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EFFECT OF BODY WEIGHT AND CONCENTRATE FEEDING FREQUENCY ON PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF BARKI EWES

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SUMMARY

Ninety-six Barki ewes in second parities, aging about two years were chosen before the mating season and randomly assigned to six groups in a 2 x 3 factorial design to examine effects of ewes body weight (30kg as light ewes; L and 40kg as heavy ewes; H) and concentrate feeding frequency (once, 1X; twice, 2X and thrice, 3X) on the productive and reproductive performance of ewes and their offspring. The experimental period represents the reproductive and productive cycle of the ewe i.e., mating, gestation and lactation periods. Animals in the experimental groups were housed and fed separately in 6 pens and each treatment was fed in group. Results illustrated that the heaviest ewes digested all nutrients better than the lighter ewes leading to significantly higher feeding values. The increased frequent feeding lead to better digestibility of CF and NFE; no differences were reported for other nutrients. Heavy weight ewes digested all nutrients better with one time feeding than the two or three times. Nutritive value was higher with heavy ewe than lighter ones. Nutritive value as TDN and DCP were not improved by concentrate feeding frequency. Values of rumen liquor pH were decreased with more frequent feeding. Feeding the experimental ration more frequently lead to an increase in VFA production than feeding once. The heavy weight ewes had more VFA than the lighter ones with all frequent feeding. Heavy ewes produced significantly more milk yield than the light once. Fat corrected milk followed the same trend. No differences were reported for milk composition%. Feeding more frequently increased milk yield and fat corrected milk; milk energy / NEL intake and milk protein/ CP intake followed the adverse trend. The light ewes reported better feed conversion than the heavy weight ewes. Feeding frequency did not affect production efficiency as well as feed conversion. During the dry period the heavy weight ewes had less dry matter intake (DMI), digestible crude protein intake (DCPI), metabolizable energy (ME) and net energy for maintenance (NE_m). While, during the early gestation period no differences were found regarding the above mentioned criteria. With increasing feeding frequency in dry period, the average body weight was significantly increased; DCPI, ME and NE_m followed the same trend. Also during early gestation period the above mentioned criteria followed the similar trend. DCPI was more during the early gestation than dry-period. During the suckling period, DCPI followed the opposite trend being better with heavy ewes than light ones with all feeding frequency.

Keywords: *Ewes weight, feeding frequency, productive and reproductive performance.*

INTRODUCTION

Barki sheep in the North West Coastal zone of Egypt (NWCE) are of greatest economic importance and live animals represent a particularly valued export commodity. The high economic value of sheep production is based on the partial use of freely available pasture vegetation. The use of supplementary feeds would certainly lead to improve animal productivity. The period of highest consumption of concentrates is from

June to December periods which match the need to feed newly-weaned lambs and the most serious period of feed shortage.

The better reproductive output in sheep herds may be attributed to better management especially plan of nutrition that followed at breeding time up to weaning the lambs. Increasing production efficiency is a challenge to the animal producers. Researchers are working with nutrition to increase conception rate, shorten the postpartum interval, increase weaned lamb produced per ewe and increase the frequency of lambing as well.

In NWCE most holders of commercial sheep flocks use body weight to evaluate the status of ewes before mating. Therefore, it is the first factor that undertaken in the present work. Michels *et al.* (2000) reported that body weight of the ewe at mating has been shown to influence both ovulation rate and subsequent litter size. The live weight of ewe lambs at mating is positively related to ovulation rate (Paganoni *et al.,* 2014), fertility rate (ewe lambs pregnant per ewe lamb presented for mating) and reproductive rate (fetuses per ewe lamb presented for mating) (Corner-Thomas *et al*., 2015). A curvilinear relationship between fertility and Romney ewe live weight at mating was identified (Haslin *et al*., 2020), suggesting that ewe lambs should be mated at a live weight of 50–55 kg, but may vary based on breed, to maximize fertility and lambing percentage without reducing ewe live weight nor the progeny performance. It is generally accepted that for successful mating, ewe lambs should have reached 60% of their expected mature live weight by the start of the mating period (Kenyon *et al*., 2014). So based on this concept, the current recommended minimum live weight for Barki ewes, therefore, is 27 kg at mating.

The range vegetation is considered the basic source of ruminants feed in NWCE. Supplementary feeding as a concentrate feed mixture once daily is a common practice (Kewan *et al*., 2021). Ruminal acidosis and reduction in fiber digestion and milk fat percentage are a serious pattern that resulted upon feeding high concentrate diets throughout certain physiological stages of ruminant animals. One factor that can be manipulated to overcome these effects is the frequency of feeding. Therefore, it is the second factor that undertaken in the present work. Feeding frequency has a wide range of influences on ruminants, including feed intake and digestion (Robles *et al*., 2007), animal performance and product quality (Pulido *et al*., 2009), reproductive performance (Afify *et al*., 2004) and rumen fermentation profiles (Sun *et al*., 2012). Feeding more frequently stabilizes ruminal pH (Taie *et al*., 2010) and improves ruminal fermentation and nutrient utilization (Cecava *et al*., 1990). Feeding less frequently may shift site of nutrient digestion from the rumen to the hindgut, altering the supply of fermentable substrate to the ruminal microbes and ultimately affecting the protein: energy ratio supplied to the small intestine. These relationships might especially be true when high concentrate diets are fed.

Nutrition during maternal and suckling periods is potential means of improving farm profitability and ewe lifetime performance. Therefore this experiment was conducted as a simulation of raising sheep under natural grazing conditions. Therefore, the peanut vine hay was used as a representative of pasture plants, with supplementary feed being provided to cover the rest of the nutrient needs for ewes, in the form of one, two or three meals a day. This study aims to evaluate the effect of both body weight of the ewes at mating and the frequency meals of concentrate feed mixture on the reproductive and productivity indicators of the ewes and their offspring.

MATERIALS AND METHODS

Animals and management:

Ninety-six Barki ewes in second parities, aging about 2 years of about 35.74 ±0.64 kg live body weight were selected based on the farm records from total number of 176 ewes herd in the current experiment which lasted for eight months. Animals rose at the Animal Production Unit of the Center for Sustainable Development of Matrouh Resources, Desert Research Center.

Ewes were chosen before the mating season and randomly assigned to 6 groups in a 2 x 3 factorial design to examine effects of ewes body weight (30kg as light ewes, L and 40kg as heavy ewes, H) and concentrate feeding frequency (once, 1X; twice, 2X and thrice, 3X) on the performance of ewes and their offspring. Ewes reproductive and productive cycle i.e., mating, gestation and lactation periods were represented by the experimental period. For mating, six fertile Barki rams were used; one for each ewe-group. To avoid ram/group confounding effect, rams were allowed to rotate among different ewes groups. The mating period lasted for 35 d (nearly two estrous cycles) after which the rams were separated from the ewes. Estrous was detected by means of colored grease on the ram brisket. Ewes were checked daily using the ram identification and service was recorded. The colors used were changed every week. Ewes were weighted before joining and every 2 weeks intervals thereafter. Reproductive performance of ewes was evaluated using different criteria; conception rate, abortion rate and lambing rate.

