

Iron-rich Teff-grain bread: an opportunity to improve individual's iron status

I. Alaunyte, V. Stojceska, E. Derbyshire, A. Plunkett and P. Ainsworth

Department of Food and Tourism Management, Manchester Metropolitan University, Manchester M14 6HR, UK

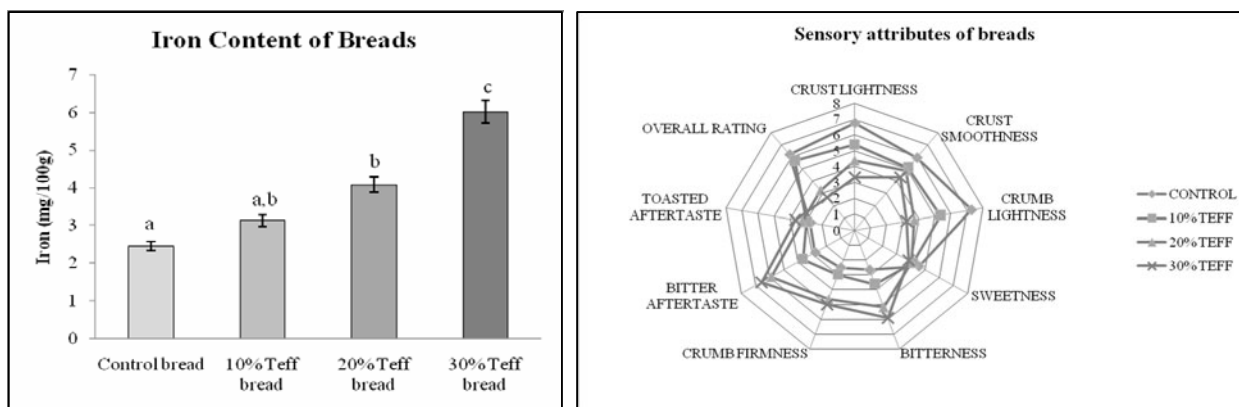
Bread has been a popular staple food for many years. In the UK the average individual consumes 677 g bread/week⁽¹⁾. Recent investigations show downward trends in purchases of white bread, yet an increase in wholegrain and ethnic breads⁽¹⁾. This factor has resulted in the development of baked products incorporating less-utilised and more-nutritious grains.

Teff (*Eragrostis tef*) is a small-grained cereal originating in Ethiopia and is favoured for its nutritional profile⁽²⁾. When compared with other grains, such as wheat, barley and sorghum, teff is a rich source of fibre, protein, Fe, Ca and Zn^(2–4). Teff is particularly abundant in Fe; ≤ 150 mg Fe/100 g is present in teff seeds⁽⁵⁾. Furthermore, the fermentation process used during bread making promotes phytate breakdown, further increasing the bioavailability of Fe⁽⁶⁾.

In the UK the average adult female consumes 8.8 mg Fe/d; notably lower than the reference nutrient intake of 14.8 mg/d^(7,8). Although, anaemia is not a major public health problem in the UK, 9% of women of reproductive age have Hb levels < 120 g/l; the diagnostic criteria for clinical anaemia⁽⁹⁾. In contrast, in Ethiopia the prevalence of Fe-deficiency anaemia is lower, which is attributed to regular teff consumption⁽¹⁰⁾.

The aims of the present study were therefore to incorporate teff grain into bread, to determine the Fe content, texture qualities, sensory attributes and cost of teff breads and to compare them with control wheat bread. Teff flour was incorporated into breads at the levels of 10, 20 and 30% (w/w). Fe content of the teff and wheat flours and all breads was determined using the dipyriddy method⁽¹¹⁾. Texture properties were evaluated using a texture analyser crumb compression test. Sensory analysis was conducted using a taste panel comprising fifty subjects.

The results clearly showed that teff flour contained significantly more Fe than wheat flour (7.64 mg/100 g v. 2.54 mg/100 g; $P < 0.001$). Consequently, the Fe level in teff breads was significantly higher (3.13–6.01 mg/100 g) when compared with control bread (2.44 mg/100 g; $P < 0.01$). Texture properties (specific loaf volume, crumb firmness, shelf life and cellular structure) showed no significant differences between control, 10 and 20% (w/w) teff breads. Only 30% (w/w) teff bread showed significant decrease in these quality variables. Sensory evaluation showed that 20–30% (w/w) teff breads were less acceptable than control and 10% (w/w) teff bread, which was significantly correlated with bitter aftertaste and flavour ($r = -0.62$, $P < 0.01$). Cost analysis showed that for a standard 400 g loaf the 10, 20 and 30% (w/w) teff breads cost £0.08, £0.17 and £0.25 respectively more than white wheat equivalent bread.



In conclusion, this research has identified that teff flour and breads are a rich source of dietary Fe. Thus, incorporating teff bread into the daily diet may be one way to improve the Fe status of women living in the UK.

1. Department for Environment, Food and Rural Affairs (2008) Family food 2007: UK purchases and expenditure on food and drink and derived energy and nutrient intakes 2007. <https://statistics.defra.gov.uk/esg/statnot/efsstatnot.pdf>
2. National Research Council (1996) In *Lost Crops of Africa*, pp. 215–534. Washington, DC: National Academy Press.
3. US Department of Agriculture (2007) National nutrient database for standard reference, Release 20. <http://www.nal.usda.gov/fnic/foodcomp/search/>
4. Mengesha MH (1966) *Econ Bot* **20**, 268–273.
5. Abebe Y, Bogale A, Hambidge KM *et al.* (2007) *J Food Compos Anal* **20**, 161–168.
6. Ramachandran K & Bolodia G (1984) *Ethiop Med J* **22**, 45–48.
7. Henderson JHL, Bates CJ, Prentice A *et al.* (2004) *The National Diet and Nutrition Survey: Adults Aged 19 to 64 Years*. vol. 5: Summary Report. London: The Stationery Office.
8. Department of Health (1991) Dietary Reference Values for Food Energy and Nutrients for the United Kingdom. London: H. M. Stationery Office.
9. Benoist BD, McLean E, Egli I *et al.* (2008) *Worldwide Prevalence of Anaemia Report: 1993–2005*. Geneva: WHO.
10. Association of Official Analytical Chemists (1990) *International Method 977.30*, 16th ed. Washington, DC: AOAC.
11. Gebre-Medhin M, Killander A, Vahlquist B *et al.* (1976) *Scand J Haematol* **16**, 168–175.