

Summary

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This investigation was carried out on some milling by - products of hard red winter wheat (*T.aestivum*) introduced from U.S. A . and obtained from EL-Hoda and EL-Marwa mills (North Cairo flour mills Co.) .

The physical and chemical characteristics of wheat kernels and wheat milling by - products in addition to flour streams, diagram flour grade 2, commercial flour grade 2, patent and 72 % flour extraction were studied. The rheological properties of some flour streams and of mixing exhaust or bran (in the percentages of 10, 20, 30 ,and 40 %) with wheat flour 72 % extraction rate, also, mixing bran flour (10 , 20 , 30 , and 40 %) with exhaust flour were studied. These blends were used to produce pan - bread which was organoliptically evaluated .

The physical properties : -

The physical properties of hard red winter wheat kernels (*T.aestivum*) indicate that hectoliter weights were 80.7 and 79.5 kg / HL while 1000 kernel weight were 37.2 and 28.69 for EL - Hoda and EL -Marwa mills . The difference in 1000 kernel weight could be due to the source and time of importing wheat kernels .

The chemical properties of wheat kernels and wheat by - products:-

Data concerning the chemical properties of wheat kernels and wheat by-products show that the kernels had 11.5 and 11.9 % moisture content . EL-Marwa kernels and it's by- products had higher ratios of moisture content which could be attributed to it's higher water absorption during conditioning.

Also, EL - Marwa Kernels ash content (1.99 %) was higher than that of EL - Hoda mill (1.68 %) . Coarse bran had highest ash content (5.82 and 6.05 %) comparing with other mill fractions while red dog had the lowest ash content (3.54 and 3.78 %) .

Crude protein content of hard red winter wheat kernels ranged between 11.99 to 12.36 % . EL- Hoda mill wheat germ had lower crude protein content (17.89 %) than that produced from EL- Marwa mill (25.06 %) which could be attributed to less purity and bran contamination .

Lipids content of wheat kernels ranged between (1.66 to 1.7 %) and wheat germ characterized by it's highest lipids content (11.33 — 11.67 %) . In general the results indicate that most of the lipids content are found in the germ and in the outer layers of kernel which produce shorts , coarse and fine bran .

Sugars content results showed that hard red winter wheat content 2.47 — 2.62% sugars while wheat milling by - products (fine and coarse bran , red and white dog and wheat germ characterized by it's high total soluble sugars content. High reducing sugars maybe due to longer conditioning time and humidity which increase the activity of alpha amylase. Also, high suagrs content could be attributed to the presence of alleurone cells and wheat germ particles.

phytate phosphorous content of wheat kernels ranged between 0.30 to 0.35 % while , wheat kernels by - products had higher phytate phosphorous content (0.91— 1.24 %) . High phytate phosphorous content could be attributed to the presence of alleurone cells and wheat germ particles. Also, there is positive relationship between ash and phytate phosphorous content .

The chemical composition of wheat flour grade 2 streams :-

Moisture contents of final flour of break stages and final flour of reduction streams ranged from 9.0 to 13.4 % and 12.9 to 14.8 % for EL-Hoda and EL- Marwa mill respectively while , the final product (72 % flour) moisture contents were 13.9 and 14.2 % for the same mills.

Ash contents of flour streams which mixed to make diagram flour grade 2 in both EL-Hoda and EL- Marwa mills ranged from 0.66 to 2.44% and 0.59 to 2.23% respectively . Ash content of these streams was higher than that of patent flour (0.45 and 0.46 %) and white flour 72 % extraction (0.50 and 0.53 %) .

The protein content of flour streams from EL-Hoda and EL- Marwa mills ranged from 9.24 to 14.26 % and 10.95 to 16.97% while patent flour had 9.63 and 10.74 % and flour 72 % extraction had 10.69 and 11.39 % protein content .

There is a positive relationship between protein and ash content for the same stream and also, a positive relationship between protein and gluten content of the same stream except the flour mill streams which contains nonglutenous protein from the aleurone layer cells.

Total lipids content for both EL-Hoda and EL- Marwa mills indicate that flour streams grade 2 had high values (4.33 - 3.66 %) and (1.33 -4.66 %) while patent and 72 % extraction flour had (1.33 - 1.06 %) and (1.33 %) respectively.

Flour streams which has less falling number was high in its ash content. Also, falling number reflects the alpha amylase activity. Exhaust flour had the highest alpha amylase activity than all other streams.

Bran and KLM flour characterized by its high reducing and total soluble sugars in addition to its high α - amylase (low falling number). Also, patent and 72 % flour characterized by its low non reducing and total sugars than that of other mill streams.

Results indicate that copper contents were relatively constant in spite of the difference in ash contents. Phosphorous, calcium and potassium forms the majority of minerals content of both flour and by - products.

