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Evaluation of Simple, Effective and Affordable Processing Methods to Reduce Phytates in the Legume Seeds Used for Feed Formulations

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Abstract : Background and Study Significance: Legume seeds are important in agriculture as they are used for feed formulations due to their nutrient-dense, low-cost, and easy accessibility. Although they are important sources of energy, proteins, carbohydrates, vitamins, and minerals, they contain abundant quantities of anti-nutritive factors that reduce the bioavailability of nutrients, digestibility of proteins, and mineral absorption in livestock. However, the removal of these factors is too costly as it requires expensive state-of-the-art techniques such as high pressure and thermal processing. Basic Methodologies: The aim of the study was to investigate cost-effective methods that can be used to reduce the inherent phytates as putative antinutrients in the legume seeds. The seeds of Arachis hypogaea, Pisum sativum and Vigna radiata L. were subjected to the single processing methods viz raw seeds plus dehulling (R+D), soaking plus dehulling (S+D), ordinary cooking plus dehulling (C+D), infusion plus dehulling (I+D), autoclave plus dehulling (A+D), microwave plus dehulling (M+D) and five combined methods (S+I+D; S+A+D; I+M+D; S+C+D; S+M+D). All the processed seeds were dried, ground into powder, extracted, and analyzed on a microplate reader to determine the percentage of phytates per dry mass of the legume seeds. Phytic acid was used as a positive control, and one-way ANOVA was used to determine the significant differences between the means of the processing methods at a threshold of 0.05. Major Findings: The results of the processing methods showed the percentage yield ranges of 39.1-96%, 67.4-88.8%, and 70.2-93.8% for V. radiata, A. hypogaea and P. sativum, respectively. Though the raw seeds contained the highest contents of phytates that ranged between 0.508 and 0.527%, as expected, the R+D resulted in a slightly lower phytate percentage range of 0.469-0.485%, while other processing methods resulted in phytate contents that were below 0.35%. The M+D and S+M+D methods showed low phytate percentage ranges of 0.276-0.296% and 0.272-0.294%, respectively, where the lowest percentage yield was determined in S+M+D of P. sativum. Furthermore, these results were found to be significantly different ($p<0.05$). Though phytates cause micronutrient deficits as they chelate important minerals such as calcium, zinc, iron, and magnesium, their reduction may enhance nutrient bioavailability since they cannot be digested by the ruminants. Concluding Statement: Despite the nutritive aspects of the processed legume seeds, which are still in progress, the M+D and S+M+D methods, which significantly reduced the phytates in the investigated legume seeds, may be recommended to the local farmers and feed-producing industries so as to enhance animal health and production at an affordable cost.

Keywords : anti-nutritive factors, extraction, legume seeds, phytate
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