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Abstract

Exploring the Impact of Traditional Processing Techniques on Iron Content and Bio-Accessibility of Six Iron-Rich Ingredients †

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Abstract: Iron (Fe) deficiency is a leading cause of anemia among Indian adolescent girls. Supplementation and fortification alone may not effectively reduce the risk of iron deficiency anemia. Therefore, sustainable food-based synergies and processing techniques must be developed to enhance mineral bio-accessibility (BAC) and bio-availability from naturally iron-rich foods. Traditional processing techniques that reduce antinutrient content and enhance mineral BAC have the potential to further enhance mineral bioavailability. This study quantifies the impact of traditional processing on Fe content and BAC in Fe-rich foods. It also quantifies the BAC of contaminant Fe from cooking in iron utensils. Three seeds were roasted and boiled in iron and non-iron utensils, and germinated. Three green leafy vegetables (GLVs) were roasted and blanched. Iron content was assessed using ICP-AES and the BAC was determined using dialyzability assay. Statistical analysis was conducted using MINITAB software, and Tukey's test was used to determine the difference between the means. The Fe content in raw seeds ranged from 5.6 to 6.6 mg/100 g, and GLVs contained 36–77 mg Fe/100 g (d.b). Processing significantly increased Fe content in seeds ($p < 0.05$), with a maximum increase of 68–258% in samples boiled in an Fe pan. Among the GLVs, only blanching led to a significant reduction (~65%) in Fe content. The BAC of Fe from seeds increased after roasting (46.6–63.6%) and germination (7.9–68%). In GLVs, the maximum increase in Fe BAC was obtained in blanched samples (102–203%). No notable difference in Fe BAC was observed between the seed samples processed in utensils made of Fe and non-Fe materials. The Fe content and its BAC in food are significantly impacted by processing. Iron utensils may increase Fe content, but the contaminant-Fe BAC is limited. Roasting might release Fe from the protein–Fe–phytate complex due to thermal treatment, while germination mobilizes antinutrients, which may improve Fe bioavailability. Blanching works favorably in case of GLVs which may be due to alterations in the soluble and insoluble dietary fiber ratio. These findings suggest that incorporating such processing techniques can be beneficial while formulating products with high Fe bioavailability to combat anemia.

Keywords: iron; food processing; bioavailability

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