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PRODUCTIVE PERFORMANCE OF BARKI EWES FED MIXTURES OF SALT TOLERANT PLANTS WITH PROTECTED FAT OR YEAST UNDER DESERT CONDITIONS

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SUMMARY

Thirty Barki ewes were randomly distributed into three equal groups to investigate the impact of feeding a mixture of salt tolerant plants (MSTP) with addition the protected fat (PF) or yeast (Y) on productive performance of Barki ewes. Ewes were fed one of the following experimental rations: Group1: Berseem hay (BH) + (CFM) without any feed additives as a control, Group 2 and 3: A mixture of salt tolerant plants (MSTP) composed of 50% Atriplex nummularia and 50 % Pearl millet (Pennisetum glaucum) + CFM with 30 gm protected fat or five gm yeast/h/d, respectively. The results in the palatability trial showed that rations contained MSHP recorded lower feed intake values than the control group (BH). Values of dry matter intakes indicated insignificant differences among groups. Water metabolism criteria demonstrate that, the tested feed additives (PF or Y) had no effect on daily water utilization. Ruminal pH and some blood measurements were within physiological and healthy ranges. Body weight of ewes in the present study were in the normal range of Barki ewes under similar conditions. Results of milk yield showed insignificant differences among groups. Lambs performance (Birth and weaning weights) didn't exhibit any significant difference among different experimental groups. The better feed conversion as Kg DM intake/L milk yield was recorded for ewes maintained on (MSTP+PF) in comparison with BH group. Economic efficiency of experimental rations was almost similar among groups.

Keywords: Salt Tolerant Plants, Protected Fat, Yeast, Barki Ewes Performance

INTRODUCTION

Animal production sector in Egypt have some challenges, especially in arid and / or semiarid regions such as, (i) availability of such lands to be cultivated with conventional fodder; such areas are threatened by salinization or desertification (Qadir *et al*., 2008), (ii) degradation of rangelands in many parts of Egyptian desert as a result of high evaporation rates, overgrazing, low erratic rainfall and long drought periods (El-Shesheny *et al*., 2014). iii) shortage in feed stuffs and scarcity of irrigated water are the two main factors controlling the sufficient animal production (Ibrahim *et al*., 2018). iv) high costs of transporting feed to the border governorate, (Helal *et al*., 2018a).

As a result of increasing salinity of soil and scarce of different available water in areas of the world, some new prospects had been made for increasing livestock production, (Masters *et al*., 2007). Cultivation of salt-tolerant plants or halophytes in lands that suffered from/or influenced by salinity had extra benefits such as, significant social and economic potentiality, prevent salinification and economically produce more available forage crops to meet nutrients requirements and confrontation feed shortage and high feeding costs, (Fahmy *et al*., 2010). There are numerous fodders can be cultivated under saline conditions, and historically, they have been used as green fodder for grazing livestock and being involved as components of mixed rations to replace traditional roughage (Masters et al., 2007).

Cultivated halophytes (*Atriplex species*) and salt tolerant plants (*Pearl millet*) have the advantage of tolerating high salt levels under saline lands and have economic potentialities under harsh conditions, (El Shaer, 1999). Also, the vegetative yields of halophytes and other salt-tolerant plants species could have great potentialities, particularly as sources of livestock fodders (Anon., 2009) Several attempts have been used to utilize and enhance desert forage resource that enhanced their acceptability for sheep in such area (Abo Bakr *et al*., 2020a).

One of these procedures is feed additives (e.g. yeast or/and protected fat) which are added to animal rations for rapid growth, improving feed efficiency, increasing animal productivity and/or healthy animal status. Daily ewes feed requirements increased dramatically during late pregnancy and early lactation, so using protected fat in ewes ration becomes more common practices (Schmidely and Sauvant, 2001).

Adding protected fat to diets of lactating ruminants could cover the high energy demands during early lactation (Antongiovanni *et al*., 2002). On the other hand, fewer studies with lower information are available on fat supplementation for small ruminants than for that of dairy cows (Chilliard *et al*., 2003). Casals *et al*. (2006) reported that the information on the effect of Ca salts supplied for dairy sheep under practical conditions are not enough available. Yeast supplementation to ruminant rations may improve feed intake, milk production, animals weight gain, improve digestion and animal ruminal fermentation. On the other side, yeast supplementation can be leading to an improvement in the productive performance of dairy ewes, (Masek *et al*., 2008).

Barki sheep have some advantages which favored them as an important source of cash revenue as well as having adaptability to desert climatic conditions, beside that they can survive on nontraditional forage (Askar *et al*., 2016).

The aim of the present study was to evaluate addition of protected fat or yeast to ewes rations based on salt tolerant plants on their productive performance under desert conditions.

MATERIALS AND METHODS

Experimental location:

This study was carried out at Ras Sudr research station, located at South Sinai governorate and belongs to Desert Research Center, Ministry of Agriculture and Land Reclamation.