Feeding:

Animals in the experimental groups were housed and fed separately in six pens and each treatment was fed in group. Ewes were fed a concentrate feed mixture consisted of undecorticated cotton seed cake 30%, yellow corn 40%, wheat bran 24%, molasses 3%, limestone 1.5%, mixture of minerals and vitamins 0.5% and common salt 1%. The concentrate diet was offered (in restriction) in different meals: once daily (at 09:00., 1X); twice daily (09:00 and 18:00., 2X) and three times a day (09:00., 14:00 and 18:00., 3X) at a feeding level based on the physiological stage of ewes under investigation. Peanut (*Arachis hypogaea L*) vine hay was provided *ad-lib* to cover the remaining requirements of the ewes depending on their physiological condition. At d 76, 130 and 205 of the experiment, 4 ewes of each group (with their offspring in the last case) were separated in pens and fed individually according their feeding regimen to determine the actual feed intake in physiological stages; early and late gestation and also lactation periods. The chemical composition of the feed ingredient is shown in Table (1).

Table (1): Chemical composition of feeds used (%on DM basis).

Item	CFM*	Peanut vine hay
Dry matter; DM	90.9	86.65
Organic matter; OM	88.79	88.72
Crude protein; CP	14.31	8.91
Crude fiber; CF	13.66	21.32
Ether extract; EE	2.02	2.40
Nitrogen free extract; NFE	58.8	56.09
Ash	11.21	11.28
Neutral detergent fiber; NDF	36.26	49.94
Acid detergent fiber; ADF	29.81	30.01
Acid detergent lignin; ADL	6.20	8.33
Hemicellulose	6.45	19.93
Cellulose	23.61	21.68

**CFM composed of 30% undecorticated cotton seed cake, 24% wheat bran, 40% yellow corn grains, 3% molasses, 1% salt , 1.5% limestone and 0.5% minerals & vitamins.*

Milk:

Milk yield was estimated every 2 weeks (5 records) except for the first 2 weeks post parturition. After separating the lambs from their dams, 5 ewes in each group were milked to empty the mammary glands, and after 4 h they were milked again to access the milk yield at 4 h and the resulted amount was assumed to be the normal rate of milk secretion and was extrapolated at 24 h to estimate daily milk yield. An individual 100 ml milk sample was collected and preserved with 0.5 ml potassium dichromate solution (70 mg/L) and frozen at -20 °C until individual analysis.

Performance of lambs:

Newborn lambs were ear-tagged and weighed within 24 h post parturition and at 2 weeks intervals thereafter until the 12- week-old (weaning of lambs), the growth performance of the growing lambs was calculated.

Digestibility and rumen fermentation:

After weaning, four ewes were randomly selected from each group to evaluate nutrients digestibility and feeding values. Water intake was also measured. Animals were placed in separate pens and fed individually according their feeding regimens with a 15-d adaptation period followed by a 5-d collection period; the actual feed and water intake were recorded. Ewes were fitted with fecal bags to collect feces daily. Total feces were recorded daily and a representative sample of about 10% of fresh total feces weight was taken daily. Soft water was available for free choice during the experimental period. Composited feces samples of each animal were mixed, dried and ground. Samples of feed offered, refused and feces were collected then stored until chemical analysis.

On day 21 of the digestibility trial, rumen liquid samples were collected 3h after morning feeding using a stomach tube and screened through four-layers of gauze. Rumen pH was measured immediately using a pH meter (Model HI 8424). Then, 20 ml of the rumen fluid was acidified with 0.4 ml of 50% (vol/vol) sulfuric acid and stored at −20°C for later analysis.

Chemical analysis:

The chemical composition of feeds, refusal if any and feces were determined according to the official methods of AOAC (2005).

Ammonia nitrogen (NH_3 -N) and total volatile fatty acids (VFA) in rumen liquor samples were analyzed according to Preston (1995) and AOAC (1997), respectively.

Milk samples were analyzed for fat, protein and lactose according to Ünal *et al*. (2008) using medium infrared spectrophotometry (Lactoscan S, Milkotronic Ltd., New Zagora, Bulgaria). Device used for milk analyses was previously calibrated for ewe's milk.

Statistical analysi:s

Data in the current study were statistically analyzed by two-way analysis of variance using the General Linear Model Procedure of the SAS software (SAS, 2002). The model used is: $Y_{ijk} = \mu + T_i + C_j + (TC)_{ij} + e_{ijk}$ where: Y_{ijk}= individual observation; μ = the overall mean; T_i = the fixed effect of ewes body weight (i, 1,2); C_j = the fixed effect of concentrate feeding frequency (j, 1, 2, 3); $(TC)_{ij}$= the interaction between ewes body weight and concentrate feeding frequency and e_{ijk} = random error. Tukey (1949) range test was used to compare differences among treatments.

RESULTS AND DISCUSSION

Data of Table (2) clearly illustrated that the heaviest ewes digested all nutrients better than the lighter ewes leading to significantly higher feeding values. The increased frequent feeding lead to better digestibility of CF and NFE; however no differences were reported for other nutrients. Light weight ewe responses positively when fed three times than other frequently fed ewes; on contrary, heavy weight ewe digested all nutrients better with one time feeding than the two or three times.

Abdel-Rahman and Suleiman (1994) revealed that digestibilities of all nutrients were increased (P<0.05) with animals fed 4X and 8X daily. Results of Taie (1996) indicated that apparent digestibility of DM, CP and CF was highest for 2X followed by 3X and least for 1X. Soto-Navarro *et al*. (2000) indicated that total tract digestibility of OM, N and starch were lowest when feed was offered twice daily with a 10% fluctuation in intake. Taie *et al*. (2010) reported that the digestion coefficients of CP, EE and CF were improved (P<0.05) when animals were fed either twice or three-times a day over those fed once daily. Differences regarding digestibility of DM, OM and NFE were not significant among the treatment groups. Borne *et al*. (2006) determined the effects of feeding frequency on protein and energy metabolism in heavy pre-ruminant calves, the calves were fed 1, 2 or 4 meals daily. The results obtained indicated that increasing feeding frequency increased the efficiency digestible protein and energy. Saldanaha *et al*. (2021) found that the feeding frequency of 3 and 4 times per day for male feedlot lambs promoted the highest digestibility of neutral detergent fiber (NDF; p = 0.008) and total digestible nutrients (TDN; p = 0.002). The feeding frequency of 3 times per day promoted the highest digestibility of crude protein (CP; p = 0.005). Ulyatt *et al*. (1984) indicated that increased feeding frequency and high dry matter intake did not affect apparent digestibility. Cecava *et al*. (1990) reported that feeding frequency had minimal effect on site or extent of nutrient digestion in Simmental steers. De Vega *et al*. (2000) studied the effects of the frequency of feeding on digestibility ewe lambs. Feeding once daily had no influence on digestibility coefficients. Elseed (2005) studied the effect of supplemental protein feeding frequency on feed intake, digestibility, N retention and microbial N yield. He demonstrated that intake of DM was not influenced by feeding frequency of protein supplement. Digestibility of OM, NDF and cellulose tended to be higher in sheep offered supplemental protein twice a day.

