

Summary and Conclusion

Production of some high dietary fiber, low sodium baking products .

First: Utilization of food processing units by-products for producing high fiber content bakery products. So, the following points were studied:

- 1- Each guava seeds and sugar-beet by-products were used through this study. The used materials were prepared through washing, autoclaving, drying and finally milled for obtaining fine powder, then part of it was used as it's as fiber-rich by-product, and the other one was used for extracting dietary fiber.
- 2- Both guava seeds powder and sugar beet by-product was tested to detect aflatoxins as a secondary metabolites for fungi growth.
- 3- By-products or its extracted dietary fiber were added to wheat flour (hard or soft) and used for manufacture pan bread and biscuits to produce high fiber content products.
- 4- Each used material or its extracted dietary fiber was chemically analyzed for protein, ash. Ether extract, crude fiber, total carbohydrates and dietary fiber.
- 5- Rheological properties of produced doughs were evaluated using farinograph, extensograph, amylograph, zymotachygraph and falling number test.

6- Hard wheat flour was partially replaced using 5, 10, 15% of fiber-rich by-products or 3, 6, 9% of its extracted dietary fiber, then pan bread was produced. Chemical composition, baking quality and organoleptic tests were determined to evaluate the produced bread.

7- Soft wheat flour was also replaced using the above-mentioned materials and high fiber content biscuits was produced and evaluated through its chemical composition, organoleptic properties and baking quality.

Second: Reduce sodium content of bakery products. The following points were studied:

1- Na, K, and Ca content of both hard and soft flours were determined.

2- Pan bread doughs usually contain 2% NaCl – So, for reducing Na content in pan bread, NaCl was gradually reduced as follow: 2, 1.5, 1, finally 0.5%.

3- Effect of NaCl reduction was studied through, rheological properties of doughs using farinograph, extensograph, amylograph, Zymotachygraph and falling number test.

4- NaCl was partially replaced using KCl or CaCl_2 . The replacing procedure was as follows:

a- 0.5% KCl or CaCl_2 + 1.5% NaCl.

b- 1% KCl or CaCl_2 + 1% NaCl.

c- 1.5 KCl or CaCl_2 + 0.5% NaCl.

d- 2% KCl or CaCl_2 .

- 5- Effect of NaCl replacement using KCl or CaCl_2 was studied through evaluating rheological properties of doughs using farinograph, extensograph, amylograph, zymotachygraph and falling number test.
- 6- Low sodium content pan bread was produced through replacement of NaCl with KCl or CaCl_2 according to the above-mentioned procedure and the bread was evaluated through evaluating baking quality and organoleptic properties of bread.
- 7- Sodium chloride was reduced in biscuit doughs as follows: (1, 0.75, 0.50, 0.25 and 0.0%) and the effect of the reduction was studied through rheological properties using farinograph, extensograph, amylograph, zymotachygraph and falling number test.
- 8- NaCl was replaced with KCl or CaCl_2 according to the following procedure:
- a- 0.25% KCl or CaCl_2 + 0.75% NaCl.
 - b- 0.50% KCl or CaCl_2 + 0.50% NaCl.
 - c- 0.25% KCl or CaCl_2 + 0.75% NaCl.
 - d- 1% KCl or CaCl_2 .
- 9- The effect of replacing of NaCl using KCl or CaCl_2 was evaluated through rheological properties determination using farinograph, extensograph, amylograph, zymotachygraph and falling number test.

- 10- Low sodium content biscuit was produced according to the above-mentioned procedure and the produced biscuit was evaluated through determination its baking quality and organoleptic properties.

