THE EFFECT OF SALINE WATER INTAKE AND FEEDING SALT TOLERANT PLANTS ON THERMOREGULATION AND PRODUCTIVE EFFICIENCY OF BARKI SHEEP IN SOUTH SINAI

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A Thesis Submitted in Partial Fulfillment

Of

The Requirement for the Doctor of Philosophy Degree

In

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APPROVAL SHEET

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ABSTRACT

This study was performed in order to investigate the impact of salinity in drinking water and the effect of feeding diets (containing salinity tolerant plants) on production and reproduction efficiency and the amount of thermoregulation of Barki sheep under semi-arid condition in Egypt.

This research was carried at South Sinai Research Station situated in RasSudrGovernorate, belonging to the Desert Research Center (DRC), Ministry of Agriculture and Land Reclamation, Egypt. Chemical analysis was executed in the Animal Production Lab of South Sinai Research Station. Whereas, determination of wool parameters, histological features and hormonal assays were conducted in the Central Lab of DRC.

Twenty nine adult ewes of ٢-٣ years old from Barki sheep breed were randomly assigned into four different feeding groups (٧, ٧, ٨ and ٧ animals for group ١, ٢, ٣ and ٤, respectively), according to both type of drinking water (i.e. tap water or saline water) and feed (i.e. berseem hay or salt-tolerant plants like Alfalfa) as the following: The first group (G١) was fed on berseem (Trifoliumalexandrinum) and drank tap water (٢٧٤ ppm) and served as control. The second group (G٢) was fed on berseem (Trifoliumalexandrinum) and drank saline water (٦٠٠٠ ppm).The third group (G٣) was fed on salt-tolerant plants (alfalfa) and drank tap water and the fourth group (G٤) was fed on salt-tolerant plants and drink saline water. All experimental groups were offered concentrate feed mixture (٠.٧٥ kg /head/day) to cover their different physiological requirements of energy.

All experimental animals were kept in semi-open pens under the same managerial and hygienic conditions and diagnosed as clinically free from internal and external parasites. Once lambing took place, the new born lambs were identified by ear tag and left with their dams till weaning at ٣ months of age.

The qualitative and quantitative measures of wool and skin of Barki sheep, raised under semi-arid conditions in Egypt, showed that the increase of the saline water and salt tolerant plants intake by the Barki ewes decreased the greasy fleece weight

and the staple length, while it slightly increased the fibre diameter. However, it did not affect the percentage of fibre types.

The non-significant changes in rectal temperature and skin temperature values among the experimental groups designated that Barki ewes were capable of maintaining their body temperature with normal range.

Respiration rate (RR) is the most sensitive index reflecting the response to the environmental condition more than other physiological responses. This fact was confirmed in Barki sheep and the present findings demonstrated that feeding salt tolerant plants resulted in increasing respiration rate where ewes of G٣ had the highest values.

The results of average litter size and average Kgs weaned/ewe joined revealed that there were no significant differences among the experimental groups as affected by drinking saline water and/ or feeding salt tolerant plants, however, the increase of the saline water and salt tolerant plants intake by the Barki ewes increased the mortality rate from birth to weaning, which reflects some negative effect of salinity on reproductive performance of Barki ewes.

The lowest birth weight (BW) value was recorded when animals were subjected to the both salinity sources. Also, results of weaning weight demonstrated that lambs born to ewe drank saline water and fed salt tolerant plants or berseem hay had higher weaning weight (WW) as compared to their counterparts drank fresh tap water. However, the differences among the experimental groups, for (BW and WW) were not significant. On the other hand, the present results declared that Barki lambs fed salt tolerant plants and drank saline water (G٤) had the highest average daily weight gain (ADG) followed by lambs fed berseem hay (BH) and drank saline water (G٣), which reflects some negative effect of salinity on growth performance of Barki lambs.

In conclusion, Care should be taken when using saline water and salt tolerant plants as a source of drinking and feeding for Barki ewes and lambs at short and medium

term. More studies are needed to declare the effect of salinity in both feed and water on sheep for long terms and large scales. Further study is also required to determine if Barki sheep can tolerate water salinity levels for more than ٦٠٠٠ ppm TDS, which is actually the upper limit of salinity tolerance in the present study.

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INTRODUCTION

Salt stress is one of the most serious limiting factors for crop growth and production in the arid regions (Jouyban, ٢٠١٢). About ٢٣٪ of the world's cultivated lands are saline and ٣٧٪ is sodic (Khan and Duke, ٢٠٠١).