Table (2): Digestibility and feeding values of the experimental diet as affected by ewes body weight and concentrate feeding frequency.

Item		ABW	Nutrients digestibility (%)					Feeding values (%)	
		(kg)	DM	CP	CF	EE	NFE	TDN	DCP
BW	L	29.6^{b}	70.8^{b}	66.7^{b}	61.9^{b}	78.3^{a}	62.7^{b}	67.3^{b}	8.11^{b}
	H	43.3^{a}	73.1^{a}	75.5^{a}	64.2^{a}	78.7^{a}	65.7^{a}	68.8^{a}	9.18^{a}
CFF	1X	35.5^{c}	72.4^{a}	71.6^{a}	62.3^{b}	78.8^{a}	63.0^{b}	68.2^{a}	8.70^{a}
	2X	36.4^{b}	71.2^{a}	70.6^{a}	61.9^{b}	78.3^{a}	64.8^{ab}	67.7^{a}	8.57^{a}
	3X	37.4^{a}	72.4^{a}	71.1^{a}	64.8^{a}	78.5^{a}	65.2^{a}	68.4^{a}	8.65^{a}
L	1X	29.2^{d}	67.4^{c}	63.9^{c}	55.1^{c}	75.7^{c}	56.8^{c}	64.2^{e}	7.76^{c}
	2X	28.9^{d}	70.0^{b}	64.7^{c}	62.3^{b}	78.0^{c}	64.9^{b}	66.9^{cd}	7.86^{c}
	3X	30.8^{c}	74.9^{a}	71.5^{b}	68.2^{a}	81.4^{ab}	66.5^{ab}	70.9^{ab}	8.69^{b}
H	1X	41.9^{b}	77.3^{a}	79.4^{a}	69.6^{a}	82.0^{a}	69.2^{a}	72.2^{a}	9.64^{a}
	2X	44.0^{a}	72.3^{b}	76.4^{a}	61.5^{b}	78.6^{bc}	64.7^{b}	68.4^{bc}	9.28^{a}
	3X	43.8^{a}	69.9^{bc}	70.8^{b}	61.5^{b}	75.6^{c}	63.9^{b}	65.9^{de}	8.60^{b}
SEM		1.68	0.82	1.40	1.19	0.65	0.95	0.70	0.17

BW: body weight; L; light; H: heavy; CFF; concentrate feeding frequency; 1X: once; 2X: twice; 3X: thrice SEM: standard error of the means; ABW: average body weight;

$^{a, b, c \text{ and } d}$: Means within column within treatment with different superscripts differ significantly ($P < 0.05$).

Differences regarding the nutritive value (calculated as TDN) were higher with heavy ewe than lighter ones (Table 2). Values of TDN were 68.8 and 67.3% for H and L, respectively. The respective DCP values were 9.18 and 8.11%. Nutritive value as TDN and DCP were not improved by concentrate feeding frequency. Taie (1996) reported better nutritive value (TDN and DCP) for the experimental diet when fed more frequently.

Table (3): Water intake and rumen fermentation parameters as affected by ewes body weight and concentrate feeding frequency.

Item		Water intake					Rumen fermentation parameters		
		ml/kg BW	ml/kg $BW^{0.82}$	ml/g DMI	ml/g TDN	ml/g DCPI	pH	NH_3-N (mg/dl)	TVFA (meq/dl)
BW	L	50.2^{b}	92.3^{b}	1.67^{b}	2.48^{b}	20.6^{b}	5.64^{b}	19.95^{b}	12.61^{b}
	H	52.0^{a}	102.4^{a}	2.08^{a}	3.02^{a}	22.7^{a}	6.03^{a}	20.48^{a}	14.11^{a}
CFF	1X	48.4^{c}	91.8^{c}	1.77^{c}	2.59^{c}	20.4^{b}	5.97^{a}	19.41^{b}	12.13^{c}
	2X	51.7^{b}	98.4^{b}	1.89^{b}	2.80^{b}	22.1^{a}	5.89^{a}	21.89^{a}	15.03^{a}
	3X	53.2^{a}	101.9^{a}	1.95^{a}	2.87^{a}	22.6^{a}	5.66^{b}	19.35^{b}	12.92^{b}
L	1X	47.3^{d}	86.9^{d}	1.57^{e}	2.45^{d}	20.3^{cd}	5.82^{b}	19.26^{b}	11.48^{d}
	2X	51.2^{bc}	93.7^{c}	1.70^{d}	2.55^{d}	21.7^{bc}	5.67^{b}	21.59^{a}	14.18^{b}
	3X	52.0^{b}	96.4^{c}	1.73^{d}	2.44^{d}	19.9^{d}	5.42^{c}	19.00^{b}	12.17^{c}
H	1X	49.4^{cd}	96.7^{c}	1.97^{c}	2.73^{c}	20.4^{cd}	6.09^{a}	19.56^{b}	12.78^{c}
	2X	52.2^{ab}	103.1^{b}	2.08^{b}	3.04^{b}	22.5^{b}	6.10^{a}	22.19^{a}	15.88^{a}
	3X	54.4^{a}	107.5^{a}	2.17^{a}	3.30^{a}	25.3^{a}	5.89^{ab}	19.70^{b}	13.67^{b}
SEM		0.57	1.62	0.05	0.08	0.46	0.05	0.26	0.3

BW: body weight; L; light; H: heavy; CFF; concentrate feeding frequency; 1X: once; 2X: twice; 3X: thrice SEM: standard error of the means; BW: average body weight;

$^{a, b, c, d \text{ and } e}$: Means within column within treatment with different superscripts differ significantly ($P < 0.05$).

Heavy ewes drank significantly more water (Table 3) than light ewes; either determined as ml/Kg BW, ml/BW$^{0.82}$, ml/g DMI, ml/g TDN and ml/g DCPI. Water intake was increased linearly as the frequency of feeding increased with both heavy and light body weight. The increase in water intake with the increase in frequency of feeding was also reported by Taie (1996).