Experimental Animals and feeding trials:

Thirty Barki ewes were randomly distributed into three equal groups (10 animals/ group) and housed in separated shaded pens. Group feeding trial for ewes started at late gestation period (4 weeks pre lambing). Concentrate feed mixture (CFM) was offered to animals according to their physiological status (Kearl, 1982). CFM was offered to cover 70% of the daily requirements (as a percentage of live body weight) of ewes at late gestation and only 50% during the early lactation for all experimental groups. Ewes were fed one of the following experimental rations: **Group1:** Berseem hay (BH) + concentrate feed mixture (CFM) without any feed additives as a control ration named as (BH). **Group 2:** A mixture of salt tolerant plants (MSTP) composed of 50% *Atriplex nummularia* and 50 % Pearl millet y(*Pennisetum glaucum*) + CFM with 30 gm protected fat (PF) /h/d, this ration named (MSTP +PF)**. Group 3:** the same MSTP+ CFM and with 5 gm /h/d from dried baker's yeast(*Saccharomyces cerevisiae*); this ration named (MSTP+Y). Experimental feed additives were mixed with a small amount of CFM and offered daily before feeding. chemical composition of protected fat (calcium soap) in given in Table (1).

The palatability trial: After the fourth month of gestation, the same thirty experimental ewes were used in a palatability trial to justify the tested ration's palatability compared to Berseem hay. All roughages were offered *ad libitum* and the refusals were daily collected and weighed to determine the actual daily roughage intake of experimental animals. Palatability trial was made to observe palatable of mixture of salt tolerant plants and continued until the daily roughage consumptions reached a constant level.

Feeding trial: Thirty Barki ewes at late gestation weighting in average 36.6 kg aged 3-4 years old were kept indoors and allocated to 3 dietary treatment groups in a complete randomized block design, which extended later to another 6 weeks of lactation. Daily feed intake and the refuels, if any, were daily weighed and recorded. Animals had free access to water throughout the experiment. Newborn lambs were weighed at birth and biweekly intervals thereafter, for 6 weeks (rearing period).

Milk yield estimation:

The total milk yield (TMY) was biweekly determined, starting from the second week of lambing till the sixth week of lactation, using the hand-milking procedure technique after separation of lambs from their dams. Lambs were separated from their mothers at 7.00 p.m on the day before measuring milk production. In the following day, lambs were weighted and left to suckle their dams till satisfaction, then kept away from their mothers until 7.00 pm, then the lambs were weighted again before and after night suckling. The amount of milk consumed by each lamb in the morning and afternoon was calculated by the difference between weight recorded before and after suckling.

Table 1. Chemical composition (g/kg) of calcium soaps of fatty acid (CSFA)*

Item	g/kg	Item	g/kg
Total fat	840.0	Linoleic acid	79.8
Myristic acid	12.6	Ash	110.0
Palmitic acid	369.6	Ca++	9.9
Stearic acid	42.0	Moisture	50.0
Oleic acid	336.0	*cited from Younis *et al*., (2012)	

Lambs Performance:

Newborn lambs were ear tagged and their birth weight (BW) was recorded within 24 hours after lambing and at two biweekly intervals thereafter, till early weaning at 6 weeks of age. The lambs were left during this period and fed (if any) with their mothers, in order to estimate lambs growth performance average daily gain (ADG).

Metabolism trials:

By the end of the feeding trial, metabolic trials were conducted using nine adult rams (44.58±1.71LBW and 2-3 years old) to estimate dry matter digestibility and daily water intake. Animals were fed in groups for 3 weeks in shaded pens and then fed individually in metabolic cages for 21 days (14 days as an adaptation period followed by another seven days as a collection period). Total feces were daily recorded and 10% of the total feces were daily taken and dried to estimate dry matter digestibility. Daily water intake was also recorded during the experimental period.

Analytical procedures:

Dry matter (DM), crude protein (CP), crude fiber (CF), ether extracts (EE) and ash of feed ingredients were determined according to A.O.A.C (2005), while carbohydrates as nitrogen-free extract (NFE) were calculated by differences. Cell wall constituents of feed ingredients as neutral detergent fiber (NDF) were determined according to Van Soest (1991). Gross energy (GE cal/g) of feed was measured by bomb calorimeter (IKA, model C 200, Staufen, Germany), using benzoic acid as a standard. pH value of rumen fluid samples was determined at 0.3 and 6 hr. of feeding using a digital pH meter.

Blood Sampling:

Blood samples were collected at the end of the feeding trial from the jugular vein of ewes (three in each group). Blood samples were analytically assessed to determine some hematological parameters, including count of red and white blood cells (RBC's and WBC's). Hematocrit value (Ht) and hemoglobin (Hg) concentration in the whole blood were also assessed. Means of corpuscular hemoglobin concentration (MCHC), corpuscular hemoglobin (MCH), corpuscular volume (MCV) values were calculated (Patterson *et al*., 1960).

