

WATER BALANCE AND BODY FLUIDS DISTRIBUTION OF BARKI LAMBS FED *Kochia indica* IN SINAI

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ABSTRACT

This work was conducted at Ras Sudr Research Station, which locates in South Sinai Governorate, belonging to Desert Research Center, to investigate the effect of short-term feeding (90 days) Barki lambs on *Kochia indica* shrubs as forage (treated group, T) compared with clover hay (control group, C). The physiological responses were body fluids distribution, water balance, some plasma electrolyte concentrations (Sodium, Na⁺ and Potassium, K⁺), in-vivo body composition and growth performance during summer.

The results revealed that, live body weight (LBW) changes over the experimental period were generally positive in both T and C groups without significant difference. The rates of LBW change in the two experimental groups represented +32.79 and +32.97%, respectively. Regarding the effect of period on body fluids distribution, the rates of changes in total body water (TBW), extracellular fluids (ECF), intracellular fluids (ICF) and interstitial fluids (ISF) were highly significant ($P < 0.01$) in the two groups with values being +36.27, +24.68, +43.37 and +18.33% vs. +36.27, +33.25, +38.47 and +32.43% respectively for T and C groups.

The averages of daily-retained water were 44.6 and 46.6 g/head for T and C groups with respective ratios of daily gain in live body weight of 65.8 and 68.7%. Plasma electrolytes showed that lambs fed *Kochia indica* elevated plasma Na⁺ concentration ($P < 0.01$), while control group kept their plasma Na⁺ concentration approximately constant. Plasma K⁺ concentration increased significantly for both groups, with higher increase in lambs fed *Kochia indica* (+26.38%) than lambs fed clover hay (+2.71%).

By the end of experimental period, the mean values of plasma, blood and red cells volumes increased in both groups, this increase was more for lambs fed *Kochia indica* than those fed clover hay.

For the Antipyrine dilution technique, the prediction equations showed no variations in body composition and growth performance between treated and control groups. Also results showed no significant effect for *Kochia indica* on in-vivo body composition fractions since total body protein (TBP), total body fat (TBF) and total body ash (TBA) increased throughout the experimental period ($P < 0.01$) without significant differences between treated and control groups. The averages of daily body weight gain throughout the study period were the same values of 67.8 g/h/d in the two groups. Water balance indicated that lambs fed *Kochia indica* showed higher water turnover rate i.e total water intake and excretion ($P < 0.01$) compared to the control group.

Keywords: sheep, *Kochia indica*, body fluids, in-vivo body composition and water balance

INTRODUCTION

The use of halophytes for fodder production may be one of means of utilizing salt affected soils. *Kochia indica* is a salt and/or drought tolerant shrubs, which produced in great biomass during dry season (Sherrod, 1973; Zahran, 1986 and Abou Zaida, 1988).

Fahmy and fayed (2000) reported that, both sheep and goats were in a good nutritional status when fed on *Kochia indica* diet and it could be highly recommended to use *Kochia indica* hay particularly during the summer season as good quality roughage instead of berseem hay. Similarly, Fahmy and Ibrahim (2005-b) and Tag El-Din *et al.* (1991) mentioned also that *Kochia indica* could be used as a good green fodder for ruminants due to its comparable content of crude protein to clover hay, which is becoming scare and expensive.

This work was designed to estimate growth performance, in-vivo body fluids distribution, in-vivo body composition, plasma electrolytes (Na^+ , K^+) concentrations and water balance for growing Barki lambs fed cultivated *Kochia indica* in comparison with those fed clover hay as a basal roughage diet during summer season in Southern Sinai.

MATERIALS AND METHODS

The present study was carried out at the Experimental Farm of Ras Sudr Research Station, which located in South Sinai Governorate, belonging to Desert Research Center. The soil in this farm is characterized as loamy sand texture containing total salinity of 6100 ppm.

Plant material:

Clover hay was used as a control diet (C) while fresh *Kochia indica* shrubs used as treated diet (T). *Kochia indica* shrubs were cultivated in agronomic plots in Ras Sudr Experimental Farm. Organic manure was applied during soil preparation with rate of 40m³/fed. *Kochia indica* was irrigated weekly using underground brackish well water. *Kochia indica* shrubs were daily harvested in the morning and mechanically chopped and used fresh.