Ruminal pH values of sheep were 5.64 and 6.03 for light and heavy weight ewes, respectively (Table 3). Values of pH were gradually decreased with more frequent feeding being 5.66 for 3X followed by 5.89 for 2X and 5.97 for 1X. With light weight ewes rumen liquor was more acidic (5.42 to 5.82) than the heavy weight ewes (5.89 to 6.1); differences were significant. The recorded pH values are within the reported ranges for normally functioning rumen (El-Sheikh, 2007). Roth and Kirchgessner (1976) reported that with higher frequency of feeding, variations of pH were less. Taie (1996) indicated that diurnal variation in ruminal pH was less dramatic with sheep fed 2X and 3X daily. Castro *et al*. (2002) measured rumen fermentation using three rumen-cannulated Merino sheep in a 3x3 Latin Square design to study the effect of either once or twice daily concentrate supplementation and found that concentrate supplementation decreased ($P<0.05$) ruminal pH. Dehority and Tirabasso (2001) fed a pelleted high roughage diet to sheep and found that animals fed once per day were recorded higher rumen pH values than these fed 6 or 24 times per day.

The results in Table (3) demonstrated that VFA was 12.61 and 14.11 meq/dl in rumen of light and heavy weight ewes, respectively. and were 12.13, 15.03 and 12.92 for ewes fed 1X, 2X and 3X, respectively; differences were significant. Feeding the experimental ration more frequently lead to significant ($P<0.05$) increase in VFA production than feeding once; VFA was 12.13, 15.03 and 12.92 meq/dl for 1X, 2X and 3X, respectively. The heavy weight ewes had more ($P<0.01$) VFA than the lighter ones with all frequent feeding.

Giving the diets to ewes of all weights more frequently leads to a more stabled ruminal environment; which in turn lead to a better fermentation and higher VFA production. Michalowski (1979) reported that total VFA were 74 to 131 mmol/liter rumen fluid in 2 weathers fed once or twice daily. Taie (1996) indicated a sharp increase in production of VFA up to 3h post-feeding then steadily increased at 6-7h post-feeding for 2X and 3X daily of sheep.

Concentration of ruminal NH3-N was higher ($P<0.05$) with heavy ewes (20.48 mg/dl) than the lighter ones (19.95 mg/dl) Table (3). Feeding twice daily produces more ammonia ($P<0.05$) with both weights of ewes. The present ruminal ammonia concentrations are in the range of those reported to be required for maximum ruminal microbial activity. Sutoh et al. (1991) revealed that ammonia nitrogen was greatly reduced with 12 feeds daily. Afify et al. (2004) fed buffalo heifers once, twice or three times daily, they found non-significant differences in ammonia-N concentration among groups. However, feeding frequently reduced the ruminal fluctuation in rumen parameters. Soto-Navarro et al (2000) indicated that OM, N and starch digestibilities were lowest when feed was offered twice daily and steers fed once daily had higher ruminal pH and total VFA than steers fed once daily. The results of Knox and Ward (1961) clearly indicated that increasing feeding frequency from two to eight times per day significant increased total VFA concentration. Robinson and Mcqueen (1994) fed Holstein cows in early lactation a basal commercial concentrate twice daily, and add two supplemental protein sources. Intakes of DM, OM, NDF and CP were not influenced by treatments. Milk yield and its content of protein, fat and lactose, rumen VFA and peptide N concentrations were not influenced by treatments. Average rumen pH was higher and propionate concentrations were lower for cows supplemented with five meals. Bunting *et al* (1987) reported that the increased feeding frequency increased water consumption and the results obtained that the increased feeding frequency not affected on N retention, ruminal pH, apparent total tract digestibility of dry matter, organic matter and cell wall constituents, but the increased feeding frequency decreased the apparent total tract digestibility of crude protein, mean ruminal ammonia-N concentrations and total volatile fatty acid concentrations.

It could be concluded that increasing feeding frequency from once up to 3 times lead to a better microbial activity (more VFA production) with constant ruminal pH. Digestibility of protein, CF and ether extract (energy source) was also better with increased frequency of feeding. More NH_3-N was available in the rumen for better microbial activity. It is well known that microbial protein synthesis within the rumen is correlated positively with the VFA production. More frequent feeding leads to a more stable ecosystem in the rumen and less diurnal fluctuation in pH, ammonia concentrations and volatile fatty acid production. Shabi *et al*. (1998) studied the feeding frequency on digestion in mid-lactation Holstein cows. The cows were fed two and four times daily. The results suggest that the ruminal ammonia N was lower when cows were fed twice and four times daily.

Data in Table (4) summarized the reproductive performance indexes of the experimental ewes. The conception rate (CR%) was higher with heavy ewes (93.8) than light ewes (89.6). Feeding twice lead to more CR (93.8) than those fed once and three times (90.6%). Lambing rate (LR%) followed the same trend. Abdel-Mageed (2009) studied the effect of body condition score (BCS) on fertility, fecundity and prolificacy traits in Ossimi ewes. He found that BCS of Ossimi ewes at mating significantly affected both fertility and fecundity measurements and did not affect both lambs born per ewe lambing and pregnancy period. Working with three ewe breeds, Abdel-Mageed (2011) reported that the reproductive and productive traits were significantly affected by BCS of ewes except lambs born / ewe lambing, lambs weaned / ewe lambing and lamb survival at weaning. When comparing which factor is more important for reproductive performance, ewe BCS at mating or ewe body weight, Abdel-Mageed and Ibrahim (2011) reported that BCS of ewes at mating significantly affected the studied reproductive traits. They recommended that BCS is more accurate than body weight to assess the status of ewes before mating. Darwish and Mahboub (2012) examined the effects of maternal body weight on placental growth, lambing length and the implications on neonatal lambs. According to lambing live weights (39-60 kg), ewes were divided into heavy and light ewes. The results illustrated that the heavy ewes tended to produce heavier placentas than the light ewes. At birth, heavy ewes produced more vigorous and heavier lambs and exhibited better average daily weight gains with fewer lamb mortalities from birth until weaning compared with lambs born to light ewes. Lambing length did not differ significantly between heavy and light dams.

Table (4): Reproductive performance indexes for light and heavy ewes.