Statistical analysis:

Data obtained in this study was statistically analyzed by one way of variances according to SAS (2004) using the following model; $Y_{ij} = \mu + T_i + e_{ij}$, whereas; Y_{ij} = experimental observation, μ = overall mean, T_i = effect of treatment, e_{ij} = experimental error. Differences among means were compared by Duncan's multiple range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition of experimental feed stuff:

Data in table (2) showed the chemical composition of concentrate feed mixture (CFM), berseem hay (BH) and the mixture of salt tolerant plants (MSTP). As shown, CFM contained acceptable percentage of nutrients for sheep nutrition, it was nearly similar to those obtained by Helal, *et al*., (2018a) who reported that, values of OM, CP, CF and NFE were 89.20, 14.72, 12.27 and 59.06, respectively. Chemical composition of the tested roughages (Table 2) showed that BH contained higher CP, NFC, NDS and GE than MSTP by 72.42%, 9.02%, 8.89% and 8.83%, respectively. Generally, the percentages of NFC for experimental roughages were within the lowest range (20-25%, NFC, Wheeler, 2003). On the other hand, MHP recorded higher CF, Ash and NDF than BH by 10.70%, 26.01% and 8.31%, respectively. This result was in agreement with El Shaer (2010) and Fahmy *et al*., (2010) who reported that halophytes and salt tolerant plants had higher concentrations of ash and CF, it was also noticeable that the mixture of halophyte plants contained lower CP value (7.18%) in comparison with BH (12.38%)**;** this meant that feeding small ruminants with mixture of halophyte plants needed to be supported with one additional nitrogenous supplement to cover their daily protein requirements as recommended by Kearl (1982).

Palatability results:

The results of palatability trial are illustrated using a Figure (1) which indicate that, the minimum roughage intake value during the first three days was that of ewes fed the third ration (MSTP+Y) followed by the second (MSTP+PF), while ewes fed BH (control group) recorded the highest roughage value. This finding might be referred to that ewes in the second and third groups were less adapted to halophyte plants (nontraditional roughage). This result agreed with those obtained by Ahmed *et al*., (2015) who pointed out to lower intake value from halophytes than BH during the first week of feeding. By the beginning of 2nd week, dry matter intake (DMI) of the different tested roughages started to be constant for different groups.

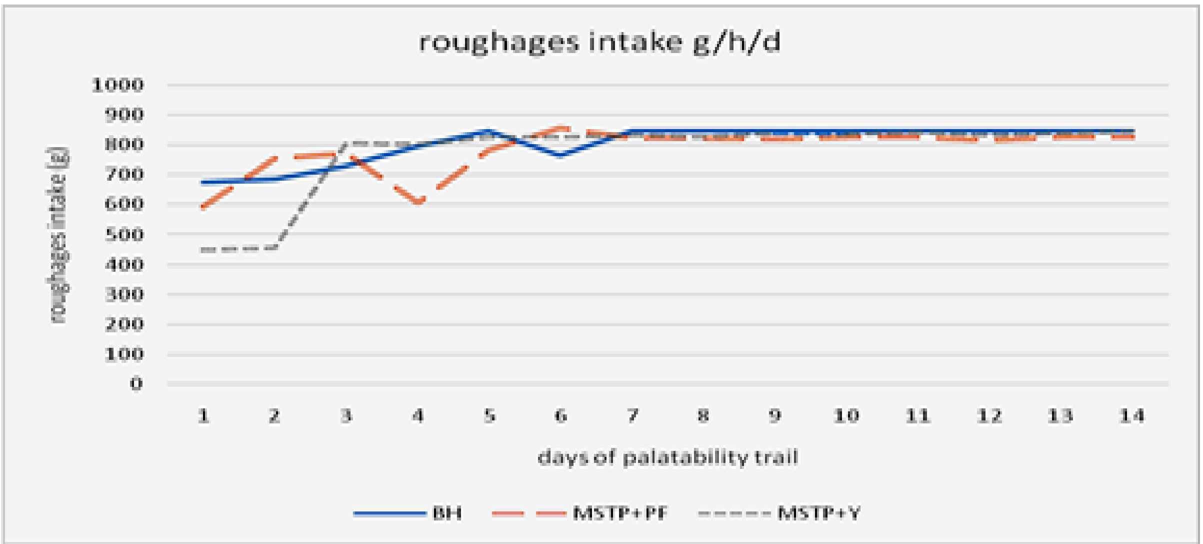

Figure 1. Roughages intake (g/h/d) for ewes during palatability trial. BH: berseem hay; MSTP+PF: mixture salt tolerant plants plus protected fat; MSTP+Y: mixture salt tolerant plants plus yeast.

Table 2. Chemical composition of CFM and experimental roughages (% on DM basis)

Items	Experimental rations		
	Concentrate feed mixture (CFM)	Berssem hay (BH)	Mixture of salt tolerant plants (MSTP)
DM	91.54	89.43	89.82
OM	89.5	87.93	84.79
CP	14.03	12.38	7.18
CF	11.42	31.67	35.06
EE	2.41	2.31	2.21
NFE	61.64	41.57	40.34
Ash	10.50	12.07	15.21
NDF	58.27	49.57	53.69
NFC1	14.79	23.67	21.71
NDS2	41.73	50.43	46.31
GE3 *(cal. /g)*.	3986	3177	2919

1NFC (Calsamiglia *et al*., 1995): Non fibrous carbohydrates% = 100 - (CP% + EE% + Ash% + NDF%). 2NDS: Neutral detergent soluble = 100 – NDF. 3GE: Gross energy *(cal. /g)*.