Experimental animals and design:

Sixteen growing male Barki lambs at 6 months old with initial average body weight of 18.5 ± 2.55 kg were used for 90-day experiment in summer (from August to October). They were allocated randomly into two equal groups (8lambs/group). The two groups were kept separately in shaded pens. The first group as control received ad lib clover hay (C), while the second as a treated group was fed ad lib, fresh *Kochia indica* (T). The roughage materials were offered twice daily (at 08:00 and 15:00 hr). Both two groups were supplemented with concentrate feed mixture (CFM) equal to 100% of its energy maintenance requirements according to Kearn (1982). The concentrate was offered once daily. Fresh drinking water was available ad lib, twice daily.

Sampling methods:

At the beginning and the end of study, in-vivo total body water (TBW) was estimated using antipyrine space method according to Brodie *et al.* (1949) and extracellular fluids (ECF) was estimated using sodium thiocyanate method according to Bowler, (1944). Plasma volume was determined by the method of Kennedy and Millikan, (1938) using the Evan's blue dye (T-1824). Intracellular fluid (ICF) volume was calculated by deduction (TBW – ECF), Interstitial fluid (ISF) volume was obtained by subtracting PV from ECF. Plasma electrolyte concentrations (Na⁺, K⁺) were estimated using Flame photometric method (Hawk *et al.* 1965).

Antipyrine (1-phenyl-2, 3-dimethyl-5pyrazolone) was employed in a dilution technique for the determination of total body water. TBW was calculated according to the following equation suggested by (Panaretto and Till, 1963). $TBW = \text{Antipyrine-space} - 0.03 \times \text{body weight}$.

Average daily-retained water (ADRW) was calculated by difference as follows: $ADRW, g = (\text{Final TBW} - \text{Initial TBW}) / 90 \text{ days}$.

Prediction of body chemical composition:

The prediction equations using total body water (TBW) to calculate body composition fractions according to Fekry *et al.* (1989) as follows:

Total body fat, (TBF) = Body weight, kg - Fat-free body, kg

Fat-free body, kg = $TBW / 0.736$

Fat-free dry solids, kg = $TBW - \text{Fat-free body}$;

Total body ash, (TBA) = $TBP - \text{Fat-free dry solids}$

Total body protein, (TBP) = $\text{Fat-free dry solids, kg} \times 0.788$

Blood samples were taken in the morning before access to feed and water. An initial blood sample was taken from the right jugular vein. A portion of the initial blood sample was transferred to a Wintrobe tubes, centrifuged for 20 minutes at 3500 rpm and the packed cell volume determined according to Dacie and Lewis, (1991). The rest of samples were centrifuged at 3500 rpm for 20 minutes to collect plasma and stored at -20C for biochemical analysis.

After 75 days of the experimental period four lambs of each group were randomly chosen and placed in metabolic cages with capability of collecting urine and fecal output separately for water balance study. One week was given for adaptation of animal to metabolic cage; this period was followed by seven days collection period. Refusals of both roughage and concentrate rations were collected every day before offering fresh feed. The total water intake was calculated each day by adding free water intake to its amount in food intake. The water balance defined as total water input (free, food and metabolic water) minus the measured output (urine and fecal moisture).

Statistical analysis:

Data were analyzed using the SAS software (SAS Institute, 1998). The repeated measurements analysis of variance (Procedure MIXED) was applied to the respective parameters. Differences among means were examined using Multiple Range Test according to Duncan, (1955).

RESULTS AND DISCUSSION

Changes in live body weight and body fluids distribution:

Live body weight (LBW) changes as indicators to animal growth performance in the two studied groups are presented in Table 1. Lambs of both groups have grown in almost the same trend where body weight of lambs increased from initial value of 18.5 to 24.6kg by the end of the study for *Kochia indica* -fed group, versus values from 18.6 to 24.7kg for clover hay-fed group. The averages of body weight gain throughout the study period were of the same value of 67.8 g/h/d in the two groups. This finding is completely in agreement with that of Fahmy and Ibrahim, (2005-b) on Barki male lambs, Gabr, (2002) on Barki ewe lambs and Atiq-ur-Rehman, (2002) on Merino wethers.