The rheological properties of some milling streams:-

The farinograph characteristics of some milling streams:-

The farinogram of some milling streams obtained from EL-Hoda mill indicate that exhaust flour had the higher values for water absorption, dough stability and valorimeter value while its dough weakening was the lowest one. On the other side, patent flour had the lower rheological properties which may be due to its low protein (9.63 %) and gluten (26.9 %) content.

EL-Hoda diagram flour grade 2 had high dough stability and valorimeter value and low degree of softening than the commercial flour grade 2 which could be attributed to the protein and gluten quantity and quality.

Although commercial flour grade 2 contains higher gluten (39.2%) than diagram flour grad 2 (32.8 %) its rheological properties is lesser than that of diagram flour grade 2 . This may be due to that commercial flour consist bran flour and exhaust flour which the first distroys the glutenious matrix network and weakened the rheological properties .

Farinogram chracteristics of EL-Marwa milling streams:

The results show that diagram flour grad 2 with its low ash (1.02 %) and high gluten (37.4 %) content showed true dough strength . The dough of KLM flour had high degree of softening (100 B . U) and low valorimeter value (46) comparing with patent and 72 % extraction flour dough . Dough softening of KLM flour may be attributed to it's low gluten content (16.97 %). Alos, KLM flour high ash (2.23 %) content affect on its rheological properties.

II The extensograph of some flour streams obtained from EL -Hoda and

El- Marwa mills :-

Results show that diagram flour grad 2 had higher strength properties than that of the commercial flour grade 2 in both EL - Hoda and EL-Marwa mills . High strength properties could be due to the quantity and quality of its high gluten content . Exhaust flour had the highest dough strength (area 305 cm²) and extensibility (277 mm) and the lowest proportional number.

Bran and KLM flours obtained from the two mills had the lowest area than other flours which may be attributed to less gluten contents (5.04 and 12.44 %).

Effect of blending some milling by - products :-

Investigation was conducted to evaluate the rheological and organoleptic properties of mixing exhaust or bran flour (in the percentage of 10 , 20 , 30 , and 40 %) with wheat flour 72 % extraction rate produced from EL - Hoda mill . Also , mixing bran flour (10 , 20 , 30 , and 40 %) with exhaust flour . These blends were used to produce pan- bread .

The rheological characteristics of mixing exhaust flour with 72 % extraction rate flour :-

The farinograph test results indicate that water absorption ratio, dough development time , stability and valorimeter values were gradually increased by increasing exhaust flour ratios in the blends. On the other side , dough weakening were decreased as mixed exhaust flour ratio increased. Results indicate that addition of exhaust flour improved the dough due to its high gluten quality and quantity (46 %) .

Extensograph test results showed that dough strength (area) , peak height and extensibility were gradually increased as the added exhaust flour ratio increased . Also, resistance to extension showed increment in its value specially in the blend which contains 40 % exhaust flour .

The rheological characteristics of mixing bran flour with wheat flour 72% extraction rate :-

Farinograph test indicate that water absorption ratio slightly increased as bran flour ratio increased . Mixing bran flour at ratios of 10 and 20 % with wheat flour 72 % show that dough stability and valorimeter values decreased while softening values increased.

On the other side mixing bran flour at ratios 30 and 40 % show increment in dough stability and valorimeter values while degree of softening increased. Such trend could be due to high water absorption of hemicellulose (pentosane) content of bran flour and to its particle effect on gluten shearing .

Extensograph test proved that dough extensibility , resisittance to extension, proportional number and strength values were decreased as the added bran flour ratio increased . Bran flour addition weakened the dough strength due to it's low gluten content inspite of its high protein content .

The rheological characteristics of mixing bran flour with exhaust flour :

Farinograph test showed that as mixed bran flour ratio increased. water absorption ratio, dough arrival time , development time, stability and valorimeter values were decreased while softening was increased . Also, bran flour addition weaken the dough due to gluten dilution beside bran particles effect on gluten shearing .

All of the extensograph parameters were gradually decreased as the added bran flour ratios increased . Therefore , addition of bran flour to exhaust flour weakened dough strength due to its low gluten content .

The organoleptic evaluation of pan - bread :-

A- Pan bread produced from wheat flour 72 %and exhaust flour :

Sensory evaluation showed that pan bread produced from blend containing 10 % exhaust flour had highest weight, volume, specific volume and score comparing with control and other blends.

B- Pan bread produced from flour 72 % and bran flour :

It is obvious that the suitable blend to produce pan bread was 90 % wheat flour and 10 % bran flour . It had high specific volume and total bread score comparing with other bread blends but lesser than 100 % wheat flour .

C- Pan bread produced from exhaust flour and bran flour :

The results indicate that increasing bran flour percentage increased pan bread weight while, volume and total score decreased. pan bread which contains 10 % bran flour is preferred than others (20 , 30 and 40 % bran flour) due to its moderate amount of bran flour .
