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Study of the Nutritional Composition of Three Types of Bread from a Local Tunisian Bakery and an Assessment of Their Postprandial Glucose, Insulin, and Metabolic Responses and Glycemic Indexes in Healthy Subjects

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INTRODUCTION & AIMS

The Mediterranean diet is renowned for its diverse food options and numerous health benefits. Primarily based on vegetables and carbohydrate-rich foods, many studies have focused on exploring its health impacts and its connection to various diseases for better management. Bread, a dietary staple for millennia, is a key source of carbohydrates in the mediterranean diet which make up 50 to 55% of a well-balanced diet. Understanding the nutritional composition and the glycemic impact of different types of bread is crucial for optimizing dietary choices.

This study aimed to determine the metabolic responses and glycemic indexes (GI) values of three types of bread from a local bakery in Tunisia.

MATERIEL & METHODS

Four types of bread were purchased from a local bakery in Tunisia on different occasions. Samples were prepared following the AOAC 14.091 method. The composition of the bread samples was determined using the Bruker MPA II analyzer (Bruker Optics, Germany), employing Fourier-Transform Near Infrared Spectroscopy (FT-NIR) The data were processed using OPUS software.

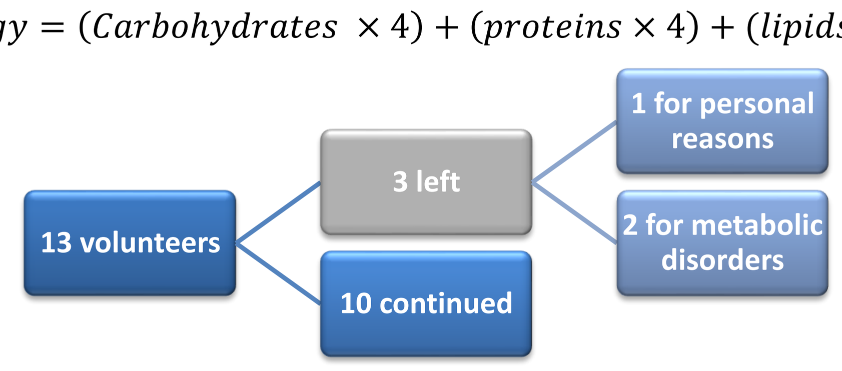
$$Total\ moisture = (intial\ weight\ - dry\ weight) + NIR\ moisture$$

$$Total\ carbohydrates = 100\%\ - (protein + lipids + ash + moisture)$$

$$Assimilable\ carbohydrates = Total\ carbohydrates - fibers$$

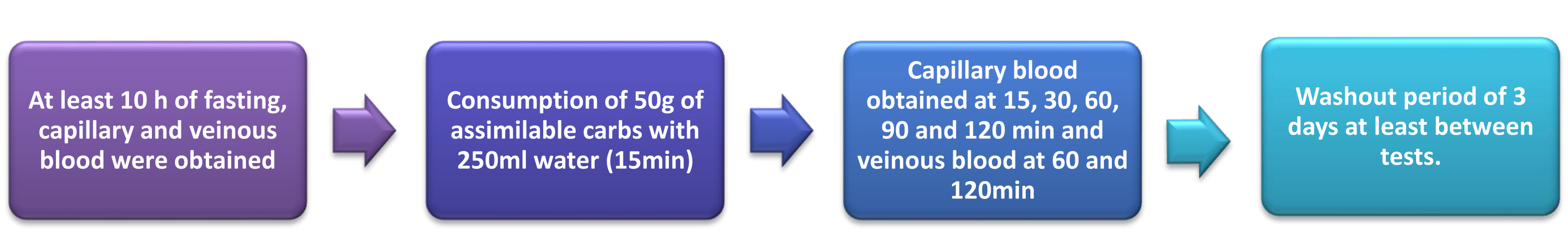
$$Energy = (Carbohydrates\ \times 4) + (proteins \times 4) + (lipids\ \times 9)$$

Study



Each participant was fully informed of the study's protocol and signed consent was obtained. A baseline blood test, height, and bioimpedance measurements were taken for each.

For glycemic index determination protocol, general instructions from ISO 26642:2010(en) and Brouns and al (2005) were followed.