The obtained results showed that:

First: Effect of using fiber-rich by-products or its extracted dietary fiber on the rheological, physical, chemical and organoleptic properties of produced bread and biscuit. As obtained results revealed:

- 1- Aflatoxins was not detected regarding all tested material (wheat flour, guava seeds, sugar beet by-product and its extracted dietary fiber).
- 2- As chemical composition revealed, hard wheat flour had higher content of protein, ether extract, ash, crude fiber and dietary fiber, than soft wheat flour. Regarding the chemical composition of by-products or its extracted dietary fiber guava seeds had higher content of crude fiber and dietary fiber.
- 3- As rheological properties tested using farinograph, hard wheat flour dough had higher water absorption, dough development time, and stability than that of soft wheat flour. Dough containing by-products or its extracted dietary fiber had higher water absorption, lower stability than that of control sample.
- 4- As revealed by extensograph test, hard wheat flour dough had higher extensibility, resistance to extension, and energy than that of soft wheat flour dough. As by-products or its extracted dietary fiber increased, extensibility decreased, but resistance to

extension increased. The same trend was observed in hard and soft wheat flour.

- 5- According to zymotachygraph results total and retained gas decreased as by-products or its extracted dietary fiber increased. The same trend was observed in both hard and soft wheat flour dough.
- 6- As rheological properties evaluated using Amylograph test, the maximum viscosity decreased as dietary fiber increased in doughs. The same trend was detected in both hard and soft wheat flour.
- 7- As falling number test revealed, falling number decreased as by-products or its extracted dietary fiber increased. The same trend observed in both hard and soft wheat flour dough.
- 8- As chemical composition of the final products revealed, ash, crude fiber and dietary fiber increased as guava seeds or sugar beet by-products or its extracted dietary fiber increased.
- 9- Baking quality and organoleptic properties decreased as by-products or its extracted dietary fiber increased. The same trend was observed in both bread and biscuit. Pan bread containing dietary fiber had lower volume and higher weight, while biscuit containing dietary fiber had lower volume and spread ratio than that of control one.

As mentioned before, as fiber increased bread and biscuit quality decreased. The by-products could be added to wheat flour up to 5% and extracted dietary fiber up to 3% to produce acceptable bread or biscuit.

Second: Effect of replacement of NaCl with KCl or CaCl₂ on pan bread or biscuit quality. The obtained results revealed that:

- 1- Hard wheat flour had higher content of Na, K, and Ca than that of soft wheat flour.
- 2- As recorded by farinograph test, water absorption decreased as salt level increased and stability increased regardless of salt or flour type.
- 3- According to extensograph test, extensibility decreased and resistance to extension increased as a result of the presence of salt regardless of salt type and the replacement of NaCl with KCl or CaCl₂ had no clear effect. The same trend was observed regarding soft and hard wheat flour.
- 4- As recorded by zymotachygraph test, total and retained gas decreased, as salt level increased. The replacement of NaCl by KCl or CaCl₂ had no clear effect. The same trend was observed concerning hard and soft wheat flour.
- 5- Regarding amylograph test, as salt level increased, maximum viscosity decreased regardless of salt type or replacing ratio.
- 6- Falling number test revealed that falling number decreased as salt level increased. The same trend was observed in both hard and soft wheat flour.
- 7- As replacement ratio increased, the replace mineral content increased in the final product as revealed through mineral content determination.

8- Baking quality and organoleptic properties tests revealed that there was no clear difference as a result of partially replacement of NaCl or CaCl₂, but used CaCl₂ or KCl instead of NaCl caused clear adverse affect of the final product concerning baking quality or sensory evaluation. As mentioned before it could be concluded that:

- 1- Guava seeds powder, sugar beet by-products and its extracted dietary fiber are suitable for high fiber bread or biscuit regarding aflatoxins test. Additional to recycling of by-products of food processing units is desirable trend regarding environmental pollution.
- 2- Guava seeds or sugar beet by-products can use up to (5% flour weight basis) and its extracted dietary fiber can use up to 3%.
- 3- NaCl can replace using KCl or CaCl₂ up to 50% for producing low sodium bread or biscuit regarding sensory evaluation and baking quality of the final products.