At the start of study, total body water (TBW) composed approximately 55.73% of LBW for lambs fed *Kochia indica* vs. 56.18 % for lambs fed clover hay. At the end of study (90 days) TBW reached to 57.11 and 57.6% for the two groups, respectively. Statistical tests revealed that, there were no significant differences on LBW and TBW between the two studied groups throughout the experimental period.

In respect of body fluids components, values of TBW, ECF, ICF and ISF at the beginning of study were similarly in both treated and control groups (Initial values in Table, 1). Concerning the effect of the experimental period on body fluids distribution, control group showed higher changes ($P<0.01$) than treated group on ECF (+33.25 vs. +24.68%) and ISF (+32.43 vs. +18.33), while treated group showed higher ($P<0.01$) value of ICF (+43.37 vs. +38.47%) Abd El-Gawad. *et al.* (1997) reported that, ECF and ISF increased significantly ($P<0.01$) in Barki goats watered saline well-water, and these increases could be attributed partly to higher intake of saline water.

Changes in plasma electrolytes (Sodium, Na⁺ and Potassium, K⁺) concentrations:

The results (Table1) showed that lambs fed *Kochia indica* elevated plasma Na⁺ concentration ($P<0.01$), while control group remained their plasma Na⁺ concentration nearly constant along the experimental period. However, plasma K⁺ concentration increased more ($P<0.01$) for T group than C one.

Regarding the effect of period on plasma electrolytes, the rates of change from initial to final values of Na⁺ and K⁺ were +8.72 and +26.78% for T group vs. -0.99 and +2.71% for C group, respectively. The elevation in plasma Na⁺ and K⁺ concentrations for *Kochia indica* group might be due to the effect of higher sodium percentage in T ration (1.96%) than C ration (1.61%) in Table 4 or might be due impairment in renal function in the form of decrease in glomerular filtration rate which led to increase in plasma Na⁺ and K⁺ concentrations in treated group. These results are in agreement with the findings of Badawy *et al.* (2002) on Barki lambs and Baladi kids and Abd El-Gawad, *et al.* (1997) on Barki and Damascus goats. The results of Khamis *et al.* (1989) and Hagsten and Perry (1979) on sheep indicated that drinking saline water increased plasma sodium and potassium concentrations.

Table (1): Means \pm SE of live body weight (LBW), total body water (TBW), extracellular fluids (ECF), intracellular fluids (ICF), interstitial fluids (ISF) and plasma electrolyte (Na⁺, K⁺) concentrations in lambs fed *Kochia indica* (T) or clover hay (C)

| Item | Periods | | | | Changes% | |
|--------------|--------------|-------|--------------|-------|----------|---------|
| | Initial | | Final | | C | T |
| | C | T | C | T | | |
| LBW (kg) | 18.6 | 18.5 | 24.7 | 24.6 | 32.79** | 32.97** |
| (SE) | (± 0.01) | | (± 0.01) | | | |
| TBW (L) | 10.45 | 10.31 | 14.20 | 14.05 | 36.27** | 36.27** |
| (SE) | (± 0.02) | | (± 0.02) | | | |
| ECF (L) | 4.15 | 3.89 | 5.53 | 4.85 | 33.25** | 24.68* |
| (SE) | (± 0.04) | | (± 0.12) | | | |
| ICF (L)) | 6.29 | 6.41 | 8.71 | 9.19 | 38.47* | 43.37** |
| (SE) | (± 0.02) | | (± 0.08) | | | |
| ISF (L) | 3.33 | 3.11 | 4.41 | 3.68 | 32.43** | 18.33* |
| (SE) | (± 0.03) | | (± 0.13) | | | |
| Na + (mEq/L) | 152 | 146.8 | 150.5 | 159.6 | -0.99NS | 8.72** |
| (SE) | (± 0.92) | | (± 1.61) | | | |
| K + (mEq/L) | 5.52 | 5.95 | 5.67 | 7.52 | 2.71* | 26.38** |
| (SE) | (± 0.08) | | (± 0.33) | | | |

C: consists of clover hay plus concentrate feed mixture

T: Consists of fresh *Kochia indica* plus concentrate feed mixture

SE = standard error

NS= non-significant

* = (P<0.05)

** = (P<0.01)

Ahmed *et al.* (1985) reported higher retention of potassium in Barki rams watered saline water (9100ppm).