The Area under the Curve (AUC) of glucose was calculated for each bread test as the area beneath the curve and above the fasting level from 0 to 120 min using GraphPad Prism 7.04 for Windows (GraphPad Software, Inc., San Diego, CA, USA).

Glycemic index of different breads was calculated according to the formula:

$$GI\% = \frac{\text{Incremental Area under glucose curve for test bread}}{Incremental\ Area\ under\ glucose\ curve\ for\ reference\ (white\ bread)} \times 100$$

The conversion from white bread reference to glucose reference :

$$GIglucose\ reference = \frac{GI\ tested\ bread\ with\ white\ bread\ reference\ \times 70}{100}$$

Significance testing was performed using Graph Pad Prism 7.04 for Windows. Differences were considered significant with $p < 0.05$ for t-tests. All values are given as the means ± SE if not otherwise stated.

RESULTS & DISCUSSION

The results of different bread compositions is presented in **figure 1**.

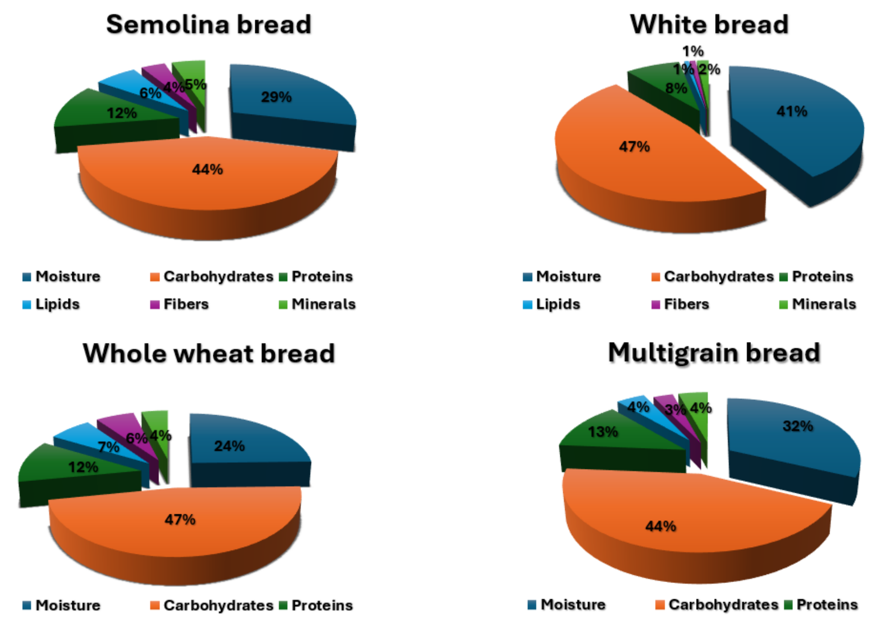


Figure 1: Nutritional values of different bread types

The results of our study differed from what was reported by Bourrée and al for whole bread in France. Tunisian whole wheat bread contained more minerals (2 times) , lipids (7 times) and proteins (plus 30%) but less fibers. Nevertheless, findings were like Bourrée and collaborator for multigrain bread nutritional values

Published Australian study by Edmen demonstrated the difference of 1.5 times less of proteins and fibers in semolina bread and 6 times less lipids compared to Tunisian Semolina bread.

An Austrian study published in 2018 presented similar findings to our study for white bread composition but not for white bread in France du to use of different types of flours (T55 for Baguette vs T80 for Tunisian bread).

The average fasting blood glucose level measured throughout the study was 0.85 ± 0.1 g/l. The graph below (Figure 2) illustrates the mean glycemic responses for each type of bread studied, along with the standard deviation. No statistically significant difference (p>0.05) was found between reference bread and studied breads.

