SUMMARY AND CONCLUSION

This study was carried out to evaluate the supplementation of wheat flour (72% extraction), with full-fat and defatted sunflower flour, for producing pan bread and sponge cake. Two varieties of sunflower seeds, cultivated in Egypt, Balady (Dahr-El-Haea) and Miak, were used for this study. Portions of sunflower flour supplementation from each variety were: 0 (Control), 5, 10, 15, and 20%.

The results obtained could be summarized as follows:

A) Physical properties:

Miak and Balady whole seeds, respectively contained 102.40 and 92.42g weight; 161 and 182ml valume and 0.64 and 0.51 g/ml specific gravity. The kernels of two varieties contained, 78.13 and 52.72g, weight; 38 and 46ml. volume and 2.06 and 1.15g/ml specific gravity. The hulls contained, 24.09 and 39.73 g weight; 21 and 23 ml volume and 1.14 and 1.73 g/ml specific gravity (per 1000 seeds).

B) Chemical composition:

Miak and Balady whole seeds; respectively contained 5.90 and 6.10% moisture, 19.30 and 22.70% protein; 41.49 and 32.82% ether extract; 14.09 and 5.99% carbohydrates; 7.23 and 8.64% ash and 20.99 and 23.75% fibers.

The kernels of the two varieties contained 5.23 and 6.32% moisture; 26.75 and 31.88% protein; 51.61 and 43.22% ether extract; 3.22 and 4.13% carbohydrates; 4.15 and 4.53% ash and 9.04 and 9.92% fibers.

The hulls contained 6.41 and 6.71% moisture; 2.84 and 3.05% protein, 2.43 and 1.87% ether extract; 21.94 and 17.09% carbohydrates; 2.37 and 2.96% ash and 64.01 and 67.82% fibers.

Full fat and defatted Miak sunflower flour contained 5.23 and 6.49% moisture; 26.75 and 53.85% protein; 51.61 and 1.78% ether extract; 3.22 and 24.47% carbohydrates; 4.15 and 8.19% ash and 9.04 and 5.22% fibers.

Full fat and defatted Balady sunflower flour contained 6.32 and 6.84% moisture; 31.88 and 57.71% protein; 43.22 and 1.14% ether extract; 4.13 and 19.63% carbohydrates; 4.53 and 8.75% ash and 9.92 and 5.93% fibers.

C) Protein digestibility of wheat flour was 79.84%. Miak and Balady full-fat sunflower flour was 92.61 and 93.40%, while defatted flour was 96.50 and 97.90%, respectively.

D) Supplementation of wheat flour with full-fat or defatted sunflower flour of the two varieties increased protein, lipids, ash and fibers while carbohydrate contents decreased.

E) The effect of supplementation on the rheological properties was determined by the Farinograph and Extensograph.

Farinograph data:

1. **Water absorption:**

Supplementation with 5, 10, 15, and 20% Miak full-fat sunflower flour decreased water absorption than the control (53.7, 53.6, 53.5 and 53.3% respectively), but was 55.5% in control. In case defatted sunflower blends, water absorption increased (57.8, 58.0, 58.4 and 58.6% respectively).

2. **Dough development time:**

Developing time of supplementation with 5 and 10% full-fat sunflower flour was longer than the control, while the levels of 15 and 20% gaves longer developing time than the

control, but still lower than 5and 10% levels (Miak full-fat blends gave 4.45, 4.45, 3.45 and 3.30 min., while Miak defatted blends gaves 6.00, 5.45, 4.45 and 4.30 min for 5, 10, 15 and 20% respectively, but was (2.00 min) in control.

3. Dough stability:

Supplementation with 5% Miak full-fat sunflower flour showed higher stability than the control (4.00 min for 5% and 1.30 min for the control). As the level of blending increased to 10, 15 and 20% the stability decreased 3.00, 2.30 and 2.30 min, respectively, but still higher than the control.

4. Weakening of dough:

Supplementation with 5, 10, 15 and 20% Miak full fat increased the weakening of blended doughs than that of the control (100, 110, 110 and 120 B.U.), respectively, but was 40 B.U. in control. Miak defatted blends gave (120, 120, 120 and 140 B.U.), respectively.

Farinoghraph data of Balady sunflower flour blends with wheat flour behaved nearly in the same trend as in Miak variety with small differences in water absorption., dough development time, dough stability and its weakening.