Changes of blood, plasma, red cells volumes and hematocrit (%):

The results in Table 2 revealed that, intravascular fluids (plasma and blood volumes) were higher in lambs fed *Kochia indica* than lambs fed clover hay, these increases were proved to be more significant (P<0.01) at the end of study. The rates of change of PV and BV were 48.29 and 49.53% for T group vs. 39.55 and 36.61 % for C group, respectively. The higher plasma volume could be due to the increase in salt intake, which increased plasma sodium content due to the absorption of sodium across the gut wall. This would have caused the movement of fluid from the interstitial fluid and gut into the plasma to maintain the osmolarity pressure gradient between compartments (Harper *et al.* 1997) thus increasing blood volume. Similar results obtained by Abd El-Gawad *et al.* (1997) on goats, reported that, plasma and blood volumes increased (P<0.01), this increase could be attributed partly to higher intake of saline well water. On contrast, Nasr *et al.* (2002) reported that, PV and BV decreased in goats fed *Atriplex halimus*.

Table (2): Means \pm SE of plasma volume (PV), blood volume (BV), red cells volume (RCV) and hematocrit (Ht) values in lambs fed clover hay or *Kochia indica*

| Item | Periods | | | | (SE) (\pm) | Changes% | |
|----------|---------|-------|-------|-------|-------------------|----------|---------|
| | Initial | | Final | | | C | T |
| | C | T | C | T | | | |
| PV (L) | 0.817 | 0.789 | 1.14 | 1.17 | ± 0.05 | 39.53** | 48.29** |
| % of LBW | 4.41 | 4.26 | 4.6 | 4.75 | | 0.19 | 0.5 |
| BV (L) | 1.12 | 1.07 | 1.53 | 1.60 | ± 0.07 | 36.61** | 49.53** |
| % of LBW | 6.0 | 5.78 | 6.1 | 6.5 | | 0.1 | 0.72 |
| RCV (L) | 0.299 | 0.282 | 0.399 | 0.433 | ± 0.02 | 31.44** | 53.55** |
| % of LBW | 1.61 | 1.52 | 1.61 | 1.76 | | 0.0 | 0.24 |
| Ht (%) | 26.75 | 26.25 | 25.63 | 27.0 | ± 0.15 | -4.19 | 2.86* |

C: consists of clover hay plus concentrate feed mixture SE = standard error * = (P<0.05) ** = (P<0.01)

T: Consists of fresh *Kochia indica* plus concentrate feed mixture

Regarding the effect of period, the mean values of PV, BV and RCV increased (P<0.01) from initial to the end of study for both T and C groups. However, these values were nearly constant relative to the LBW at the same occasions of measuring. At the start of the study, the percentages of PV, BV and RCV were 4.26, 5.78 and 1.52% for T group vs. 4.41, 6.0 and 1.61% for C group, respectively. The corresponding values at the end of study were 4.75, 6.5 and 1.76% vs. 4.6, 6.1 and 1.61%. On contrast, Singh and Taneja, (1978) reported that, Marwari ewes provided different levels of salinity in drinking water exhibited no signs of change in their blood volume over a period of six months.

The results (Table, 2) indicated that no significant effect of treatment on hematocrit value. This result was in agreement with the finding of Nasr *et al.* (2002). Likewise, Azamel (1997) and Badawy *et al.* (2002) reported that, the values of packed cell volume of lambs and kids fed Atriplex and Acacia lied within the normal range reported for sheep and goats. Statistical analysis showed significant increase (P<0.05) in hematocrit value as percentage from initial value in lambs fed *Kochia indica* by the end of experimental period.

Changes in predicted body compositions:

In-vivo body composition is essential for studying both the growth performance and body development. It is known that, there are high correlations between the body weight and the weights of its components. That body composition could be predicted from body weight and total body water in animals of the same breed and even consuming different amounts of the same diet. Although, animals under study was of the same breed but fed on different roughage diets, the rates of change in body composition (TBP, TBF and TBA) were approximately similar (Table 3) and this may prove the nutritive value of *Kochia indica* and clover hay were much similar. Fahmy and Ibrahim, (2005-b) reported that, concentrations of crude protein and potassium were similar between *Kochia indica* and clover hay. Moreover,

digestibility of dry matter, crude protein and crude fiber were greater for *Kochia indica* than clover hay.

