

Bioavailability of Iron and Zinc in Biofortified Common Beans (*Phaseolus vulgaris* L.) from Burundi: An In Vivo *Gallus gallus* Feeding Trial

Background

Micronutrient malnutrition, particularly deficiencies in iron and zinc, remains a significant global public health issue, impacting over half of the world's population. To address this problem, common bean breeders have developed biofortified bean varieties rich in iron and zinc. These common beans are widely consumed in low-income areas like Burundi, where they serve as a primary food source. However, evidence from recent studies indicate that a high concentration of these minerals does not necessarily ensure high bioavailability, as antinutritional factors such as phytic acid interfere with mineral absorption.

Methods

This study determined the bioavailability of iron and zinc in dry cooked biofortified common bean varieties (MAC44 and RWR2245), a non-biofortified variety (*Kinure*) and commercial broiler mash as the control, using an in vivo *Gallus gallus*. Thirty six broiler chickens were randomly allocated to the four treatments over a seven-week feeding trial. Standard methods were used to determine dietary proximate analysis, phytic acid, and mineral concentration and experiments replicated thrice. Data analysis was conducted at a 95% confidence level and included Analysis of Variance and Pearson's correlation. *Post-hoc* analysis was performed using Tukey's Honestly Significant Difference.

Results

Results indicated that while common bean-based diets had higher iron concentrations compared to the commercial broilers mash, their higher phytic acid content limited iron bioavailability, resulting in significantly similar Hemoglobin Maintenance Efficiency (HME) across the common bean-based diets. While the commercial broiler mash yielded the highest HME and fractional zinc absorption, RWR2245 demonstrated the most favorable fractional zinc absorption among the common bean-based formulations, though it remained slightly below the non-biofortified common bean variety, *Kinure*.

Conclusions

Should the results from this *Gallus gallus* model be extrapolated to human nutrition, the high phytate-to mineral ration in these biofortified beans would similarly limit fractional absorption

ad of zinc and utilization of iron for HME. Therefore, there is a need to conduct human clinical trials to determine other factors necessary to overcome these bioavailability barriers in target populations.