Item	BW		CFF			L			H		
	L	H	1X	2X	3X	1X	2X	3X	1X	2X	3X
NER	48	48	32	32	32	16	16	16	16	16	16
NEC	43	45	29	30	29	14	15	14	15	15	15
CR%	89.6	93.8	90.6	93.8	90.6	87.5	93.8	87.5	93.8	93.8	93.8
NEA	0	0	0	0	0	0	0	0	0	0	0
AR%	0	0	0	0	0	0	0	0	0	0	0
NS	1	0	0	1	0	0	1	0	0	0	0
TN	0	1	1	0	0	0	0	0	1	0	0
NEL	42	45	29	29	29	14	14	14	15	15	15
LR%	87.5	93.8	90.6	90.6	90.6	87.5	87.5	87.5	93.8	93.8	93.8
LMN	0	1	1	0	0	0	0	0	1	0	0
LM%	0	2.17	3.33	0	0	0	0	0	6.25	0	0
LV%	100	97.8	96.7	100	100	100	100	100	93.8	100	100
WML%	52	54.6	50.1	48.5	61.3	27.3	42.9	85.7	71.4	53.8	38.5
WFL%	48	45.4	49.9	51.5	38.7	72.7	57.1	14.3	28.6	46.2	62.5

BW: body weight; L; light; H: heavy; CFF; concentrate feeding frequency; 1X: once; 2X: twice; 3X: thrice NER: Number of ewes joined to rams; NEC: Number of ewes conceived; CR: Conception rate; NEA: Number of ewes aborted; AR: Abortion rate; NS: Number of stillbirth; TN: Twins number; NEL: Number of ewes lambed; LR: Lambing rate; LMN: lamb mortality number; LM; Lamb mortality rate ; LV: Lamb viability; WML: Weaned male lambs; WFL: Weaned female lambs.

Milk production and composition as affected by ewe weight and frequency of feeding are presented in Table (5). Heavy ewes produced significantly more milk yield than the light once being 627ml vs 459ml. Fat corrected milk followed the same trend. No differences were reported for milk composition%. Feeding more frequently increased milk yield and fat corrected milk being 595 and 593ml/d for 3X feeding. Milk composition followed almost the same trend.

Efficiency of milk production and feed conversion are presented in Table (6). Light ewes showed higher ($P < 0.05$) milk energy/ NEL intake, % was 45.72 vs 40.67, lower ($P < 0.05$) milk protein/ CP intake and better feed conversion than the heavy weight ewes. Feeding frequency did not affect production efficiency as well as feed conversion. Yang and Varga (1989) studied the effect of three concentrate feeding frequencies on milk yield in dairy cows. The forage portion of the diet was fed twice daily to all cows separately from the concentrate. They found that cows fed concentrate four times daily increased milk fat and protein production.

Table (5): Milk production and composition for light and heavy weight ewes fed concentrate supplement for once, twice and thrice times a day.

Item		IBW	Milk production				Milk composition %		
			MY	4%	FCM	ECM	Fat	Protein	Lactose
		Kg	ml/h/d	ml/d		ml/kg W	%	%	%
BW	L	30.47^b	459^b	464^b		13.6^a	4.02^a	3.52^a	5.28^a
	H	40.03^a	627^a	637^a		15.4^a	4.08^a	3.57^a	5.37^a
CFF	1X	35.06^a	530^a	538^a		14.7^a	4.07^a	3.53^a	5.30^a
	2X	35.31^a	503^a	522^a		13.5^a	4.18^a	3.63^a	5.45^a
	3X	35.39^a	595^a	593^a		15.4^a	4.00^a	3.48^a	5.22^a
L	1X	30.28^b	426^c	435^a		13.4^a	4.13^a	3.53^a	5.31^a
	2X	30.85^b	450^{bc}	492^a		13.5^a	4.45^a	3.59^a	5.39^a
	3X	30.29^b	500^{abc}	466^a		14.0^a	3.50^a	3.44^a	5.16^a
H	1X	39.85^a	634^{ab}	640^a		16.0^a	4.02^a	3.53^a	5.30^a
	2X	39.77^a	556^{abc}	551^a		13.4^a	3.92^a	3.67^a	5.51^a
	3X	40.48^a	690^a	721^a		16.8^a	4.30^a	3.52^a	5.29^a
SEM		0.64	29.7	37.3		0.84	0.19	0.05	0.07

BW: body weight; L; light; H: heavy; CFF; concentrate feeding frequency; 1X: once; 2X: twice; 3X: thrice SEM: standard error of the means.IBW: Initial body weight; MP: milk yield; FCM: fat corrected milk; ECM: energy corrected milk.
[a, b, and c:] Means within column within treatment with different superscripts differ significantly ($P < 0.05$).

Shabi *et al*. (1999) studied the effect of feeding frequency on milk yield in Holstein cows fed a high concentrate diet. Results indicated that efficiency of milk energy and milk protein synthesis was increased. But it was reduced dry matter intake and yield of milk and milk components. Judy *et al. (2018)* studied the effects of feeding multiple times a day on energy balance in late-lactation of dairy cattle. The results demonstrated that dry matter intake, milk fat and milk protein percentage was not affected. Gross energy, digestible energy, metabolizable energy and energy maintenance and balance per kilogram of DMI did not differ by feeding frequency. The effects of frequency of feeding on milk yield and milk composition in cows were studied by French *et al*. (1990). The results clear that the increased frequency of concentrate feeding tended to result in elevated milk fat percentage, milk protein, but lactose concentrations were not influenced by feeding frequency.

Nutrient intakes throughout dry and early gestation periods (Table 7) indicated that during the dry period the heavy ewes had lower ($P < 0.05$) DMI, DCPI, ME and NEm , than light ewes, while during the early gestation period no differences were found regarding the above mentioned criteria. With increasing feeding frequency in dry period, the average body weight was significantly increased; DCPI, ME and NEm followed the same trend. During early gestation period the DMI, DCPI, ME and NEm followed similar trend. During both periods of the study, the light weight ewes responded significantly more than the higher weight ones. The DCPI was more during the early gestation than dry-period. Early studies (Prior, 1976 and Coleman et al., 1984) did not observe any differences in DM intake due to frequency of feeding. Elseed (2005) also reported that intake of DM was not influenced by feeding frequency of protein supplement. De Vega *et al*.

(2000) studied the effects of the frequency of feeding on voluntary intake of ewe lambs. They reported that animals fed twice daily or continuously were a small difference in feed intake. Feeding once daily resulted in a much lower dry matter and digestible organic matter intake.

Table (6): Milk production efficiency and feed conversion for light and heavy weight ewes fed concentrate supplement for once, twice and thrice times a day.