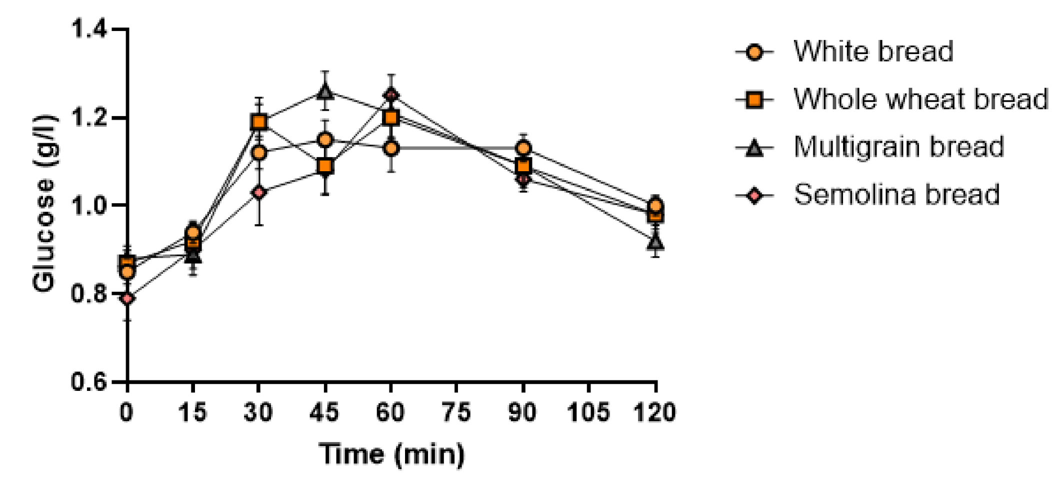


Figure 2: Glycemic response to different types of bread

The highest mean area under the curve was observed with semolina bread (33.17 ± 16.68 g/l), which even surpassed that of the reference bread (29.97 ± 9.52 g/l). The smallest mean area under the curve was recorded with cereal bread (24.34 ± 9.65 g/l).

Plasma glucose peaks were recorded between 45 and 60 minutes after the consumption of the test breads and then gradually decreased (**figure 2**).

Glycemic index (GI) was calculated individually for every type of bread and then calculated for the study population with white bread as reference then glucose (**table 1**) .

Table 1: Glycemic index of different types of bread

	White bread	Whole wheat bread	Multigrain bread	Semolina bread
Glycemic index [%] (white bread reference)	100	91,99 ± 34.08	89,22 ± 37,25	132,14 ± 71,91
Glycemic index [%] (glucose reference)	-	64,39	62,5	92,5

Our results are close to those published in the International Glycemic Index Table in 2002 for whole wheat bread and cereal bread, but not for semolina bread.

No significant changes were observed in uric acid, triglycerides, total cholesterol, HDL-cholesterol, or LDL-cholesterol for any bread type (p>0.05) between T0, T60 and T120min.

Although the insulin response demonstrated highly significative variation between T0 and T60 (**figure 3**) which is correlated to the highest glycemic peak, but it never regained its initial values and continued to be relatively high.

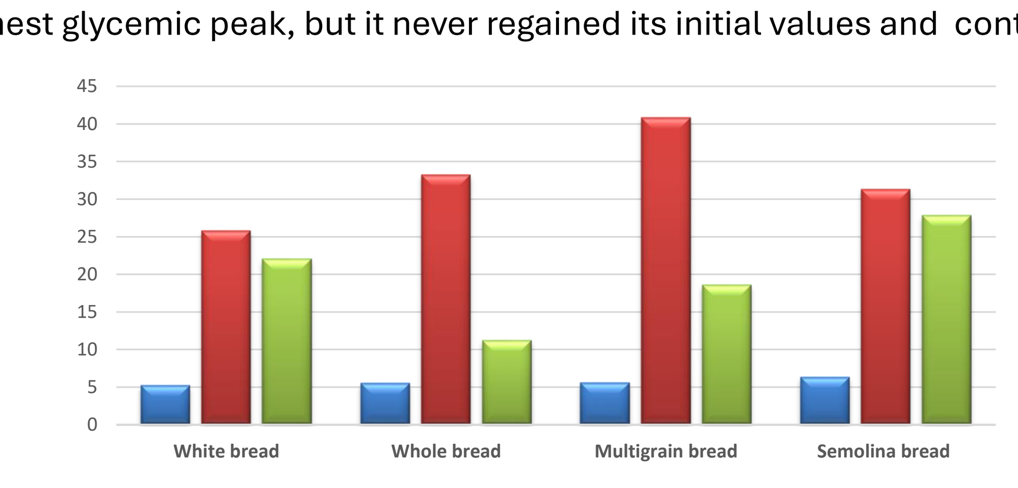


Figure 3: Insulinemic response to different type of breads

No correlation was found in this study (**figure 4**) between different component and GI in different types of bread even if it was reported by different works the potential effect of fibers and proteins in reducing GI.