As a general evidence, rations contained MHP recorded lower feed intake values (during first week) than the control group (BH). The lowest intake for (MSTP+Y and MSTP+PF groups) might be referred to their high ash and fiber contents (Attia-Ismail, 2015) or/and due to the lower crude protein percentage in salt tolerant plants, which might decrease roughage intake (Abo Bakr *et al*. 2020a).

Voluntary feed intake and digestion coefficient of dry matter:

Concentrate, roughage, total DMI and digestion coefficient of dry matter are presented in (Table 3). Values of DM (concentrate, roughage and total DMI g/h/d) indicated insignificant differences among groups. The present results of intake are supported by the findings of El-Waziry and Ibrahim (2007) for ration supplemented with yeast, and Ebeid *et al*. (2007) also, pointed out to insignificant differences in DM intake for rations supplemented with protected fat compared with the unsupplemented ones, and as a general evidence, ration contained MSTP plus yeast recorded the highest DMI intake value than (MSTP+PF), while (BH) group (the control) recorded the lowest values. Similar results were obtained by Kewan *et al*. (2021) who observed a slight increase in DMI for ruminants supplemented with yeast as compared with the control ration. Data of DM digestibility in the current study did not differ ($P<0.05$) between both the two types of feed additives (PF or Y) and that of the control. Similar results were obtained by Ghoniem and Atia (2020) who reported that there were no significant differences in DM digestibility between rations supplemented or unsupplemented with protected fat, while, Helal *et al*. (2018b) pointed out to lower DM digestibility for ration contained mixture of halophytes and supplemented with Propionic bacteria compared to control.

Table 3. Dry matter intake (g/h/d) and experimental rations DM digestibility (on DM basis)

Items	Experimental rations			±SE
	BH	MSTP+PF	MSTP+Y	
Concentrate intake (g/h/d)	378	381	394	23.72
Roughage intake (g/h/d)	463	466	478	29.82
Total intake (g/h/d)	841	847	872	53.53
% Digestion coefficients of DM	56.64	47.89	52.37	3.43
Crude protein intake from concentrate	53.0	53.5	55.3	3.33
Crude protein intake from roughage	57.62^{a}	33.46^{b}	34.3^{b}	2.96
Total Crude protein intake	110.62^{a}	86.96^{b}	89.60^{ab}	4.30
Total Crude protein intake/ kg LBW	24.86^{a}	19.40^{b}	20.2^{b}	1.18

a, b means at the same row with different superscript are significant at (P<0.05).

Results herein, were consistent with those previously obtained by Askar *et al*. (2016), who reported lowest digestibility for ration based on halophyte fodder in compared with high quality roughage (BH), which might be attributed to its highest fiber content and lowest CP concentration, for the former which might have turned to negative digestion impacts. CP intake from CFM for different tested rations indicated insignificant differences among groups, while ewes of the control group recorded higher ($P<0.05$) CP intake value from BH than the other two groups, this may be referred to the high CP content for BH ration compared with MSTP (Table2). The same trend, was also observed for the total CP intake (g/kg LBW) were showed higher ($P<0.05$) value (26.9%) for the control (BH) than

(MSTP+PF) group. Generally, values of total CP intake (g/kg LBW) ranged between 19.4 g/kg LBW in MSTP+PF group to 24.86 g/kg LBW in BH group.

Water utilization:

Water metabolism criteria are shown in (Table 4). Data demonstrate that, the tested feed additives (PF or Y) had no effect ($p<0.05$) on daily water utilization (total water intake, fecal, urinary, the total water execration and water balance). Generally, animals fed control ration (BH) showed insignificant higher drinking and total water intake (ml/h/d) than those fed the other two tested rations (MSTP+PF and MSTP+Y). Such result was in corroboration with previous findings by Abo Bakr *et al*. (2020a). On the other hand, animals fed ration based on BH (control group) recorded insignificant higher water balance value (2257 ml/h/d) than rations contained MSTP and supplemented with different feed additives (PF or Y) by 25.7 and 20.2 %, respectively

Table 4. Water utilization (ml/h/d) as affected by feeding rams on different roughages and feed additives

Items	BH	MSTP+PF	MSTP+Y	±SE
Drinking water	4101	3812	3888	411.58
Feed water	90	90	93	5.77
Total water intake	4191	3902	3981	413.51
Fecal water	394	462	423	39.72
Urinary water	1540	1646	1681	363.33
Total water exertion	1934	2108	2104	333.71
Water balance ml/h/d	2257	1794	1877	194.47

Higher values of water balance were recorded by the control group (BH) which might be resulted as a consequence of higher water turnover rate and/or digest flow (Araújo *et al*., 2010). However, yeast group (MSTP+Y) showed the lowest water balance than BH group, this matter might be referred to that yeast have anti-oxidative stress effects for animals (Hyun-Sun *et al*., 2009). As general evidence, it is worth noting that, adding PF or Y to rations contained MSTP resulted in lower insignificant water consumption, and this result was acceptable as advantages to mammals raised under desert conditions.

