



# Fiber's fractions in biscuits enriched with anti-grain flour obtained at industrial scale level from minimally processed apple pomace



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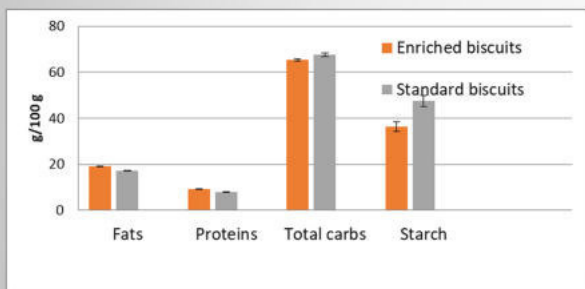
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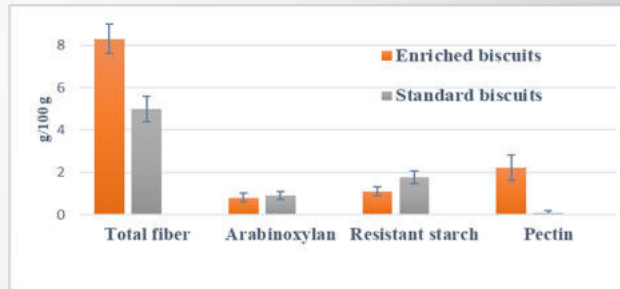
**Introduction** By-products from the fruit and vegetable processing industry, particularly those obtained through juicing, have significant potential as sources of bioactive compounds, primarily fiber and its individual fractions. In this study, apple pomace flour, produced using a recently developed technological process, was incorporated into a confectionery product on an industrial scale. The aim was to analyze the enriched product, which contains pectin—a soluble fiber with prebiotic and anti-lipemic properties—as well as arabinoxylan, an insoluble fiber naturally present in wheat flour that exhibits prebiotic activity and helps regulate postprandial glycemia and insulin response. The combination of apple pomace flour and whole wheat flour enhances the fiber content of the enriched product, thereby improving its nutritional value.

**Methodology** The proximate composition and fiber fractions in standard and enriched product – biscuits were analysed and compared. Proximate composition was determined by standard AOAC methods, total fiber by enzymatic-gravimetric methods, while resistant starch, pectin and arabinoxylan were determined by spectrometric methods. The standard product contained whole and white wheat flour while in enriched one a part of the white wheat flour was replaced with apple pomace flour.

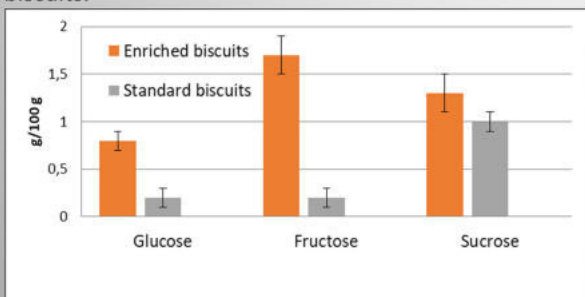
**Results** The total fiber content in standard and enriched biscuits was 5 g/100 g and 8.3 g/100 g, respectively. The incorporation of apple pomace flour led to a 66% increase in total fiber content. The carbohydrate-to-fiber ratio was 13 in standard biscuits and 8 in enriched biscuits. In the standard product, the arabinoxylan and resistant starch contents were 0.9 g/100 g and 1.7 g/100 g, respectively, whereas in the enriched product, they were 0.8 g/100 g and 1.1 g/100 g. When apple pomace was incorporated into the standard product without pectin, its total fiber content increased to 2.2 g/100 g. A significant change was observed in starch content: the standard product contained 47.5 g/100 g of starch, whereas the enriched biscuit showed a 23% reduction. Additionally, the contents of fructose, glucose, and sucrose increased in the enriched biscuits. However, the sugar-to-fiber ratio remained very low, at 0.4 in the enriched biscuit and 0.3 in the standard biscuit.



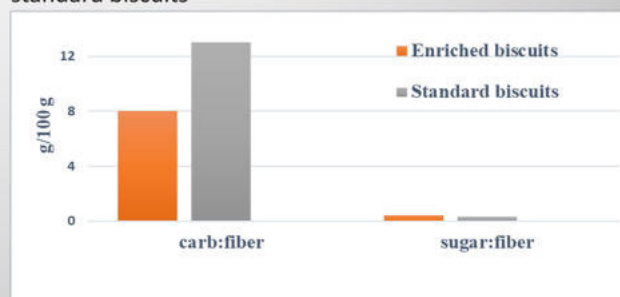
**Fig 1.** Content of total fats, proteins, carbs and starch in biscuits with apple pomace flour and standard biscuits.



**Fig 2.** Content of total fiber, arabinoxylan, resistant starch and pectine in biscuits with apple pomace flour and standard biscuits



**Fig 3.** Content of glucose, fructose and sucrose in biscuits with apple pomace flour and standard biscuits



**Fig 4.** Carb:fiber and sugar:fiber ratios in biscuits with apple pomace flour and standard biscuits

**Conclusion** The application of pomace in confectionery can compensate the lack of fiber and enrich the product with fiber such as pectin, with proven health benefits. Since the lack of fiber in modern diet causes a range of non-communicable diseases (NCD), such as obesity, diabetes, gastrointestinal and heart disease, effectively valorizing and utilizing minimally processed apple pomace, can be beneficial in terms of NCD prevention. The reduction of starch content, accompanied by the reduction of phytic acid which is commonly present in cereal flours, can also have a positive effect on the health.

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