ± 0.01 | 346.67 ± 0.01 |

**Table 3:** proximate analysis of different wheat flour obtained from six different wheat kernels.

**ArW =**Argentine Soft Red winter Wheat**, GeW =**Germany Soft Red Wheat**, UkW** Ukrainian Hard Red Wheat, **AmW =**American Soft Red Winter Wheat, **AuW =**Australian Stander White Wheat, **ESW=**Egyptian soft White Wheat (gamaza 7).

| Wheat Flour | | | ArW | GeW | UkW | AmW | AuW | ESW |
|---|---|---|---|---|---|---|---|---|
| Starch damage % | | | 5.34 | 5.60 | 5.23 | 4.59 | 5.16 | 5.10 |
| Gluten quantity | Wet% | | 25.30 | 25.0 | 24.30 | 20.0 | 30.0 | 20.40 |
| | Dry% | | 8.10 | 8.0 | 7.77 | 6.40 | 9.60 | 6.52 |
| | Hydration ratio | | 2.12 | 2.13 | 2.08 | 2.13 | 2.13 | 2.12 |
| | Index% | | 93.40 | 92.60 | 90.70 | 83.50 | 93.30 | 80.10 |
| Protein sediment % | | | 27 | 33 | 30 | 15 | 40 | 16 |
| Falling Number Sec. | | | 442±1.0 | 360±1.0 | 436±1.0 | 383±1.0 | 430±1.0 | 154±1.0 |
| flour Colour % yellow | | White | 29.60 | 32.0 | 31.0 | 30.10 | 38.50 | 39.90 |
| | | 17.10 | 15.80 | 15.20 | 16.30 | 14.0 | 12.80 | |

**Table 4:** physicochemical properties of different wheat flour obtained from six different wheat kernels.

**ArW =**Argentine Soft Red winter Wheat**, GeW =**Germany Soft Red Wheat**, UkW** Ukrainian Hard Red Wheat,
**AmW =**American Soft Red Winter Wheat, **AuW =**Australian Stander White Wheat, **ESW=**Egyptian soft White Wheat (gamaza 7).

| Wheat Flour | | ArW | GeW | UkW | AmW | AuW | ESW |
|---|---|---|---|---|---|---|---|
| Farinograph test | Water absorption % | 57.0 | 57.50 | 56.50 | 49.50 | 55.60 | 57.50 |
| | Arrival Time min | 1.0 | 1.25 | 1.0 | 1.0 | 1.25 | 1.0 |
| | Dough stability Min | 4.0 | 5.50 | 3.0 | 2.50 | 18 | 2.50 |
| | Development time min | 2.50 | 2.0 | 1.50 | 2.0 | 3.0 | 1.50 |
| | Mixing tolerance index Brabender | 80 | 50 | 60 | 110 | 30 | 140 |
| | Dough weaking Brabender | 100 | 90 | 100 | 150 | 50 | 240 |
| | Softening Brabender | 60 | 60 | 70 | 90 | 20 | 170 |
| Alveograph test | Tenacity mm H2o (p) | 117 | 112 | 88 | 57 | 75 | 117 |
| | Expandability mm (L) | 73 | 73 | 55 | 63 | 116 | 73 |
| | Swelling ml (G) | 18.5 | 18.6 | 17.2 | 18.4 | 23.9 | 18.1 |
| | Baking strength Jol (w) | 295 | 260 | 156 | 116 | 233 | 295 |
| | Configuration rate % (P/L) | 1.60 | 1.67 | 1.60 | 0.90 | 0.64 | 1.60 |
| Mixolab test | Absorption | medium | medium | medium | low | medium | Medium |
| | Mixing | Low | medium | Low | low | medium | Low |
| | Gluten | very high | very high | high | medium | very high | Medium |
| | Viscosity | medium | high | high | very high | medium | Low |
| | Amylase | very high | high | very high | high | medium | Low |
| | Retrogradation | high | medium | high | high | high | Low |

**Table 5:** Rheological properties of different wheat flour obtained from six different wheat kernels.

**ArW =**Argentine Soft Red winter Wheat**, GeW =**Germany Soft Red Wheat**, UkW** Ukrainian Hard Red Wheat,
**AmW =**American Soft Red Winter Wheat, **AuW =**Australian Stander White Wheat, **ESW=**Egyptian soft White Wheat (gamaza 7).