Table (3): Means ± SE of total body protein (TBP), total body fat (TBF) and total body ash (TBA) in lambs fed clover hay or *Kochia indica*

| Item | Periods | | | | (SE) | Changes% | |
|----------|---------|-------|-------|------|-------|----------|---------------------|
| | Initial | | Final | | | C | T |
| | C | T | C | T | | | |
| TBP (Kg) | 2.95 | 2.91 | 4.02 | 3.97 | ±0.15 | 36.27 | 36.43 ^{NS} |
| TBF (Kg) | 4.43 | 4.49 | 5.35 | 5.47 | ±0.14 | 20.77 | 21.83 ^{NS} |
| TBA (Kg) | 0.795 | 0.784 | 1.08 | 1.07 | ±0.04 | 35.85 | 36.48 ^{NS} |

C: consists of clover hay plus concentrate feed mixture SE = standard error NS= non-significant

T: Consists of fresh *Kochia indica* plus concentrate feed mixture

Regarding the effect of treatment on body composition, few studies are available. Statistical analysis indicated that, no significant differences were found in the predicted in-vivo body composition (TBP, TBF and TBA). Also, no particular trend observed between two groups of animals under study. The rates of changes were +36.4, +21.83 and +36.48% for TBP, TBF and TBA for lambs fed *Kochia indica* versus +36.27; +20.77 and +35.85% for lambs fed clover hay, respectively. Itoko *et al.* (2006) on cattle and Buffaloes, found that The 48h of water deprivation affected the mobilization of body fat and protein, but with no significant difference among animal species in the change of empty body composition, while Abdel-Fattah (1994) on sheep found that, TBP and TBA increased significantly ($P<0.01$) by increasing the level of salinity in drinking water in summer and winter.

Feed and water intakes:

Chemical composition and mineral contents of feed ingredients and tested rations (% on DM basis) are given in Table 4. The present results regarding the chemical composition of *Kochia indica* are close to the findings of Nour (1995) and Shehata *et al.* (2001). The mean of total feed intakes (± SE) for lambs fed *Kochia indica* (Table 5) was greater ($P<0.01$) than those consumed by control group. This increase was attributed to the increase ($P<0.01$) intake of *Kochia indica* in fresh matter compared with clover hay. Fahmy and Ibrahim, (2005-b) found that, Barki lambs consumed more dry matter and organic matter amounted to 31.9 and 29.9% from *Kochia indica* than clover hay, respectively. Nour (1995) found that, when fresh *Kochia indica* was fed as a sole diet of adult Rahmany rams, the dry matter intake was higher ($P<0.01$). The results indicated that, the total digestible nutrient (TDN) was 542 vs. 469 g/head/day and the digestible crude protein (DCP) was 81.2 vs. 67.1g/head/day for lambs fed *Kochia indica* compared to those of clover hay groups, respectively (Table5). This result was in agreed with Fahmy and Ibrahim, (2005-b) on Barki lambs.

Table (4): Chemical composition and mineral contents of feed ingredients and tested rations on dry matter basis (%)

| Item | DM | CP | CF | EE | NFE | Ash | OM | Na+ | K+ |
|----------------------|------|------|------|------|-------|------|------|------|------|
| Clover hay | 89 | 13.9 | 29.6 | 3.90 | 38.5 | 14.1 | 85.9 | 2.52 | 1.96 |
| <i>Kochia indica</i> | 39.9 | 12.5 | 27.0 | 3.53 | 41.17 | 15.8 | 84.2 | 2.96 | 1.81 |
| CFM | 90 | 15.5 | 25.7 | 3.61 | 46.99 | 8.20 | 91.8 | 0.80 | 1.37 |
| C ration | 89.5 | 14.7 | 27.5 | 3.74 | 43.16 | 10.9 | 89.0 | 1.61 | 1.65 |
| T ration | 63.1 | 13.9 | 26.4 | 3.57 | 43.83 | 12.3 | 87.6 | 1.96 | 1.60 |

C ration: consists of clover hay plus concentrate feed mixture CF= crude fiber EE= ether extract

T ration: Consists of fresh *Kochia indica* plus concentrate feed mixture DM= dry matter, CP= crude protein,

