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Observations on serum copper levels in three Omani goat breeds in different regions of Oman

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Introduction

Goats comprise a very important source of income for many Omanis, and are preferred for meat consumption. There are three economically important goat breeds in Oman, named after their local regions: Jabal Akhdar (JA), Batina (BAT) and Dofari (DOF). Copper deficiency is an endemic problem in local Omani livestock. It was found to cause many deleterious economical effects in goats including reduced growth rate (Osman et al, 2008), ataxia (Ivans, et al., 1990) and low haemoglobin concentration (Osman, et al., 2009). Low plasma Cu levels were reported in the three breeds of goats in intensive management system (Osman, et al, 2003) and in grazing livestock (Ivans, et al, 1990). In other Omani animal species low plasma or serum Cu was also detected in racing camels kept in both regions of Muscat (Osman, 2012) and Alshargia (Ettahir, et al., 2010). In these studies high dietary iron, sulphur, elevated molybdenum and low forage copper content were suggested to contribute in the low Cu levels in Omani livestock. This work was carried to investigate the prevalence of Cu deficiency in these goat breeds in Aljabal Alakgdar, Albatina and Dofar regions of Oman.

Material and Methods

Blood samples were collected randomly from the jugular veins of 184 goats of the three local breeds belonging to the geographical regions of Oman: Aljabal Alakhdar (n=93), Albatina (n=42) and Dofar (n=50) (Figure 1). The goats' ages ranged between 3m to 8y (Table 1), and were comprised of 34 males and 150 females.

The Jabal Akhdar goats were raised on partial range grazing plus stall supplementation while the Batina and Dofari goats were kept and fed indoors. All animals were supplemented with extra Rhodes grass hay plus a variety of concentrates as well as mineralized salt licks that included copper.

Serum was collected from blood samples in situ, separated in vials



Fig. 1 Map of Oman presenting the areas of investigation on prevalence of copper deficiency

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and kept in a cool temperature, moved to the lab and frozen. They were then chemically analyzed for total serum copper using atomic absorption spectrophotometry.

Serum samples had Cu content ≤ 0.67 mg/l were considered low or deficient (Ivans, et al., 1990). Type III general linear model statistical analysis using SPSS 19 was used to study the regional prevalence, breed and age differences in serum Cu levels.

Table 1 Numbers of goats within each age group used in investigation on copper deficiency prevalence in Oman

Age group	(Age1): 2 months -1y	(Age2): >1-2y	(Age3): >2-3y	(Age4): >3-4y	(Age 5): > 4y
Number of goats	26	31	41	49	37

Results and Discussion

145 out of the 187 goats studied (i.e. 77.5%) were sub-clinically low or deficient in serum copper (Fig. 2). All Batina goats, however, were within the low range. A proportion of 43% of serum samples collected from goats in a survey carried by Ivans et al (1990) in different regions of Oman were indicative of Cu deficiency. The means of serum Cu (mg/l) within all breeds ranged from low to deficient (Figure 3). Batina mean serum Cu was significantly ($p<0.05$) lower than means of Jabal Akdar and Dofari. Ivan et al (1990) pointed that shallal (posterior ataxia) was most common in the north Batina and north Interior regions of Oman. The authors indicated that fresh alfalfa and grass were most common feeds in the most affected regions, the same was found in the current study. High dietary iron was found in feeds (Osman et al., 2003) and liver of affected animals (Ivan, 1990) to which Cu deficiency was attributed. Copper enhanced salt licks were found to be provided in all regions studied, but apparently with no enough impact. The copper source given to these goats, the salt-lick, was also not enough when used for growing kids (Osman, et al, 2003) or camels (Osman, 2012). Low copper, high iron and/or high sulphur and elevated molybdenum dietary levels were found in feeds offered to goats in previous studies in Oman (Ivans, et al. 1990; Osman, et al., 2003).

No significant effect of age or sex or their interaction on serum Cu levels in Omani goats was observed in this study ($p<0.05$). This result contradicted with that found earlier (Osman, et al. 2003) in which 7 month old goats had higher plasma levels than adult goats.