Ruminal pH:

Ruminal pH value is one of the most important factors, which affect microbial fermentation in the rumen and in turn influenced its functions. Rumen pH at 0, 3 and 6 hrs. post-feeding on BH, MSTP+PF and MSTP+Y groups are given in (Table 5). Data showed that maintaining ewes on resulted in MSTP+PF treatment decreasing ($p< 0.05$) ruminal pH values for 3 hrs. post feeding as compared with the other two groups. In an agreement with our results, Behan *et al*., (2019) reported decreased ruminal pH value for animals fed rations supplemented with protected fat compared with the control. pH values at 6 hrs. post feeding indicated similar significant decrease ($p< 0.05$) in sheep fed ration supplemented with yeast compared with that of the control. These results agreed with the previous results of yeast supplementation (Kewan *et al*.,2021). Decreasing pH values in yeast group might be explained by releasing the yeast extracellular metabolites, including organic acids, in the rumen (Shurson, 2018). And as a general evidence, results indicated insignificant differences in average pH values among different experimental groups, which agreed with the findings of Bin Kim *et al*. (2020) and Behan *et al*. (2019) who reported that there was no change in ruminal pH value due to supplementing animal rations with protected fat.

Table 5. Effect of experimental rations on ruminal fermentation (pH value)

Items	BH	MSTP+PF	MSTP+Y	±SE
0 hr.	7.84	7.58	7.49	0.10
3 hr.	6.79^{a}	6.59^{b}	6.89^{a}	0.04
6 hr.	6.85^{a}	6.60^{ab}	6.47^{b}	0.10
Average	7.16	6.92	6.95	0.07

a, b means at the same row with different superscript are significant at ($P<0.05$).

Also, Kewan *et al*. (2021) who pointed out to insignificant differences in average ruminal value pH for sheep fed control or experimental ration (yeast or ZADO). As shown in (Table 5), ruminal pH values before feeding tented to be decreased after feeding; this result agreed well with the findings of Bhatt *et al.* (2013). Generally, the mean values of ruminal pH in the present study ranged between 6.92 to 7.16 and was within the range reported by Abo Bakr *et al*. (2020a and b) who reviewed from numerous studies that the normal ruminal pH value for Barki sheep (fed MSTP) ranged between (6.18 and 7.17).

Productive performance of ewes during experimental period:

Changes in live body weights for ewes fed experimental rations are shown in (Table 6). The obtained results indicated generally, insignificant difference in ewes weight among different tested rations, all over the different gestation and lactation periods however, there was a little insignificant increase by about (1.1%) on the average weight for (MSTP+PF) compared with BH (control group) during pregnancy. Similar results were previously observed by Younis, *et al*. (2012). Also, Kewan *et al.,* (2021) found that the weight of ewes fed rations supplemented with biological feed additives did not differ (P≤ 0.05) among groups.

Table 6. Effect of different tested rations on changes occurred in live body weight of Barki ewes during experimental period

Items	BH	MSTP+PF	MSTP+Y	±SE
Initial live body weight (LBW)	36.5	36.37	36.92	2.34
Avg. LBW during pregnancy period	47.85	48.39	47.44	1.94
Avg. LBW just before lambing	49.87	49.20	49.84	2.09
Avg. LBW after lambing	42.18	41.90	43.26	2.03
Body weight loss just after kidding	7.69	7.30	6.58	0.65
Avg. LBW during lactation period	44.67	41.38	42.42	1.64

Similarly, Helal *et al*. (2018b) pointed out to in significant difference in ewes body weights for those fed salt tolerant plants in compare with the corresponding ones fed with or without probiotic and the control. Practically, and under desert conditions, these results demonstrated the potentiality of such halophytes' mixture to fulfill pregnant animal's requirements which resulted in maintaining pregnant ewes in good body weight status during gestation. In general, weights of ewes in the present study were in the normal range (37.18 kg to 49.57) of Barki ewes which was recorded by some other authors (Ibrahim *et al*.,2018 and Helal *et al*., 2018b) under similar physiological, nutritional, climatic and geographic conditions.

Milk yield and economic evaluation for the experimental rations:

Results of milk yield during different weeks of lactation are shown in (Table 7) which indicted insignificant differences among groups. However, average daily milk yield was slightly insignificant increased for the control group ewes by about 4.6% and 17.7% compared with MSTP+PF and MSTP+Y, respectively. The higher insignificant daily milk yield (ml/h/d) for ewes of the control group might be related to type of roughage intake (BH) compared with those maintained on salt tolerant plants (MSTP groups). Similar results on lactating ewes fed halophytic (supplemented with probiotic) were obtained by Helal *et al*. (2018c) and Bianchi *et al*. (2018) who illustrated that, adding protected fat to ewes ration did not have any significant effect on ewes daily milk yield compared with the corresponding control group. On the contrary, Ibrahim (2014) clarified that Barki ewes fed halophytic silage had higher average daily milk yield than ewes fed traditional roughage (BH).