NFE= nitrogen free extract OM= organic matter Na⁺ = sodium K⁺ = potassium

Table (5): Means ± (SE) of feed and water intakes in lambs fed clover hay (C) or *kochia indica* (T) during water balance study

| Item | Experimental groups | | SE (±) | T test |
|---|---------------------|---------|--------|--------|
| | C | T | | |
| Concentrate | 0.535 | 0.537 | 0.28 | NS |
| Roughage, Kg (base a dry matter) | 0.509 | 0.853 | 1.24 | ** |
| | --- | (1.42▲) | | |
| Total feed intake, Kg (base a dry matter) | 1.044 | 1.390 | 1.35 | ** |
| Dry matter intake (g/Kg BW) | 42 | 52 | 0.02 | ** |
| Digested nutrients intake: | | | | |
| * TDN, g/head/day | 469 | 542 | 1.59 | NS |
| * DCP, g/head/day | 67.1 | 81.2 | 0.41 | * |
| Free water intake (L/h/d) | 4.207 | 4.352 | 0.04 | * |
| Free water intake (ml/g DMI) | 4.03 | 3.13 | 15.8 | * |

C: consists of clover hay plus concentrate feed mixture; ▲ = *Kochia indica* as a forage * = (P<0.05)

TDN = Total digestible nutrient

DCP = digestible crude protein

T: Consists of fresh *Kochia indica* plus concentrate feed mixture NS= non-significant

**= p<0.01

Free water intakes for lambs fed *Kochia indica* and those fed clover hay were 4.352 and 4.207L/head/day. The results in Table 6 and statistical analysis revealed that, there was significant increase (P<0.01) in free water intake for lambs fed *Kochia indica* compared with those fed clover hay. These results were in agreement with the results of Abou-El Nasr *et al* (1988) and Sooud *et al.* (1993) on sheep, goat and camels. The results in Table 5 revealed that, values of free water intake represented 3.13 and 4.03 ml/g of DMI for lambs fed *Kochia indica* and those fed clover hay, respectively.

Water balance:

Regarding the water balance components (Table 6), Total water intake consisted of 4.352; 1.233 and 0.3252 L/head/day for free; feed and metabolic water, respectively for lambs fed *Kochia indica*. The corresponding values for lambs fed clover hay were 4.207; 0.935 and 0.2814 L/head/day. These results revealed that, feed water is greater (P<0.05) for lambs fed *Kochia indica* than for those fed clover hay due to higher moisture percentage (dry mater of *Kochia indica* equal to 39.9%, Table 4).

Total water intake significantly ($P < 0.01$) varied between the two diets. The total water intake followed the same trend of feed water intake. Such results are in agreement with those reported by Hassan *et al.* (1982); El-Shaer and kandil, (1990); El-Shaer *et al.* (1991) on sheep and goat, Shawket *et al.* (2002) on lambs and kids, Fahmy and Ibrahim, (2005-b) on Barki lambs.

Table (6): Water balance for Barki lambs fed clover hay (C) or *Kochia indica* (T) during summer season

| Variable | Experimental groups | |
|-----------------------------------|---------------------|-----------|
| | C | T |
| Free water intake (L/d) | 4.207 | 4.352 * |
| Free water intake (ml/kg BW) | 170.32 | 176.91 |
| Feed Water intake (L/d) | 0.935 | 1.233 * |
| Feed Water intake (ml/kg BW) | 37.84 | 50.12** |
| Metabolic water intake (L/d) | 0.2814 | 0.3252 |
| Metabolic water intake (ml/kg BW) | 11.39 | 13.22 |
| Total water intake (L/d) | 5.423 | 5.9102 ** |
| Total water intake (ml/kg BW) | 219.55 | 240.25 |
| Water loss via urine (L/d) | 1.306 | 1.986 ** |
| Water loss via feces (L/d) | 0.413 | 0.518 * |
| Total water losses (L/d) | 1.719 | 2.504 ** |
| Total water losses (ml/kg BW) | 69.59 | 101.79 |
| Water balance (ml/kg BW) | 149.96 | 138.46 |

Metabolic water = one gram TDN intake produce 0.6ml metabolic water (English,1966).