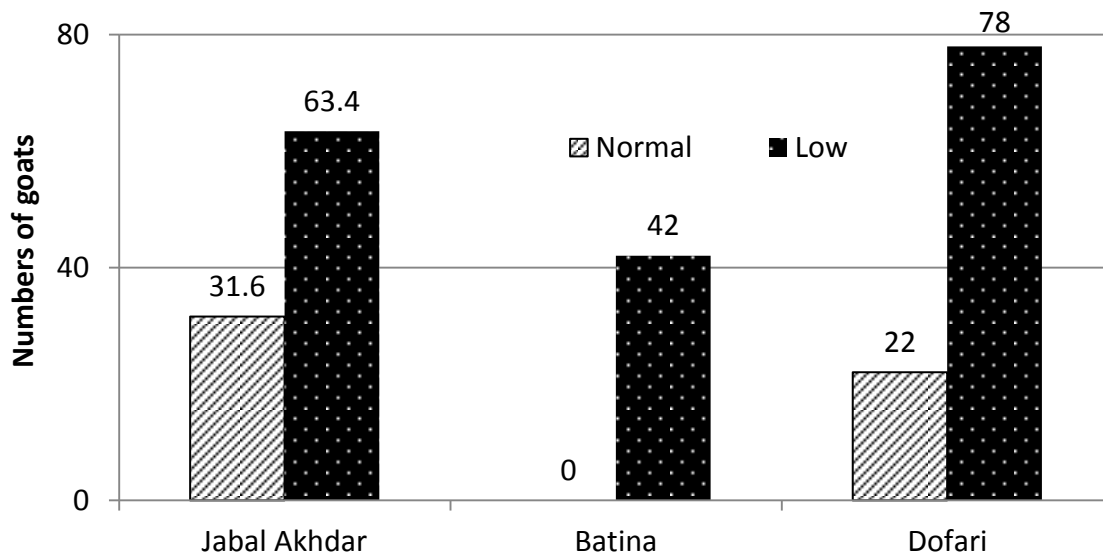


Figure 2: Numbers of goats had normal (> 0.67 mg/l) or low (≤ 0.67 mg/l) serum copper levels in three Omani breeds

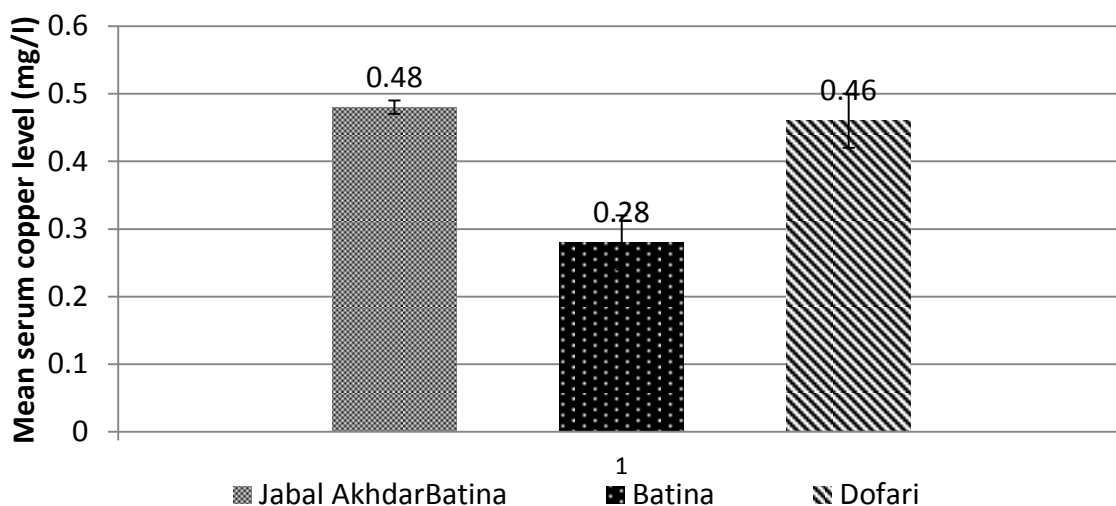


Figure 3: Mean serum copper (mg/l) in Omani goat breeds raised in their local regions

Conclusions and and Outlook

This study indicated that subclinical Cu deficiency in Omani goats may be prevalent in geographical regions covered in this study. That may indicate that any measurements which could have been followed by goat owners for alleviation of copper deficiency appeared to be inadequate. Studies carried on this issue in Oman are very scarce and are still within the investigation level. The economical effects and methods of alleviation of copper deficiency need to get more attention and studies. Further studies are needed to investigate levels of other minerals and trace elements in goat serum and levels in rangeland and pasture.

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