Item		Production efficiency		Feed conversion		
		Milk energy/ NEL intake%	Milk protein/ CP intake%	g DMI/ ml milk	g TDNI/ ml milk	g DCPI/ 100 ml milk
BW	L	45.72^{a}	12.10^{a}	3.39^{a}	2.17^{a}	38.3^{a}
	H	40.67^{b}	13.76^{a}	2.87^{b}	1.84^{b}	32.5^{b}
CFF	1X	43.53^{a}	13.06^{a}	3.07^{ab}	1.97^{ab}	34.8^{ab}
	2X	43.47^{a}	11.95^{a}	3.53^{a}	2.27^{a}	39.8^{a}
	3X	42.58^{a}	13.78^{a}	2.79^{b}	1.79^{b}	31.6^{b}
L	1X	46.21^{a}	11.80^{a}	3.44^{a}	2.21^{a}	38.8^{a}
	2X	44.61^{a}	11.43^{a}	3.70^{a}	2.38^{a}	41.8^{a}
	3X	46.32^{a}	13.07^{a}	3.03^{a}	1.94^{a}	34.2^{a}
H	1X	40.86^{a}	14.32^{a}	2.70^{a}	1.73^{a}	30.7^{a}
	2X	42.33^{a}	12.48^{a}	3.36^{a}	2.16^{a}	37.8^{a}
	3X	38.84^{a}	14.48^{a}	2.56^{a}	1.64^{a}	29.0^{a}
SEM		1.01	1.00	0.16	0.1	2.00

BW: body weight; L; light; H: heavy; CFF; concentrate feeding frequency; 1X: once; 2X: twice; 3X: thrice
SEM: standard error of the means, NEL, net energy for lactation.
[a and b:] *Means within column within treatment with different superscripts differ significantly ($P < 0.05$).*

Table (7): Average body weight and nutrients intake of ewes throughout dry (21 d) and early gestation periods (90 d).

Item		Dry period (21 d)					Early gestation period (90 d)				
		ABW	DMI	DCPI	ME	NE_m	ABW	DMI	DCPI	ME	NE_m
BW	L	29.61^{b}	30.1^{a}	2.43^{a}	73.3^{a}	57.5^{a}	33.5^{b}	31.8^{a}	2.58^{b}	77.6^{a}	60.9^{a}
	H	43.29^{a}	25.0^{b}	2.30^{b}	62.4^{b}	48.9b	42.7a	31.5^{a}	2.89^{a}	78.4^{a}	61.6^{a}
CFF	1X	35.54^{c}	27.6^{a}	2.38^{b}	67.7^{b}	53.1^{b}	37.8^{a}	32.3^{a}	2.81^{a}	79.7^{a}	62.5^{a}
	2X	36.43^{b}	27.6^{a}	2.34^{c}	67.4^{c}	52.9^{c}	38.2^{a}	31.6^{ab}	2.66^{c}	76.0^{b}	59.7^{b}
	3X	37.39^{a}	27.6^{a}	2.39^{a}	68.5^{a}	53.7^{a}	38.4^{a}	31.0^{b}	2.73^{b}	78.3^{a}	61.5^{a}
L	1X	29.18^{d}	30.1^{a}	2.33^{d}	69.7^{c}	54.8^{c}	33.6^{b}	32.8^{a}	2.55^{d}	76.2^{bc}	59.8^{bc}
	2X	28.85^{d}	30.1^{a}	2.36^{c}	72.8^{b}	57.1^{b}	33.8^{b}	30.7^{b}	2.41^{c}	74.3^{c}	58.3^{c}
	3X	30.81^{c}	30.1^{a}	2.62^{a}	77.3^{a}	60.6^{a}	33.2^{b}	32.0^{ab}	2.78^{c}	82.2^{a}	64.5^{a}
H	1X	41.91^{b}	25.1^{b}	2.42^{b}	65.5^{d}	51.3^{d}	41.9^{a}	31.8^{ab}	3.08^{a}	83.1^{a}	65.3^{a}
	2X	44.00^{a}	25.6^{b}	2.33^{d}	62.1^{e}	48.6^{e}	42.7^{a}	31.4^{b}	2.91^{b}	77.7^{b}	61.0^{b}
	3X	43.97^{a}	25.2^{b}	2.15^{e}	59.7^{f}	46.7^{f}	43.6^{a}	31.2^{b}	2.68^{c}	74.4^{c}	58.4^{c}
SEM		1.68	0.61	0.03	1.48	1.17	0.63	0.15	0.03	0.51	0.40

BW: body weight; L; light; H: heavy; CFF; concentrate feeding frequency; 1X: once; 2X: twice; 3X: thrice SEM: standard error of the means.ABW: average body weight (kg); DMI: dry matter intake (g/kg body weight); DCPI: digestible crude protein intake (g/kg body weight); ME: metabolizable energy (calorie/ kg body weight); NE_m: net energy for maintenance (calorie/ kg body weight).

[a, b, c, d, e and f:] *Means within column within treatment with different superscripts differ significantly ($P < 0.05$).*

Rakes *et al.* (1960) studied some effects of feeding frequency on the utilization of isocaloric diets by young and adult sheep, the animal fed one, 4 and 8 times per day. They reported that young sheep gained an average of 65% more body weight when fed 8 meals than when fed the same isocaloric ration in one meal per day. The apparent absorption of energy or nitrogen was not affected by the feeding treatments. Results refer to the young weathers excreted approximately 20% less nitrogen in the urine when they were fed 8 times per day than when fed only once daily. The frequency with which the group of older sheep was fed did not affect significantly the rate of body gain or the efficiency of feed utilization. Kenyon et al. (2014) reported that the relationship between body condition and production traits is positive.

The performance of the experimental ewes during late gestation period was almost similar to that during the early gestation period (Table 8) with all feeding frequency. Otherwise, ewes performance followed the opposite trend during the suckling period (Table 9) being better with heavy ewes that light ones with all feeding frequency.

Table (8): Average body weight and nutrients intake of ewes throughout late gestation period (60d).

Item		ABW Kg	DMI g/ kg W	DCPI g/kg W	ME Cal/kg W	NEm Cal/ kg W	BWC in gestation period (145 d) Kg
BW	L	38.66^{b}	38.47^{a}	3.12^{b}	89.39^{a}	70.22^{a}	10.29^{a}
	H	48.02^{a}	36.99^{b}	3.40^{a}	85.16^{b}	66.88^{b}	10.54^{a}
CFF	1X	42.56^{a}	38.83^{a}	3.37^{a}	89.05^{a}	69.96^{a}	9.54^{b}
	2X	43.73^{a}	37.40^{b}	3.20^{b}	86.90^{b}	68.25^{b}	11.07^{a}
	3X	43.72^{a}	36.95^{b}	3.20^{b}	85.87^{b}	67.43^{b}	10.63^{a}
L	1X	38.75^{c}	39.20^{a}	3.04^{c}	91.10^{a}	71.57^{a}	10.25^{bcd}
	2X	39.37^{c}	38.27^{a}	3.01^{c}	88.94^{ab}	69.86^{ab}	110.38^{ab}
	3X	37.85^{c}	37.93^{a}	3.30^{b}	88.13^{abc}	69.22^{abc}	9.25^{cd}
H	1X	46.38^{b}	38.46^{a}	3.70^{a}	87.01^{bcd}	68.35^{bc}	8.83^{d}
	2X	48.08^{ab}	36.52^{b}	3.39^{b}	84.86^{cd}	66.64^{cd}	11.38^{ab}
	3X	49.60^{a}	35.98^{b}	3.10^{c}	83.60^{d}	65.65^{d}	12.01^{a}
SEM		0.62	0.17	0.02	0.45	0.35	0.19

BW: body weight; L: light; H: heavy; CFF: concentrate feeding frequency; 1X: once; 2X: twice; 3X: thrice SEM: standard error of the means.