For lambs fed *Kochia indica*, total water loss consisted of 1.986 and 0.518 L/head/day for urinary water and fecal moisture, respectively. The corresponding values for lambs fed clover hay were 1.306 and 0.413 L/head/day. According to water balance values in Table 6, urinary water excretion increased as the increase of water intake in lambs fed *Kochia indica* compared with lambs fed clover hay. Kandil *et al.* (1985) reported that, urinary water excretion increased as the increase of water, respectively for lambs fed *Kochia indica*. The corresponding values for lambs fed clover hay were 4.207; 0.935 and 0.2814 L/head/day. These results revealed that, feed water is greater ($P < 0.05$) for lambs fed *Kochia indica* than for those fed clover hay due to higher moisture percentage (dry mater of *Kochia indica* equal to 39.9%, Table 4). Total water intake significantly ($P < 0.01$) varied between the two diets. The total water intake followed the same trend of feed water intake. Such results are in agreement with those reported by Hassan *et al.* (1982); El-

Shaer and kandil, (1990); El-Shaer *et al.* (1991) on sheep and goat, Shawket *et al.* (2002) on lambs and kids, Fahmy and Ibrahim, (2005-b) on Barki lambs.

Water intake resulting high water turnover rate. The same pattern was observed on the fecal moisture and consequently on the total water excretion in camels as effected by drinking saline water. El-Faramawy (1984) and Abdel-Fattah, (1994) found that, urine volume of saline-watered sheep was significantly ($P<0.01$) higher than that of the control group by all the levels of salinity in drinking water. Increasing water excretion through the urinary pathway is believed to be an adaptive mechanisms assisting the animal to get rid of excess salts and maintaining the osmolarity of blood and other body fluids (Ahmed, 1984). Water excretion via faeces in the two groups showed similar trend and recorded lower values of 0.518 vs. 0.413 L/day in lambs fed *Kochia indica* compared with lambs fed clover hay.

Water balance for lambs fed *Kochia indica* retained +138.46 ml/kg LBW, versus +149.96 ml/kg LBW for lambs fed clover hay. These results showed that, the animals fed *Kochia indica* remained water balance near to the control group, accordingly it could be expected that, the treated group had tolerant thermoregulation similar to the control group under heat stress of the desert. The same findings were reported-by Hamed *et al.* (2007).

The results in Table 6 and statistical analysis revealed that, there was an apparent increase ($P<0.01$) in each of water intake and water output in lambs fed *Kochia indica* compared with lambs fed clover hay. These results were in agreement with the results obtained by Abou-El-Nasr *et al.* (1988) and Sooud *et al.* (1993) on sheep, goat, and camels.

CONCLUSION

When growing Barki lambs were subjected to salt stress in *Kochia indica* for 90-day experiment during summer season, live body weight (LBW) change was generally positive without significant differences between control and treated groups. Also, values of total body water (TBW), extracellular fluids (ECF), intracellular fluids (ICF) and interstitial fluids (ISF) were similar in both groups of lambs fed *Kochia indica* and those fed clover hay. For prediction of body composition and growth performance by Antipyrine dilution technique, this method explained no variations between treated and control groups. Water balance indicated that lambs fed *Kochia indica* showed higher water turnover rate or higher total water intake and excretion ($P<0.01$) compared to the control group.

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ميزان الماء وتوزيع سوائل الجسم للحملان البرقي المغذاة على نبات الكوخيا انديكا المنزرع بجنوب سيناء

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يعتبر الكوخيا انديكا احد نباتات المراعي الحولية التابعة للعائلة الرمرامية التي تتحمل الجفاف والملوحة وتصلح نباتاته لتغذية الحيوانات لارتفاع قيمتها الغذائية ولذلك تم تنفيذ هذا البحث بمحطة بحوث رأس سدر بزراعة نبات الكوخيا انديكا وتسميده بالسماد العضوي (بمعدل ٤٠ م ٣ للفدان) تحت ظروف الري بالمياه المالحة (٨٠٠٠ جزء في المليون) حيث استخدم في هذه الدراسة ١٦ ذكر اغنام برقي نامي (متوسط الوزن ١٨,٥ ± ٢,٥٥ كجم) خلال موسم الصيف و قسمت الحيوانات الى مجموعتين متساويتين حيث غذيت المجموعة الاولى على دريس البرسيم المصري (لحد الشبع) بينما غذيت المجموعة الثانية على شجيرات الكوخيا انديكا (لحد الشبع) بالإضافة الى تغذية تكميلية للمجموعتين بمخلوط العلف المركز لتغطية ١٠٠% من الاحتياجات الحافظة من الطاقة وذلك لمدة ٩٠ يوما خلال موسم الصيف.