value in all samples even American soft red winter wheat flour had low value and mixing had medium value in all samples instand of that the Egyptian soft white wheat flour, Ukrainian hard red wheat flour and American soft red winter wheat flour had low value for mixing. Table also showed the gluten ranged between very high and medium so Argentine soft red winter wheat flour, Germany hard red wheat flour and Australian stander white wheat flour was very high value while American soft red winter wheat flour and Egyptian soft white wheat flour were medium value .on the other hand viscosity were very high value for American soft red winter wheat flour while Egyptian soft white wheat flour was low value. Amylase enzyme activity is measured by viscosity tests. It is influenced by wheat growing conditions and malting at the mill and is most important in straight lean doughs, where it affects the amount of yeast fermentation D, Appolonia and Emeritus, (1996). For Mixolab test, results obtained from Table (5) and Fig (3) showed that the properties of wheat flour cultivars are highly different values between low and very high. Theses different are might to the amylase and gluten content. The result of amylase showed that Argentine soft red winter wheat flour and Ukrainian hard red wheat flour had the very high very value while Egyptian soft white wheat flour was low value on the other hand the retrogradation showed that Argentine soft red winter wheat flour, Ukrainian hard red wheat flour, American soft red winter wheat flour and Australian stander white wheat flour had the high value while the Egyptian soft white wheat flour was low value. from the previous result it can be concluded that high value of amylase helping bread to retrogradation with high value. Mixo lab is an effective and efficient device to be used for characterizing the wheat varieties. The obtained results allow a complete picture of the rheological characteristics of the studied varieties. The American soft red winter wheat flour is characterized by weaker water absorption. The Argentine Soft Red winter Wheat flour is strong varieties being characterized by long development times. The protein quality of the Argentine Soft Red winter Wheat variety is very good. The Germany hard red wheat flour is characterized by a strong gelling capacity and the Egyptian soft white wheat flour is characterized by a lower Retrogradation Banu., et al. (2009). This results agree with result obtained by Nagarajan, (2005). From obtained results of Table (5), it can be concluded that Argentine soft red winter wheat flour is very good quality and very strong wheat flowed by Australian stander white wheat flour which is balanced quality wheat while American soft red winter wheat flour is bad quality and poor quality wheat. Moreover can be addition that the Ukrainian hard red wheat flour is biscuit quality wheat.

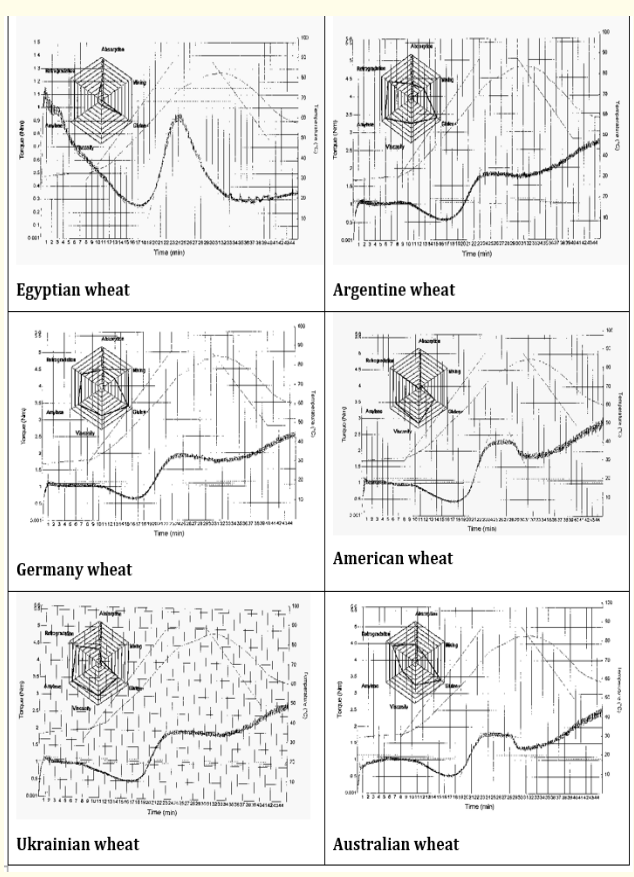


**Figure 3:** Mixolab Test.

## Conclusions

Data indicated that Australian and Argentine, flours had more suitable properties for bread- making than the American and Egyptian flours. From the different tested wheat flours indicated that those made from Australian wheat, and Argentine wheat flours were superior.

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