ABW: average body weight; DMI: dry matter intake; DCPI: digestible crude protein intake; ME: metabolizable energy; NEm: net energy for maintenance; BWC: body weight change.

$^{a,\ b,\ c,\ and\ d}$: Means within column within treatment with different superscripts differ significantly (P < 0.05).

Table (9): Average body weight and nutrients intake of ewes throughout suckling period (90 d).

Item		BWP Kg	BWC Kg	ABW Kg	DMI g/ kg W	DCPI g/kg W	ME Cal/kg W	NEm Cal/ kg W	NEL Cal/kg	BWL Kg	BWW Kg
BW	L	35.58^{b}	5.18^{b}	34.62^{b}	43.4^{a}	3.52^{b}	106^{a}	83.1^{a}	42.2^{a}	1.58^{a}	34.00^{b}
	H	44.26^{a}	6.31^{a}	42.96^{a}	40.1^{b}	3.67^{a}	100^{b}	78.5^{b}	34.0^{b}	2.57^{b}	41.70^{a}
CFF	1X	38.84^{a}	5.76^{a}	37.83^{a}	41.5^{c}	3.59^{b}	102^{b}	80.3^{b}	38.9^{a}	2.00^{a}	36.86^{a}
	2X	40.46^{a}	5.91^{a}	39.07^{a}	41.7^{b}	3.56^{c}	102^{b}	80.3b	37.7^{a}	2.27^{a}	38.19^{a}
	3X	40.47^{a}	5.55^{a}	39.48^{a}	42.0^{a}	3.63^{a}	104^{a}	81.8^{a}	37.6^{a}	1.97^{a}	38.49^{a}
L	1X	34.93^{c}	5.59^{a}	34.29^{c}	43.1^{c}	3.34^{f}	100^{d}	78.7^{d}	42.6^{a}	1.28^{a}	33.65^{c}
	2X	36.87^{c}	5.35^{a}	35.47^{c}	43.4^{b}	3.41^{e}	105^{b}	82.5^{b}	41.3^{a}	1.77^{ab}	35.11^{c}
	3X	34.93^{c}	4.61^{a}	34.09^{c}	43.7^{a}	3.80^{b}	112^{a}	88.2^{a}	42.7^{a}	1.70^{ab}	33.24^{c}
H	1X	42.75^{b}	5.93^{a}	41.36^{b}	39.9^{f}	3.84^{a}	104^{c}	81.9^{c}	35.2^{b}	2.68^{cd}	40.07^{b}
	2X	44.04^{ab}	6.49^{a}	42.66^{ab}	40.1^{e}	3.72^{c}	99^{e}	78.1^{e}	34.1^{b}	2.77^{d}	41.28^{ab}
	3X	46.00^{a}	6.50^{a}	44.88^{a}	40.3^{d}	3.46^{d}	96^{f}	75.5^{f}	32.5^{b}	2.25^{bc}	43.75^{a}
SEM		0.62	0.21	0.58	0.19	0.02	0.57	0.45	0.57	0.08	0.57

BW: body weight; L; light; H: heavy; CFF; concentrate feeding frequency; 1X: once; 2X: twice; 3X: thrice
SEM: standard error of the means.

BWP: body weight after parturition; BWC: body weight Change after lambing; ABW: average body weight; BWL: body weight loss in lactation period (90d), BWW: body weight at weaning (90d).

$^{a,\ b,\ c,\ d,\ e,\ and\ f}$: Means within column within treatment with different superscripts differ significantly (P < 0.05).

The performance of suckling lambs is summarized in Table (10). Male lambs of H ewes grew faster (253g/d) than the L group (209g/d). Female lambs followed the same pattern with higher ADG being higher (222 vs 185g/d). All lambs grew better (242g/d) for H ewes than L ewes (196g/d).No differences were recorded due to feeding frequency.

Abozed *et al*. (2021) studied the effect of feeding frequency under different housing systems on physiological responses and growth performance under Upper Egypt hot conditions. Animals were divided into four groups; group I fed twice daily and housed in a semi-open pen, group II fed twice daily and housed in double-roofed pens, group III fed three times daily and kept in a semi-open pen and group IV fed three times daily and kept in a double-roofed pen. The results demonstrated that group III had the highest final body weight and total body weight gain and average daily gain followed by group I then group IV and group II.

Table (10): Performance of suckling lambs (90 d).

		Male lambs			Female lambs			Total lambs		
Item		BIW kg	WW kg	ADG g	BIW kg	WW kg	ADG g	BIW kg	WW kg	ADG g
BW	L	3.69^{b}	22.5^{b}	209^{b}	3.52^{b}	20.1^{b}	185^{b}	3.60^{b}	21.2^{b}	196^{b}
	H	4.17^{a}	27.0^{a}	253^{a}	4.07^{a}	29.1^{a}	222^{a}	4.16^{a}	25.9^{a}	242^{a}
CFF	1X	3.99^{a}	23.8^{a}	220^{a}	3.60^{a}	20.7^{b}	190^{a}	3.82^{a}	22.6^{a}	209^{a}
	2X	3.84^{a}	25.5^{a}	241^{a}	4.06^{a}	22.9^{a}	209^{a}	3.94^{a}	24.1a	224a
	3X	3.96^{a}	24.9^{a}	233^{a}	3.72^{a}	22.7^{ab}	211^{a}	3.87^{a}	24.0^{a}	224^{a}
L	1X	3.97^{ab}	21.1^{b}	191^{a}	3.60^{ab}	19.3^{b}	174^{b}	3.76^{abc}	20.1^{d}	181^{c}
	2X	3.69^{ab}	24.2^{ab}	228^{a}	3.65^{ab}	20.6^{b}	188^{b}	3.67^{bc}	22.1^{bcd}	205^{abc}
	3X	3.41^{b}	22.1^{ab}	207^{a}	3.30^{b}	20.69^{b}	192^{ab}	3.36^{c}	21.4^{cd}	201^{bc}
H	1X	4.01^{ab}	26.5^{ab}	249^{a}	3.60^{ab}	22.2^{ab}	207^{ab}	3.88^{abc}	25.1^{abc}	236^{ab}
	2X	3.99^{ab}	26.7^{ab}	253^{a}	4.47^{a}	25.2^{a}	230^{a}	4.21^{ab}	26.0^{ab}	242^{ab}
	3X	4.52^{a}	27.7^{a}	258^{a}	4.15^{ab}	24.8^{a}	229^{a}	4.38^{a}	26.6^{a}	247^{a}
SEM		0.10	0.68	7.34	0.11	0.49	4.75	0.07	0.47	4.90

