summary

S U M M A R Y

Different wheat varieties which import for various baking industries were subjected to different analysis. Two main species of wheat T. aestivum and T. durum and their varieties C.W.R.S. three degree, Australian , Canadian Amber 3 degree and the Egyptian durum stork's were chosen for studying the different factors affecting pasta industry in Egypt. Although semolina imported by private sector,(Capri, Roma, Buitoni..) were subjected to the same analysis. Results concerning the following items:

1- Physical and chemical properties of wheat kernels flour and semolina.
2- Conditioning lying time.
3- Pasta browning
4- Pasta quality.

were discussed in detailes:

Results could be summerize as follows:

I- Physical and chemical characteristics of wheat flour and pasta:

I.1. Physical characteristics of different wheat varieties:

Results showed that Egyptian durum storks showed higher values for hectoliter weight (81.1 Kg/HL)and 1000 kernel weight (53.75 g) than that other hard wheat varieties.

Canadian Amber grade 3 characterized by the highest vitreous percentage (79.70%) followed by Egyptian stork's (65.33%), while Australian soft wheat are without vitreous and has the highest hectoliter weight (84.0 Kg/HL).

I.2. Chemical constituents of wheat kernels, flour and pasta:

Egyptian stork's flour had the higher moisture content (15.8%) which may be due to its higher water absorption during conditioning, while imported semolina moisture content was ranged between 11.8% and 12.0%.

Imported semolina contained lower quantities of ash than local durum. Egyptian stork's flour ash content is higher than aestivum varieties wheat flour. High ash content has negative effect on the colour of the produced macaroni.

Crude fiber ranged between 2.0-2.6% in the different wheat varieties. Stork's vitreous kernels showed the highest fiber content (2.6%) while Australian soft wheat had the lowest (2.0%). Pasta quality are affected by ash content and bran contamination.

Durum wheats contained higher protein content than aestivium wheats. Stork's vitreous kernels had higher protein content than starchy. The Egyptian durum wheat stork's had 14.85% protein which was higher than T. aestivum

(13.60 and 8.84 for C.W.R.S. and Australian) and was lower than canadian durum wheat (15.69%). The gluten content have good relation with total protein, canadian west red spring wheat showed the highest wet and dry gluten content (48.80 and 16.72%).

The Australian flour had the lowest wet and dry gluten (25.0 and 10.0%). In general dry gluten followed the wet gluten up and down, stork's vitreous flour showed more gluten content than starchy flour. Cooking quality is related to protein content, it improves with increasing protein content. So, patent flour from low protein , australian wheat was not suitable for pasta production.

Soluble protein fraction (alb. + glob.) shows slightly difference between different varieties and ranged between 13.49% and 15.61%. Gliadins represent the major proportion of protein fractions for flour and semolina. Glutelins contents of flour were independent of the total protein content but differ among cultivars. T. aestivum wheat kernels had higher starch content than durum varieties. Stork's starchy kernels showed higher starch content (64.6%) than vitreous kernels (56.9%). The alpha-amylase activity for the extracted flours showed the same trend of the whole wheat kernels. Semolina alpha-amylase was 13.39, 15.50 and 16.40 for Roma, Buitoni and Capri which was lower than stork's (22.00).

The australian soft wheat and extracted flour had the lowest percentage of crude lipids (1.97 and 1.12%). The whole wheat kernels had higher crude lipids content than the extracted flour or semolina because of the higher lipids content of the germ and bran.

The pigment content of T. aestivum varieties was lower than that of T. durum. Pigments content of Egyptian durum flour (7.1 p p m) have the same trend of the imported semolina (between 6.70 and 7.4 p p m).

II- Effect of conditioning lying time:

The effect of conditioning lying time (1,5,12,18 and 24 hrs.) on the extraction rate, chemical composition and rheological properties was studied.

II.1. Effect of conditioning lying time on T. durum stork's:

Increasing lying time showed a slight decrease in extraction rate (72.09 to 71.78) ash content (from 1.00 to 0.88%), non-reducing sugars (from 1.75 to 0.98%), pigment content (from 7.1 tc 6.4 p p m), and lipids content (from 2.4 to 1.32%). In the same time moisture content and reducing sugars increased from (12.9 to 14.2%) and (0.38 to 1.24%) respectively. Also, increasing conditioning lying time activate different hydrolysing enzymes. Alpha-amylase activity increased in both wheat kernels (from 13.27 to 32.00) and flour (from 11.75 to 16.57),non-protein

nitrogen increased from 0.156 to 0.305% due to increasing proteases activity. The rheological properties of dough showed that dough development (1.75 min) arrival (0.5 min) and stability (5.1 min) were higher in the sample conditioned for 5 h Water absorption (60.87%) and weakening of dough (75 B.u) showed its lowest value after 5 h conditioning lying time. Therefore 5 h conditioning lying time is preffered for Egyptian stork's yield pasta of good quality.

II.2. Effect of conditioning lying time on T. aestivium (Australian wheat):

Conditioning lying time affected on the chemical constituents of wheat kernels and flour. Flour yield and ash content decreased (from 74.27 to 72.78%) and (from 0.77 to 0.51%) respectively, while moisture content increased (from 13.9 to 14.3%) by increasing lying time. Also a positive relation between browning, alpha amylase activity and non-protein nitrogen was observed. Pigment amount showed a relation between pigment content and the extraction rate

The rheological properties of the dough showed that water absorption was low (57.0%) and dough stability was high (4.7 min) at 12 h lying time. The mixing time and arrival time increased gradually by increasing conditioning lying time which indicate that T. aestivium contains stronger gluten content than T. durum. Results showed that 12 h

conditioning lying time is suitable for australian T. aestivium.