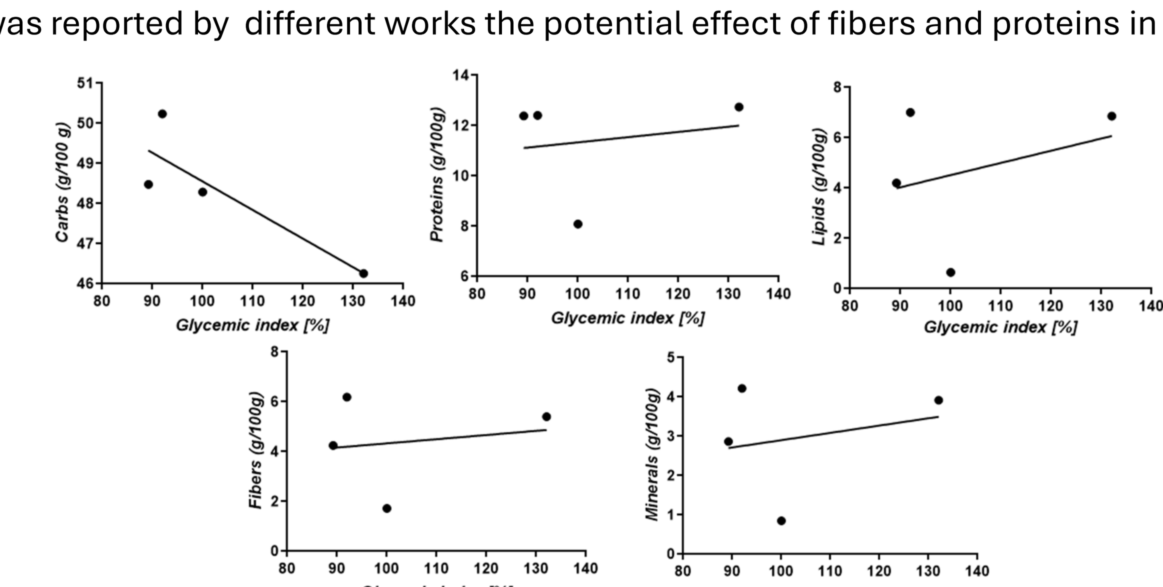


Figure 4: Correlation between bread types and macronutrient

CONCLUSION

To our knowledge this work was released for the first time in Tunisia in which different type of breads were studied. According to our findings no statistically significant differences were observed between the GI of different types of bread studied and white commercial bread, also no detectable effect was found on the metabolic profile.

The glycemic index is a highly variable concept that remains specific to the food being tested so it's use should be more controlled. It would be of grate value to determine glycemic indices specific to Tunisian foods.

FUTURE WORK / REFERENCES

ISO 26642:2010(en), Food products — Determination of the glycaemic index (GI) and recommendation for food classification

Brouns F, Bjorck I, Frayn KN, Gibbs AL, Lang V, Slama G, et al. Glycaemic index methodology. Nutr Res Rev. juin 2005;18(1):145-71

Bourre J-M, Bégat A, Leroux M-C, Mousques-Cami V, Pérardel N, Souply F. Valeur nutritionnelle (macro et micro-nutriments) de farines et pains français. Médecine Nutr. 2008;44(2):49–76.

Foster-Powell K, Holt SH, Brand-Miller JC. International table of glycemic index and glycemic load values: 2002. Am J Clin Nutr. 2002;76(1):5–56.

d'Emden, M. C., Marwick, T. H., Dreghorn, J., Howlett, V. L., & Cameron, D. P. (1987). Post-prandial glucose and insulin responses to different types of spaghetti and bread. European Journal of Clinical Nutrition, 41(2), 109-115

Lanzerstorfer, P., Rechenmacher, E., Lugmayr, O., Stadlbauer, V., Höglinger, O., Vollmar, A., & Weghuber, J. (2018). Effects of various commercial whole-grain breads on postprandial blood glucose response and glycemic index in healthy subjects. Journal of Nutrition & Food Sciences, 8(1), Article 1000670

Acknowledgments/ Potential Conflicts of Interest

The authors are grateful to all participants and staff implicated in this study.

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Informed consent was obtained from all subjects involved in the study.