BW: body weight; L; light; H: heavy; CFF; concentrate feeding frequency; 1X: once; 2X: twice; 3X: thrice;
SEM: standard error of the means. BIW: birth weight; WW: weaning weight; ADG: average daily gain;
$^{a,\ b,\ and\ c:}$ *Means within column within treatment with different superscripts differ significantly (P < 0.05).*

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تأثير وزن الجسم وتكرار تغذية العلف المركز على الأداء الإنتاجي والتناسلى لنعاج الأغنام البرقى

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تهدف هذه الدراسة الى تقييم تأثير وزن الجسم (30كجم نعاج خفيفة الوزن – 40 كجم ننعاج ثقيلة الوزن) وعدد مرات تغذية العلف المركز يوميا (مرة واحدة ، X1 ، مرتين ؛ X2 ، وثلاث مرات ؛ X3) على الأداء الإنتاجي والتناسلى للنعاج وحملانها , لذا فقد تم استخدام ستة وتسعون نعجة برقى موسم ثانى وعند عمر حوالي سنتين قبل موسم التلقيح وتم توزيعها عشوائياً على ست مجموعات في تصميم عاملي 2 × 3. الفترة التجريبية والتى استمرت ثمانية أشهر تضمنت الدورة التناسلية والإنتاجية للنعاج ، أي فترات التلقيح والحمل والرضاعة.
الحيوانات في المجموعات التجريبية تم إيواءها وتغذيتها بشكل منفصل في 6 حظائر وتم تغذية كل معاملة في مجموعة مستقلة. في اليوم 76 و 130 و 205 من التجربة ، 4 نعاج من كل مجموعة وضعت في حظائر منفصلة وتم تغذيتها بشكل فردي وفقًا لنظام التغذية الخاص بها لتحديد المأكول الفعلي فى مراحلها الفسيولوجية المختلفة ؛ الحمل المبكر والمتأخر وكذلك فترات الرضاعة. إنتاج اللبن تم تسجيله كل أسبوعين (5 سجلات) باستثناء الأسبوعين الأولين بعد الولادة. بعد فصل الحملان عن الأمهات ، تم حلب 5 نعجات في كل مجموعة لتفريغ الغدد اللبنية وحلبها مرة أخرى بعد 4 ساعات لتقييم إنتاج اللبن عند 4 ساعات ، وافترض أن الكمية الناتجة هي المعدل الطبيعي لإفراز اللبن وتم استقراءها عند 24 ساعة لتقدير إنتاج اللبن اليومي. أجريت تجارب الهضم بعد الفطام باستخدام 4 نعاج من كل مجموعة تم اختيارها عشوائياً لتقدير معاملات الهضم والقيمة الغذائية. كمية الماء المستهلكة تم تسجيلها و كان لجميع الحيوانات حرية الوصول إلى ماء الشرب. عينات سائل الكرش أخذت باستخدام اللى المعدى بعد 3 ساعات من تناول وجبة الصباح. أوضحت نتائج الدراسة ما يلى:-

- النعاج ذات الوزن الثقيل هضمت جميع العناصر الغذائية بشكل أفضل من النعاج الأخف وزنا مما أدى إلى قيم غذائية أعلى بشكل معنوى مقارنة بالنعاج الأخف وزنا.
- أدت زيادة عدد مرات تغذية العلف المركز إلى تحسين هضم الألياف والكربوهيدرات الذائبة ؛ مع عدم وجود فروق معنوية لباقى العناصر الغذائية الأخرى.
- استجابت النعاج خفيفة الوزن بشكل إيجابي عند تغذيتها ثلاث مرات مقارنة بالنعاج الأخرى ذات عدد مرات التغذية الاقل؛ فى المقابل ، فإن النعاج ذات الوزن الثقيل هضمت جميع العناصر الغذائية بشكل أفضل مع تغذيتها مرة واحدة مقارنة بالتغذية مرتين أو ثلاث مرات.
- القيمة الغذائية كانت أعلى مع النعاج الثقيلة مقارنة بالنعاج الأخف وزنا.
- القيمة الغذائية (TDN , DCP) لم تتحسن بزيادة عدد مرات التغذية المركزة.
- انخفضت قيم ال pH لعينات سائل الكرش بزيادة عدد مرات التغذية.
- أدت زيادة عدد مرات تغذية العلف المركز إلى زيادة إنتاج الأحماض الدهنية الطيارة (VFA) مقارنة بالتغذية مرة واحدة. النعاج ذات الوزن الثقيل سجلت قيم أعلى من VFA مقارنة بالنعاج الأخف وزناً مع مختلف عدد مرات التغذية.
- انتاج اللبن ارتفع معنويا فى النعاج الثقيلة مقارنة بالنعاج خفيفة الوزن,اتبع اللبن المعدل نفس الاتجاه و لم تسجل فروق معنوية بالنسبة لمكونات اللبن بين المجوعات التجريبية.
- زيادة عدد مرات التغذية أدت الى زيادة إنتاج اللبن واللبن المعدل للدهن , فى حين اتبعت طاقة اللبن/ NEL intake. بروتين اللبن/ CP intake الاتجاه العكسي.
- سجلت النعاج الخفيفة كفاءة غذائية تحويلية أفضل من النعاج ذات الوزن الثقيل و لم تؤثر تكرار عدد مرات التغذية على الكفاءة الإنتاجية وكذلك الكفاءة الغذائية التحويلية.
- خلال فترة الجفاف كانت النعاج ذات الوزن الثقيل أقل في المادة الجافة المأكولة (DMI) و المأكول من البروتين الخام المهضوم (DCPI) و الطاقة القابلة للتمثيل (ME) و الطاقة الصافية الحافظة (NEm).بينما لم تكن هناك اختلافات خلال فترة الحمل المبكرة فيما يتعلق بالقياسات المذكورة أعلاه.
- مع زيادة عدد مرات التغذية خلال فترة الجفاف ، زاد متوسط وزن الجسم بشكل ملحوظ ؛ اتبعت DCPI و ME و NEm نفس الاتجاه ولم يختلف الأمر للقياسات سابقة الذكر فيما عدا وزن الجسم خلال فترة الحمل المبكرة.
- خلال فترة الحمل المبكر كان DCPI أكبر مقارنة بفترة الجفاف , وسلك الاتجاه المعاكس خلال فترة الرضاعة مع تسجيل النعاج الثقيلة الأفضلية مقارنة بالنعاج الخفيفة مع مختلف تكرار مرات التغذية.
- تم تسجيل أداء الحيوانات الأفضل بشكل أساسي مع النعاج الثقيلة عند تغذيتها ثلاث مرات في اليوم.