Table 7. Effect of different experimental rations on experimental ewes milk production

Items	BH	MSTP+PF	MSTP+Y	±SE
Avg. Milk Yield (ml/h/d) during first three weeks	524	512	446	25.72
Avg. Milk Yield (ml/h/d) during second three weeks	660	620	560	53.54
Avg. Milk Yield (ml/h/d) during the whole period	592	566	503	33.49

Contrarily, Ghoniem and Atia (2020) pointed out to higher (P<0.05) daily milk yield for lactating ewes fed ration supplemented with protected fat than that of the control ones. In general, the average milk production in the present study (503-592 ml/h/d) were within the normal range (510-720 ml/h/d) of Barki ewes species which detected by other numerous authors (El-Hawy *et al*., 2019 and Helal *et al*., 2018b) under desert conditions.

Lamb's performance:

Birth and weaning weights of newborn lambs in different experimental groups are shown in (Table 8). The average birth weight of lambs didn't exhibit any significant difference among different experimental groups and ranged between 3.68 to 3.99 kg/h for BH and MSTP+Y, respectively. The present results were consistent with those of Titi and Obeidat (2008). Similar results were also shown in lambs weaning weight indicating insignificant difference among different tested lambs groups, Mohammady *et al*. (2014) and Ibrahim *et al*. (2018) didn't find any significant difference in lambs birth and weaning weight for Barki lambs born to ewes fed salt tolerant plants in compared with those maintained on berseem hay.

Table 8. Growth performance of suckling lambs born to ewes fed different experimental rations

Items	BH	MSTP+PF	MSTP+Y	±SE
Average lambs birth weight (kg)	3.68	3.81	3.99	0.15
Average lambs weaning weight (kg)	9.83	9.34	9.38	0.28
Average daily weight gain (g/h/d)	147 a	132ab	128b	5.06
Average live body weight gain (kg) from birth to weaning	6.15a	5.53ab	5.39b	0.16

a, b means at the same row with different superscript are significant at (P<0.05).

However, results obtained pointed out to significant differences (P<0.05) between lambs born to BH and MSTP+Y ewes group in average daily (g/h/d) and total LBW gain (kg/group). Lambs born to the control ewes group recorded higher (P<0.05) gain compared with other tested groups. The average daily weight gains for different experimental lambs groups ranged between 128 and 147 g/h/d, which coincide with the published records of daily weight gain value (150 g/d) for lambs born to Barki ewes fed untraditional rations, but being lower than the values recorded for lambs born to Barki ewes fed traditional roughage and CFM (160 g/h/d) according to the recommended allowances of Farid *et al*. (2005). According to lambs performance results, it was concluded that, lambs born to ewes maintained on salt tolerant fodder during pregnancy and lactation could achieve moderate and normal healthy live body weight and daily gain without any dietary deleterious influences on lambs performance.

Blood parameters

Hematological parameters:

Hematological parameters of ewes fed different experimental rations were presented in (Table 9). As shown, different parameters indicated (P<0.05) differences among different tested groups (MSTP+PF and MSTP+Y) in compare with the control ewes (BH) group in different blood traits measurements. It was also noticeable that ewes fed MSTP+PF (group two) had significantly (P<0.05) higher RBC, Hb, MCH, MCHC and Ht values than the other two groups (9.33, 10.89, 11.70, 41.50 and 26.20. The higher (P<0.05) estimated values in RBCs and Hb for ewes of (MHP+PF or MHP+Y) groups might be attributed to a haemoconcentration status, due to the lower total water intake (Table 4) which coincide with that of (Abo Bakr *et al*., 2020a). Generally, the total mean RBC counts range for different experimental animals ranged between 7.15 to 9.33; such result agreed with those reported by (Egbe-Nwiyi *et al*., 2000) (6.30 – 8.29). The higher (P<0.05) increases in Hb concentration (in MSTP+PF group) are really associated with good health immunity and being an obvious indicator of good nutrition status of the experimental animals (Tambuwal *et al*., 2002). The higher (P<0.05) MCV value (29.88) was recorded by ewes maintained on ration supplemented with yeast (Group 3). this result agreed with those recorded by Abo Bakr *et al.* (2020b), who reported that adding yeast increased the average MCV blood values. The higher (P<0.05) values of MCH and MCHC were also assessed in ewes maintained on rations supplemented with dietary protected fat and yeast. Awodi *et al*. (2005) demonstrated that higher values of MCV, MCH and MCHC are very important indicators in the diagnosis of anemia and also served as a useful index of the capability of bone marrow to produce red blood cells. The average total mean WBC counts in this study ranged between 9.80 to 12.60 and was agreed with the findings of Holman (1944) and Egbe-Nwiyi *et al*. (2000) who cleared that the total WBS counts in sheep ranged between 11.86 to 16.17.