هدفت الدراسة الى: بحث التغيرات التي قد تحدث في توزيع سوائل الجسم ومكونات الجسم والكتروليات البلازما نتيجة التغذية على هذه النباتات الملحية وقد أجريت أيضا تجربة لدراسة

ميزان الماء Water balance study

التجربة الأولى:

اختصت بقياس سوائل الجسم ومكونات الجسم والكتروليات البلازما (عند بداية ونهاية الـ ٩٠ يوما) وهي كالتالي:

* سوائل الجسم الكلية TBW لكل حيوان باستخدام طريقة حيز الأنتيبيرين .
* حجم السوائل بين الخلايا ECF باستخدام طريقة الحقن الوريدي بمادة الـ Sodium thiocyanate .

* حجم بلازما الدم باستخدام الحقن الوريدي بصيغة الـ Evan's blue وقياس الهيماتوكريت تم حساب حجم الدم باستخدام معادلة حسابية.

* قياس تركيز كل من بلازما الصوديوم والبوتاسيوم

التجربة الثانية:

اختصت بدراسة ميزان الماء حيث وضعت الحيوانات في صناديق الهضم لقياس كل من الـ Input و الـ Output لكل حيوان على حده خلال الـ ١٥ الأخيرة من الدراسة.

وقد اوضحت النتائج ما يلي:

١- أظهرت النتائج حدوث تغيرات ايجابية في وزن الجسم دون فرق معنوي بين مجموعة الحملان المغذاة على الكوخيا انديكا والمجموعة المغذاة على دريس البرسيم المصري

- (الكنترول) حيث سجل معدل الزيادة في الوزن لمجموعة الكوخيا انديكا ٣٢,٧٩% مقابل ٣٢,٩٧% لمجموعة الكنترول خلال مدة التجربة.
- ٢- تساوت مجموعة الحملان المغذاه على الكوخيا انديكا مع تلك المغذاه على دريس الرسم المصري في معدل الزيادة اليومية لوزن الجسم حيث سجل ٦٧,٨ جرام/رأس/اليوم.
- ٣- فيما يخص ماء الجسم الكلي TBW لم يكن هناك فروق معنوية بين مجموعتي الكوخيا انديكا والمقارنة حيث كان معدل التغير ٣٦,٢٧% لمجموعة الكوخيا انديكا مقابل ٣٦,٢٧% لمجموعة الكنترول.
- ٤- سجل كل من سوائل الجسم سواء بين أو داخل الخلايا ICF, ECF ارتفاعاً في الحملان المغذاه على الكوخيا انديكا مقابل مجموعة الكونتترول حيث سجلت ٣٣,٢٥ مقابل ٣٢,٤٣% للـ ECF بينما سجلت ٢٤,٦٨ مقابل ١٨,٣٣% للـ ICF.
- ٥- أظهرت النتائج ارتفاعاً في حجم الدم وبلازما الدم وحجم خلايا الدم الحمراء في مجموعة الكوخيا انديكا عن مجموعة الكنترول (٤٩,٥٣ & ٤٨,٢٩ & ٥٣,٥٣% مقابل ٣٦,٦١ & ٣٩,٥٣ & ٣١,٤٤%).
- ٦- زيادة ماء الجسم الكلي ومكوناته أدى إلى زيادة ايجابية في وزن الجسم في المجموعتين وفي المقابل كان هناك زيادة ايجابية في مكونات الجسم من البروتين والدهن والرماد في المجموعتين.
- ٧- سجلت مجموعة الحملان المغذاه على الكوخيا انديكا ارتفاعاً معنوياً في معدل استهلاك ماء الشرب وفي المقابل زيادة في حجم البول الخارج عن المجموعة الكنترول.
- ٨- سجل تركيز بلازما الصوديوم ارتفاعاً معنوياً في مجموعة الكوخيا انديكا عن مجموعة الكونتترول بينما تشابه تركيز البوتاسيوم في المجموعتين .
- وخلصت الدراسة إلى تقبل الحملان البرقي التغذية على نباتات الكوخيا انديكا كبديل للأعلاف التقليدية مع درجة عالية من التحمل لملوحة هذه النباتات دون حدوث آثار جانبية خلال مدة التجربة.