

Studies on the transfer of mineral nutrients from feed, water, soil and plants to buffaloes under arid environments

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Abstract

Studies were conducted at a Livestock Farm in an arid region of Pakistan, to determine the uptake of mineral nutrients from the food of buffaloes. Samples of feed, water, forage, soil as well as blood, milk, urine, and faeces of the animals were collected and analysed for K^+ , Ca^{2+} , and Fe^{2+} during summer and winter. The results showed that the concentrations of K^+ and Ca^{2+} in plants were low, whereas that of Fe^{2+} was high. In animals, K^+ was not found in the milk in significant amounts, rather it was excreted in the urine. The calcium taken in by the animals was used for the synthesis of milk, as a result of which low Ca^{2+} concentrations were detected in urine. Mineral nutrient concentrations (K^+ and Ca^{2+}) in forage plants and water were lower than the optimum requirement of the animals, as a result of which blood plasma contained lower amounts of minerals (K^+ and Fe^{2+}) than that of the normal animals or critical limits. From the findings of the present study, it can be concluded that the buffaloes raised at the livestock farm had a severe deficiency of mineral nutrients, particularly K^+ in lactating and Fe^{2+} in both lactating and non-lactating animals. Feed supplements, that can overcome these deficiencies, should be used for the optimum growth, milk production and resistance to diseases.

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1. Introduction

Most of the land in Pakistan is arid or semi-arid type. Limited research conducted in the country has indicated that soil, water and animal feed stuffs available in the arid areas of Pakistan have severe deficiencies in mineral nutrients essential for animal growth (Khattak and Perveen, 1985; Khan et al., 2003).

Livestock plays a very important role in the economy of the country contributing to more than 8% to the annual gross domestic product (GDP) of the country. In addition, livestock provides motive power and hide, contributing significantly to foreign exchange earnings (Gillani, 1993). Due to urbanization, livestock production has remained limited up to rearing in villages and a few dairy farms, resulting in a serious shortage of meat and milk supply in Pakistan. Buffaloes play an important role in the meat and milk production of the country. It is a well-established fact that levels of mineral nutrients in the forage utilized by the animals affect growth and reproductive capacity of both male and female animals (Bicknell, 1995). Minerals are essential nutrients and either an excess or deficiency produces detrimental effects on the productivity of livestock. Mineral imbalances in soil and forage have long been held responsible for impaired performance among the ruminants. Infertility, non-infectious abortions, anaemia and bone abnormalities are some common clinical signs of mineral deficiencies in livestock (McDowell et al., 1993; Bicknell, 1995). To overcome this problem, more research is required on the subject to find the sources responsible for these mineral imbalances in livestock.

The aim of the present study is to provide information to small holders raising livestock regarding the use of mineral nutrients. By evaluating the mineral status of the soil, forages, and animals (milk, blood, urine, faeces), it will be possible to overcome nutritional constraints limiting productivity and impairing the health of livestock.

2. Materials and methods

Investigations were conducted at a livestock farm at Rakh Ghulama, District Bhakkar, Pakistan. The study examined 10 lactating and 10 non-lactating buffaloes of approximately the same size (400–450 kg, a lot of 80 animals being reared at the farm for the last 4–5 years. The age of animals ranged from 48 to 54 months. Average temperature during the experimental year was $39 \pm 5^\circ\text{C}$ during summer and $15 \pm 6^\circ\text{C}$ during winter. Relative humidity was $48 \pm 5\%$ during summer and $78 \pm 8\%$ during winter. To study the transfer of mineral nutrients from feed, water, soil and plants to buffaloes, soil, forage (summer forage: *Sorghum bicolor*, *Pennisetum glaucum*, *Cyamopsis tetragonoloba* supplemented with dried wheat straw; winter forage: *Trifolium alexandrinum*, *Brassica campestris*, *Avena sativa* supplemented with dried wheat straw), animal feed (cotton oilseed cake having 38–40% protein) as well as blood, milk, urine and faecal samples from the buffaloes were collected from the farm during summer (May to June) and winter (December to January) of the year 2002. Daily average intake of forage/feed by each animal was 55–60 kg (fresh weight). Four samples each were collected, after each fortnight interval from soil, water, forage, feed, faeces, blood, milk and urine during each season.

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