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Research Article

Evaluation of macro, micro, and toxic minerals in Dates fodder in Basra, Southern Iraq

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Abstract
Mineral concentrations in plants are affected by a number of factors, which in turn affect the amounts available directly or indirectly to animals, so the concentration of some nutrients may be insufficient for the needs of animals. The article aimed to evaluate a wide variety of chemical elements in date fodder often used to feed cows, buffaloes, and sheep in Basra Governorate, Southern Iraq. In addition, it establishes the acceptability of chemical element concentrations in the dates, which included macro-minerals, micro-elements, and hazardous metals. The feed was prepared to be digested and then all minerals were analyzed using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) equipment to determine the amounts of macro-minerals, micro-elements, and hazardous elements in the feed. Where macro-minerals included (calcium, magnesium, phosphorus, potassium, sodium, and sulfur) and micro-elements included (iron, copper, nickel, selenium, chromium, tin, silicon, vanadium, and molybdenum, while toxic elements included (aluminium, arsenic, cadmium, uranium, and lead). Most major and minor elements had low values compared to the critical level determined for their presence in fodders, as all elements did not reach the maximum tolerable(4.5% of macro-minerals and 40 ppm of micro-elements) and much less than the minimum limit(<0.06 of macro-minerals and <0.20ppm of micro-elements), whereas the toxic elements in the chosen dates fodder had low and acceptable concentrations compared to the risk index for their presence in fodder(100 mg Kg^{-1}). The current study helps farmers in Basra Governorate in their understanding of the mineral nutritional needs of cattle while relying significantly on this type of fodder.

Keywords: Dates Fodder, Macro, Micro, Minerals, Southern Iraq, Toxic

INTRODUCTION

Production, distribution, and consumption of feed all significantly contribute to global food security. Plant byproducts are a significant source of non-edible animal feed on a global scale (Salami *et al.*, 2019). The need for more sustainable production and consumption of animal-source food is central to the achievement of sustainable development goals (Van Zanten *et al.*, 2018). It is crucial to find more non-food plant resources to support the animal feed sector and boost livestock production because the cost of animal feed is continuously rising. Plant wastes may contaminate the air, land, and water. However, they may be valuable resources if they are wisely managed. Plant wastes are utilized as fertilizer and fodder for livestock. They are more beneficial than fertilizers when used as animal feed, though. These wastes are more valuable for feeding ruminants than poultry due to their high fiber and non-protein N content. The profitability of feed producers and the environmental quality could be improved by using plant wastes as feedstuffs. (Alagawany *et al.*, 2022).

Livestock systems are built on the foundation of animal feed and feeding. It has an impact on the whole livestock industry, linked services, and public goods and services, such as animal production, health and welfare, product quality and safety, land use and land-use change, and greenhouse gas emissions, directly or indirectly. Current cattle production practices need a lot of energy, land, chemicals, and water, all of which are becoming increasingly rare. In addition to presently recognized nutrition-based requirements for supplying commercially viable, safe animal products by creating