In Egypt, about ٩٥٪ of the land is desert, where the soil is sandy and most of the available ground-water is too saline to raise and sustain conventional crops (Ashour *et al*., ١٩٩٧). Southern Sinai is hyper arid region of Egypt with salt affected natural resources (water, soil, plants, etc.). Therefore, feed resources in this region represent one of the main obstacles for animal production development. Salt tolerant plants could play an important role in the region (Fayed *et al.*, ٢٠١٠). Feeding salt tolerant plants is a feasible solution to minimize, in general, the problem of feed shortage in arid and semi- arid areas of Egypt. Salt tolerant plants have great potentialities to induce agricultural revolution in such areas since it is known to be tolerant to salinity and drought, so it could play an important role in such arid regions (Jouyban, ٢٠١٢).

On the other side, the combination of salt in feeding and drinking water is of critical importance. When the high salt intake comes from feed alone, and there is an unlimited supply of fresh water, the animal can cope by increasing water intake and therefore increasing the salt excreting capacity of the kidneys. This cannot be done if the salt is present in both feed and water. This has significant practical consequences; any level of salt in drinking water will compound the effects of a high dietary salt intake. Such an interaction is likely to be more important during the hotter, dry periods of the year than during colder, wetter times of the year (Wilson, ١٩٧٥).

In Egypt, sheep are reared mainly for meat and secondary for coarse wool production. Wool is used by most of Bedouins communities for making handmade products and may contribute as a source of income for Bedouins. On the other hand, sheep are important species of animals that can be used in animal production development in the desert regions of Egypt because of their ability to convert forages and crops and household residues into meat, fibre, skins and milk. Barki is one of the three major sheep breeds of Egypt. About one million head of this breed are maintained along the North Western Coastal Area (Molar, ٢٠٠٤), out of which ٧٠٠ thousand weaned lambs may be produced yearly. Wool is considered the second main product of Barki sheep, the dominant breed at the desert of Egypt, which contributes to the economic value of that breed of sheep.

The insufficient information about the effect of feeding salt-tolerant plants and drinking saline water on the thermoregulation and reproductive and productive performance of Barki sheep was the motive of this study. Most previous local studies concerned, in general, with the effect of water salinity on the performance and physiological responses of desert animals (Ibrahim, ١٩٩٥ and El-Sherif and El-Hassanein, ١٩٩٦), however, few studies took in consideration its effects on

coat cover characteristics in sheep (Taha *et al*., ٢٠٠٩; Abd El-Ghany *et al*., ٢٠١٢ and Helal and Fayed, ٢٠١٣). Therefore, the present study was principally carried out to investigate the effect of feeding salt tolerant plants and drinking saline water on the thermoregulation and physiological, reproductive and productive performance, in addition to the histochemical structures of coat (i.e. skin and wool) of Barki sheep under desert condition.

REVIEW OF LITERATURE

The review summarizes some of the available data on the different factors affecting the different traits considered in the present study. Climatic conditions and type of feeding are considered in our study as main sources of variation.

١. Body coat characteristics

١.١. Wool parameters

Wool defines as protein fiber affected significantly by both feed quality and quantity. Moreover, wool as one of sheep's products is influenced by the quantity and quality of both drinking water and type of feeding plants.

1.1.1. Greasy fleece weight:

Greasy fleece weight is an important quantitative trait, as it greatly contributes to the economic value of sheep (Terrill et al., ١٩٥٠). Greasy fleece weight of the Egyptian sheep has been studied by many workers. The reported results were variable due to breed differences and the effect of environmental factors.

Working on males of Ossimi and Merino sheep and their crosses, Gheith (١٩٦٩) reported values for greasy fleece weight of ٢.٠٩, ٣.٢٧ and ٣.٦٦ kg, respectively. The corresponding values for the females were ١.٦٩, ٢.٧٧ and ٢.٩٣ kg, respectively. El-Sherbiny et al. (١٩٧٩) had similar estimates of greasy fleece weight in the Ossimi breed, accounting in average for ١.٦٤ kg. The values reported in the studies of Ibrahim et al. (١٩٩٣) ranged between ٠.٧٢ and ٢.١١ kg.

In Rahmani sheep, an average greasy fleece weight of ١.٦ kg was reported by Aboul-Naga and Afifi (١٩٧٧). Working on Ossimi and Rahmani sheep and their crosses, Khalil (١٩٦٦) had lower values of greasy fleece weight, accounting for ٠.٦, ٠.٦ and ٠.٧٥ kg, respectively. El-Masry (١٩٨٦) reported values for the same breeds that ranged between ١.٣ and ٢.٧ kg.

In Barki breed, higher values were showed by Seoudy (١٩٦٦) accounting for ٢.٤٢ kg. Fahmy (١٩٦٧) reported least-square means of greasy fleece weight of Barki and Awassi sheep accounting for ٣.١٤ and ٢.٣٧ kg, respectively. Guirgis (١٩٨٠) obtained values of ٢.٥ kg., however, Bahnas (١٩٨٤) showed lower value as ١.٨ kg. In the same breed, Azzam (١٩٩٩) and Gad Allah (٢٠٠١)