Table 9. Some hematological parameters recorded for ewes fed the different experimental rations at the mid suckling period

Items	BH	MSTP+PF	MSTP+Y	±SE
RBC	7.20^{c}	9.33^{a}	7.80^{b}	0.04
WBCs (10-3 Cells/mm3)	12.60^{a}	9.80^{b}	12.33^{a}	0.05
Hb (g/dl)	7.80^{c}	10.89^{a}	8.86^{b}	0.04
MCV (Fl=liter×10-15)	28.00^{b}	28.00^{b}	29.86^{a}	0.11
MCH (pg=10-12 g)	10.96^{c}	11.70^{a}	11.33^{b}	0.05
MCHC (%)	38.50^{b}	41.50^{a}	37.60^{b}	0.17
Ht (%)	20.40^{c}	26.20^{a}	23.60^{b}	0.10

a, b and c means at the same row with different superscript are significant at (P<0.05).

The higher (P<0.05) value of MCV (29.86) was assessed in ewes maintained on ration supplemented with yeast. This result agreed with those obtained by Abo Bakr *et al.*(2020b) who reported that adding yeast increased MCV values. The higher (P<0.05) values of MCH and MCHC were recorded in ewes maintained on ration supplemented with protected fat. Awodi *et al*. (2005) demonstrated that the higher values of MCV, MCHC and MCH are very important in the diagnosis of anemia and also serve as a useful index of the capability of bone marrow to produce red blood cells and are very important indicators in the diagnosis of anemia. The increased hematocrit values in the present study might be related to rations experimental additives, besides the lower total water intake (Abo Bakr *et al*., 2020b) and lower pH values. This was an inconsistent with the results obtained by Vieira *et al*. (2012) who suggested that, lower pH value tended to cause splenic contraction due to the action of epinephrine hormone which lead to an increase in hematocrit value. Such interpretation might lead to conclude that, feeding a mixture of halophyte plants did not result in any harmful effect on animal's immune system. On the other hand, Helal *et al.* (2017) demonstrated that feeding salt tolerant plants of mixture resulted in a significant decrease in RBCs, WBCs, PCV%, Hb concentration and MCHC, MCH (pg).

Productive performance and economic evaluation of Barki ewes fed the different experimental rations

Barki ewes productive performance:

Results of intake for ewes during the lactation period are presented in (Table 10). The obtained results showed that intakes from CFM, roughage or total dry matter (TDM) differed slightly and indicating nearly similar values. This result might be related to the no significant differences in ewes average live body weights during lactation period (Table 6). This result agreed with those obtained by Bianchi *et al*. (2018), who noted that there was insignificant difference in daily feed intake of different groups with or without protected fat, also Mahrous, *et al*. (2019), who didn't observe any significant difference in TDMI for dairy goats fed rations supported with yeast as compared with the unsupported ones. The better feed conversion (the lower values) as Kg DM intake/L milk yield was recorded for ewes maintained on (MSTP+PF) in compare with BH, while the worst was the corresponding group raised on (MSTP+Y). The present result herein, agreed with those recognized by Ghoniem and Atia (2020), who recognized better feed efficiency for groups consumed fatty acid supplemented ration as a result of their lower DM intake, but higher milk production, besides an improved digestion coefficients value of the experimental rations. From another point of view, the better feed conversion ratio estimated as average ewes MY/kg LBW of weaned lambs was (3.93L/kg) and /or (2.23 L/kg) as MY/ kg weaning weight gain during six weeks suckling period, respectively, (Table 10) was achieved by lambing group of ewes raised on salt tolerant plants and supplemented with yeast (group 3)Feed conversion ratio estimated as daily milk reared/average weaned lambs gain(kg) in our study ranged between, (3.92 to 4.29 L/kg, while that of Titi and Obeidat (2008), the ratio of milk consumed (suckled) to lambs daily gain for the control group and those supplemented with 3% protected fat ranged between 4.54 to 5.05 (kg/kg), respectively. Moreover, Helal *et al*. (2018b) reported that the milk feed conversion ratio for the control was 4.07 and improved to 3.95(L/kg) for lambs fed ration based on salt tolerant plants and supplemented with probiotic.

Economic evaluation:

Economic efficiency of experimental rations is presented in (Table 10). The average daily feed cost of concentrate was almost similar among groups, however, the cost of roughage in BH group was higher by about 2.7 and 2.5% compare with MSTP+PF and MSTP+Y, respectively. The higher feed cost (BH group) of daily roughage intake/head was due to the higher cost price of BH (3000 LE/ton) compared with (1250 LE/ton) for MSTP, hence (BH) group recorded the higher cost of daily feed intake (8.06 LE/h/d) in compared with the other two tested rations. This is mainly referred to the higher cost of BH, which was negatively reflected on the total daily feed cost of the control group and led consequently to higher feed cost. Abo Bakr, *et al*. (2020c) reported that economic efficiency is real affected by some other factors, such as cost of feed ingredients, daily dry matter intake, animals weight gains which might be consequently reflected on the net profit returns. Investigating economic efficiency (Table 10) pointed out to insignificant higher total gain in BH group (the control), while the higher cost of PF supplement (0.9 LE) was due to protected fat supplement negatively reflected on average return income. This result is consistent with Abo Bakr *et al*. (2020a) showed feeding sheep on salt tolerant plants.

led to higher net revenue (%) than animals fed BH under similar nutritional condition. According to the available economic data (Table 10) it was observed that the average feed cost/ewe/group was 338.5, 288.5 and 266.2 LE, respectively for different experimental groups allover 42 days suckling period. Total income (LE/ewe/group) as a result of kg. live body weaned lambs/ewe/group all over the same productive period was found to 884.7, 840.6 and 844.2 LE, respectively. Such net income, resulted in a net revenue/ewe/group as 546.2, 552.1 and 577.9 LE/ewe/ group, which represented approximately equal income in compare with the control ewes group.