III- Pasta browning:

The obtained results showed that T. durum stork's pasta was brown and had the highest grade colour value (10.6) while pasta processed from imported semolina, Roma, Capri and Buitoni was yellow and had the lowest colour (3.5 , 3.6 and 3.3). T. aestivum pasta, Amoun and Mataria had brown and bale brown colour and lesser grade values than stork's. (8.4 and 4.1). Brownness in macaroni was attributed to varietal, bran contamination, enzymatic and non - enzymatic reactions. Both of these factors were discussed. T. durum stork's pasta had the highest pigment loss during processing '51.41%), while Roma, capri and Buitoni had the lowest loss (22.24, 14.57 and 23.0%). Spaghetti processed from T. aestivum had 35.12% and 37.69% pigment has loss for Amoun and Mataria respectively.

Due to Stork's highest pigment loss during processing, stork's spaghetti had the lowest pigment content (3.45 p p m.) comparing with other durum spaghetties. The obtained results showed that lipoxidase activity is higher in Egyptian durum stork's than that of the imported semolina. Also, a positive correlation between pigment loss percentage and brownness during pasta processing was observed.

IV- Pasta quality:

Results of the reheological properteis showed that the semolina samples had the lowest water absorption value (between 50,o and 50,9%) and its dough development time (D.D.T.) was higher than other flour samples. Stork's D.D.T. was the lowest one (1,2 min), which is due to its weaker gluten content.

Semolina and stork's showed short periods of dough stability (between 2.0 and 2.4 min), while Amoun had the highest dough stability (6.7 min). Stork's had the highest dough weakening while Amoun had the lowest one. Weaking of the dough is very important factor affecting its suitability for macaroni production.

The cooking quality of different commercial macaroni samples were examined. Results showed that water absorption increasing of weight and swelling index for pasta processed from T. aestivium were lower than those from T. durum. The cooking loss showed a reverse correlation with water absorption. Therefore, samples with lowest amount of cooking loss, high protein content, slight weaking of gluten properties and high percentage weight and volume after cooking were of good cooking quality.

To improve pasta quality ascorbic acid and wheat germ flour were added to pasta dough with different concentrations. Ascorbic acid was added in concentration of 50,

100 and 1000 p p m Results showed that ascorbic acid has a superior effect for preventing pigment loss and decrease browning reaction during pasta processing. Ascorbic acid was more effective in preventing pigment loss of stork's pasta than australian wheat pasta due to the high pigment content of the former (5.8 p p m) than the later (2.85 p.p.m.). Pasta colour appearance showed a yellow colour at 100 and 1000 p p m addition. Addition of wheat germ (0.1, 1.0 and 10.0%) showed that stork's pasta had higher improvement in pigment loss and pasta browning than aestivium pasta. Addition of 1.0%wheat germ to aestivium pasta yields a yellow colour appearance of pasta, while 0.1 % addition to stork's pasta yields the same colour appearance.

To avoid wheat germ addition disadvantage (dough weakness) ascorbic acid (50 and 100 p p m) was added to pasta dough containing wheat germ processed (0.1%). The cooking quality of mixed wheat germ and ascorbic acid addition yielded pasta with better quality, specially when wheat germ 0.1% and ascorbic acid 100 p p m were added to the pasta dough.

V- High fiber bread:

To produce high fiber bread characterized with minimum phytate phosphorous and moderate protein content, the chemical constituents of commercial bread and low calories bread were studied. Also the distribution of phytate,fiber

and ash of red and white kernels and their milling products were subjected to different analysis. Results showed that most of the phytate was found in the germ and course bran. The ratio between phytate and fiber were higher in red wheat fine bran and shorts (12.25 and 15.43%) than white fine bran and shorts (11.35 and 12.42%). White wheat shorts was chosen as a source of low phytate phosphorous and high fiber content (0.77 and 6.20%). Also white wheat shorts have ability for eating than coarse and fine bran.

Factors affecting phytate hydrolysis (toasting , incubation, and yeast addition) were studied. Phytate phosphorous loss increased by increasing incubation time. The highest loss was obtained after 3 hrs by using tap water at 40°C for white wheat shorts (91.6%).and 4 h at 40°C for red wheat shorts (71.9%).Also shorts incubation before mixing with flour and other dough ingredients gave good results of phytate loss, in addition to dough strength preservation.

Toast treatment reduces phytate phosphorous content specially at low shorts adding concentration (not exceed 25%). At high shorts addition concentration (more than 25%) phytate destruction was very slow which indicate that toasting had a limited affect on phytate destruction rates.

Addition of yeast to shorts before incubation,have the lowest value of phytate destruction due to hindering effect of added yeast on phytase activity.

Also, incubation of shorts for 2 hrs before yeast addition have the highest value of phytate destruction (93.14%). Addition of ascorbic acid (100 p p m) has no effect on phytase activity, and phytate loss showed the same percentage (25.27%) like the former treatment which produced bread with non incubated shorts.

The rheological properties of mixing shorts (15, 25 and 40%) with wheat flour were studied. Absorption ratio, dough development time, arrival time, stability and valorimeter values were increased by increasing shorts percentages, while dough weaking was decreased and showed a negative relationship with added shorts percentage.

Extensograph results showed that shorts addition weaked dough strength and hence it is expected to produce bread of smaller volume than that of 100% wheat flour. High fiber bread with 25% shorts is preffered than others (15 and 40%) due to its moderate amount of fiber 11.18% Also its extensigram showed that high shorts addition weakened dough strength and produced smaller volume bread.