Extensograph data:

1. Extensibility:

Supplementation with 15 and 20% Miak full-fat gave higher extensibility (160 and 154 mm) than that of control (150 mm), also, Miak defatted gave higher extensibility (161 and 155 mm), respectively.

2. Resistance to extension:

Supplemnation with 5, 10, 15 and 20% Miak full-fat sunflower flour decreased the resistance to extension (460, 350, 215 and 116 B.U.), while in defatted blends was (340, 265, 180 and 170 B.U.), respectively but in control was (470 B.U.).

3. Proportional number:

Supplemnation with 5, 10, 15 and 20% Miak full-fat sunflower flour decreased the proportion number (3.24, 2.32, 1.34 and 1.19), also, Miak defatted blends decreased (2.54, 2.09, 1.12 and 1.09), respectively but in control was (3.1).

4. Energy:

The area under the extensogram decreased gradually as the level of blending increased (71.4, 58.8, 45.4 and 34.4 cm^2 for 5, 10, 15 and 20% level of Miak full-fat blends, while in defatted was (47.3, 39.2, 37.2 and 28.8 cm^2, respectively, but in control was (76.0 cm^2).

Extensograph data of supplementation with Balady full-fat and defatted flours behaved nearly in the same trend as in Miak variety with small differences in extensibility, resistance to extension, proportional number and energy.

F) Physical properties of pan bread and sponge cake:

Supplementation of sunflower flour to wheat flour resulted in an increase of all the weights (158.54, 162.43, 168.31 and 171.65g) and (156.23, 159.82, 162.63 and 166.65g) for pan bread made of 5, 10, 15 and 20% Miak full-fat and defatted blends, respectively. But the weight in control was (152.41g).

The volume gaves 525 cm^3 in control, 555, 640, 510 and 495 cm^3 in 5, 10, 15 and 20% level of Miak full-fat blends, while in defatted was 540, 535, 440 and 425 cm^3, respectively.

The effect of adding full-fat and defatted sunflower flour to wheat flour on the physical properties of sponge cake it behaved nearly in the same trend in pan bread with small variations.

G) Chemical composition of pan bread and sponge cake:

Supplementation of wheat flour (72%) with full-fat and defatted sunflower flour of the two varieties increased protein, ether extract, ash and fibers, while carbohydrate contents decreased in both pan bread and sponge cake.

In case of defatted supplementation, protein content increased at higher level in the different blendiang ratios than in full-fat counterparts.

H) Protein digestability of pan bread of the control was (77.6%). Pan bread made of Miak full-fat and defatted blends at 5, 10, 15 and 20% increased respectively, (81.40, 82.30, 83.50 and 84.92% - 82.70, 83.93, 85.30 and 87.60%).

Protein digestibility of sponge cake made of wheat sunflower flours blends increased as the supplementation increased. These increase was more pronounced in the blends of defatted sunflower flour.

Generally, the protein digestibility of sponge cake was higher than it of pan bread.

I) Sensory evaluation of pan bread and sponge cake:

The most suitable additive level in baking good quality pan bread was up to 15% in Miak full-fat blends, while it was

up to 10% in Balady full-fat blends. But in defatted flour blends it was found to be 10% for both Miak and Balady.

In cake production the treatment of 5% addition level gave the most superior product in case of full-fat or defatted flour in both varieties.

J) Effect of adding full-fat and defatted sunflower flour to wheat flour on (A.W.R.C.) of pan bread and sponge cake.

The presence of oil (51.61 and 43.22%) in Miak and Balady full-fat sunflower flour gave the highest improving effect in pan bread and sponge cake, especially in retardation of staling process. Oil resulted in elongation of freshness period of baked products without deterioration. Miak variety had the superioriety in oil and phosphorus, thus it gave more fresh products than the Balady variety (501.25 for 6 hrs, 511.80 for 12 hrs and 512.30 for 24hrs). of levels 5, 10, 15 and 20% respectively. But in Balady full-fat blends were (497.00 for 6 hrs, 510.3 for 12 hrs and 509.6 for 24 hrs) of levels 10, 15 and 20% respectively.

Finally, it should be mentioned that the most suitable percent for blending sunflower flour (full-fat or defatted) with wheat flour for production of pan bread or sponge cake was found to be at 5% level in both Miak and Balady varieties.

But, full-fat sunflower blends may be used up to 15% level in Miak, and 10% in Balady. While, defatted sunflower blends may be used up to 10% in both Miak and Balady varieties.

Generally, Miak variety gave more fresh products than Balady variety.