CONCLUSION

As a general conclusion, results obtained, herein the present study indicated that salt tolerant plants prevailed as a daily roughage in South Sinai, and supplemented with some economic feed additives, could fulfill the daily feed requirements of Barki ewes at late gestation and early lactation (6wks.). neither ewes health nor ewes productivity were negatively influenced by such managerial feed regimen.

Table 10. Productive performance, Feed conversion and Economical evaluation of ewes during the experimental periods

Items	BH	MSTP+PF	MSTP+Y
Productive performance			
Daily concentrate intake g/h/d	894	828	848
Daily roughage intake g/h/d	894	828	848
Total dry matter intake g/h/d	1788	1656	1696
Avg. Milk Yield (L/h/d)/ewe/group	0.59	0.57	0.50
Avg. weaning weight (kg/group)	9.83	9.34	9.38
Avg. lambs Average live body weight gain (kg) from birth to weaning gain (kg/group)	6.15	5.53	5.39
Avg. Milk Yield (L/h/6wks)	24.78	23.94	21.0

Table 10. Cont.

Feed conversion ratio			
Total Dry Matter Intake (kg)/MY(L)	3.0	2.9	3.4
Avg. suckled milk(L/h)/avg. live body weight gain(kg/h)	4.04	4.29	3.93
suckled milk/ weaning weight (L/kg)	2.52	2.56	2.23
Economic evaluation			
Cost of concentrate intake LE/h/d	5.36	4.97	5.09
Cost of roughage intake LE/h/d	2.70	1.00	1.10
Cost of daily feed additives/h/d	0	0.9	0.15
Total daily feed cost/ewe/group (LE)	8.06	6.87	6.34
Total daily feed cost/ewe/group/period (LE)	338.5	288.5	266.3
Returns of live body weight weaned lambs/ewe/group (LE) 42 days sulked milk /ewe	884.7	840.6	844.2
Net revenue /h/group (LE)	546.2	552.1	577.9
Improvement (%) of net revenue /h/group (LE)	100	1.01	1.05

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الأداء الإنتاجى للنعاج البرقى المغذاة على مخلوط من النباتات المتحملة للملوحة مع الدهن المحمى أو الخميرة تحت الظروف الصحراوية

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تم توزيع ثلاثين نعجة برقى بشكل عشوائي على ثلاث مجموعات متساوية لمعرفة تأثير تغذية خليط من النباتات المقاومة للملوحة مع الدهون المحمية أو الخميرة على الأداء الإنتاجي للنعاج خلال فترتى نهاية الحمل والحليب، غذيت النعاج بإحدى الثلاث علائق التالية: المجموعة الاولى: دريس البرسيم+ مخلوط العلف المركز بدون أي إضافات علفية (الكنترول)، المجموعة الثانية والثالثة: خليط من النباتات المتحملة للملوحة مكون من ٥٠٪ من نبات القطف الملحى و ٥٠٪ من نبات الدخن اللؤلؤي+مخلوط العلف المركز مضاف له ٣٠ جم من الدهون المحمية أو ٥ جم خميرة/راس/يوم ، على التوالى. أظهرت النتائج ما يلى: - أظهرت تجربة الاستساغة أن العلائق التى تحتوي على خليط النباتات المتحملة للملوحة سجلت قيمًا أقل مقارنة بدريس البرسيم خاصة خلال الاسبوع الاول. بينما المأكول الكلى من المادة الجافة أظهر اختلافات طفيفة بين المجموعات. قياسات استهلاك الماء لم تظهر اختلافات معنوية للعلائق المزودة ببعض الاضافات الغذائية.. كانت درجة الحموضة في الكرش وبعض قياسات الدم داخل المدى الطبيعى ولم يكن للعلائق المختبرة أى تأثير سلبى على صحة الحيوانات. كانت أوزان النعاج في الدراسة الحالية في المعدل الطبيعي للنعاج البرقي في ظل ظروف غذائية وفسيولوجية مماثلة. أظهرت نتائج إنتاج اللبن فروق طفيفة بين المجموعات. لم يظهر أداء الحملان (وزن الولادة والفطام) أي فرق كبير بين المجموعات التجريبية المختلفة. تم تسجيل أفضل معدل تحويل غذائي (كجم مادة جافة ماكولة /لتر لبن منتج) لصالح النعاج المغذاة على خليط النباتات المتحملة للملوحة والمضاف لعلفها المركز الدهن المحمى مقارنة مع دريس البرسيم. كانت الكفاءة الاقتصادية للعلائق التجريبية متشابهة تقريبًا بين المجموعات.