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In conclusion. As a result of the time budget and physiological difference between lactating ewes with their lambs and non lactating ewes we suggest that providing separate pastures for each class of animals will be better due to the difference in their behaviors and energy demands.

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Lactating ewes had more grazing time and less walking than non lactating, as they concentrated all their interest on feed consumption to compensate the energy demand for lactation. Penning et al (1995) observed that ewes markedly altered their grazing time in relation to their physiological state and intake rate of herbage.

The total rumination time was more in case of barseem grazing in all animals, as this was attributed to the nature and structure of the plant and due to large bolus masses of regurgitated feed which need more chewing time during rumination. Adult animals had more rumination bouts and total rumination time than lambs; this is because of the lambs get small amounts of forages that need little time for rumination. However it has been recognized that the body size is an important determinant of ruminal nutritional ecology, since nutrient requirements are allometrically related to the body size (Owen-Smith 1988).

As lambs try to get their fed from the upper portion of the plant thus needs more time and more place to get all its needs and due to that lambs were very active and they try exploring their area thoroughly. Lambs spent most of their time in walking and playing activities around their dams and they formed subgroups and engaged in group playing activities as jumping and running. In case of crop residue grazing, the percentage of time walking and playing were more in case of ewes, but in case of lambs they had higher percentage during barseem

Results of the effect of the type of forages available in the grazing land on body weight of ewes and suckling lambs were presented in (Tables 4-a&b). During crop residue grazing, lactating and non lactating ewes lost weight all over the study, indicating that they were in negative energy balance, but in case of barseem grazing, they lost weight during the first four weeks then started to regain weight. This is because of barseem is good diet for lambs which led to reduction in suckling behavior. And also might be related to lamb's age as when the lambs get older , it depend more on barseem , thus decreased the suckling behavior. At the same time, ewes ate large amount of barseem, and this led to positive energy balance. The reduction in body weight at the start of barseem grazing might be related to the composition of the plant itself. Suckling lambs continue in gaining weight throughout the study, but the rate of growth was faster on barseem grazing. Penning et al., (1995) stated that clover generally had higher digestibility and nitrogen concentration than grass and this would increase its nutritional advantage over grass.

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lactating, this was because of frequent standing up and lying down in response to suckling by the lambs.

The effect of type of forage on rumination behavior of ewes (lactating and non lactating) and lambs was presented in (Tables 2-a &b). It was clear that there was a great difference in rumination behavior between crop residue and barseem grazing. The time between stopping grazing and starting of rumination was shorter in case of crop residue grazing, this is because of the small particles and small amount of grass ingested. The voluntary intake is limited by the rate at which rumen digesta can be regarded and cleared from the rumen (Weston, 1996 and Wilson and Kennedy, 1996). The bolus duration, and total rumination time (both during standing and lying down) were more in case of barseem grazing; this is because of the nature of the plant and its long stem that needs more time to be digested. These results agree with what reported by (Allen, 2000), as he reported that the decrease forage particle size leads to reduction of the time spent rumination, rumination periods and its duration. Animals ruminated significantly more in lying down position. Our results agree with (Ruckstuhl, 1998) who observed that sheep seemed to be ruminated most of the time when lying. The number of chews per boli was also affected by the type of plant grazed as it was more in case of barseem grazing. This might be attributed to the large quantity of barseem ingested by the animal and its dry matter content. Hadjigeorgiou et al., (2003) stated that the rumination chewing occupied a considerable proportion of the day and it was affected by plant length.

The effect of type of forage grazed by the animals on the percentage of time doing different behavioral patterns was shown in (Table 3a & b). As regarding the forge type effect, it is clear that the percentage of grazing time, walking or playing around were higher during crop residue grazing. This might be attributed to the less availability of forages in the field and animals tended to move very frequently to get all their needs. Prache, (1997) explained this by increase in time spent searching and gathering herbage because of selective grazing and to severing and chewing more fibrous herbage . Also the cause may be related to the rumination as it was faster in case of crop residue grazing, thus animals spent long time walking and playing around and moving between plants and involved in social activities. Penning et al., (1995) suggested that sheep can eat clover faster than grass because less time is required to prehend and masticate a bite of given mass for clover than grass.

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behavior. The grazing bouts . number of bites . and grazing time increased significantly in case of crop residue than barseem grazing. while the biting rate increased but not significant. This is due to that in case of crop residue grazing. the plants were short and scattered in the field. sheep graze longer to obtain adequate intake of good and poor quality forages and they moved very frequently in the field. which led to increase in the grazing time searching for feed. and as animals get less feed per bite hence. more bites as the grazing time is inversely proportional to the quality of pasture as reported by (De Wall and Biel. 1989). who stated that when the available amount of the animal's preferred forages is limited. the selective behaviors of the grazing sheep can cause drastic decrease in feed intake because the animal spends too much time looking for the plant parts it likes. Prache (1997) stated that the time per bite was linearly related to intake per bite on the vegetation structure. time spent on searching and handling. While in case of barseem. plants were long and in massive amounts. thus animals have larger bite area on barseem than on grass and they get all their needs in short bouts and less time with lower number of bites and this led to decrease the biting rate. Orr et al., (1997) found that fresh bite masses were greater for clover than grass.

The number of chews per bite before swallowing was foraging dependent. It was more during barseem than crop residue grazing. this is because of the long stem of barseem which needs more chewing movements and more time before swallowing and due to increase the bite mass than in case of crop residue grazing. Our results agree with what reported by Konoff and Heinrichs (2003) they reported that the reducing particle size resulted in decreased chewing activity per unit of dry matter. Penning et al.. (1991) stated that the bite mass increase with the increase the sward height and this was associated with reduced prehension rate and increased the mastication rate. Bouts duration were greater in case of crop residue than barseem. this was attributed to that barseem needs longer time for mastication. hence the lower bout duration.

From (Table 2-a) it was clear that the rumination behavior was affected by the physiological state of the ewes. The lactating ewes started rumination shortly after stopping grazing. It was found that in case of lactating ewes. the decreasing chewing movements of the regurgitated boli and the short bolus duration led to increase the number of boli per minute. more rumination bouts and decreased the rumination time than non lactating. Rumination during lying down was lower in lactating ewes than non

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Table (4-b): Effect of type of forage grazed by lambs on body weight (kg):

Weeks	Crop residue	Barseem
First	4.52 ± 5.8	5.25 ± 5.30
Second	6.21 ± 3.66	7.56 ± 4.58
Third	7.25 ± 5.45	9.57 ± 5.63
Fourth	9.06 ± 4.68	10.89 ± 7.30
Fifth	11.24 ± 3.67	12.29 ± 8.24
Sixth	12.45 ± 3.12	14.75 ± 5.84
Seventh	14.56 ± 6.94	16.28 ± 9.35
Eighth	15.67 ± 6.08	18.94 ± 8.35

DISCUSSION

From (Table 1-a) it is clear that the grazing behavior was significantly affected with the physiological state of ewes. Lactating ewes had significantly more grazing time, more number of bites, biting rate to get more feed as they need more energy for lactation than non lactating ones, this led to reduction in bite mass and smaller bites which requires lower number of chews per bite before swallowing, thus enhanced prehension biting rate. Spalinger and Hobbs, (1992) found an inverse relationship between bite mass and bite frequency. Prache (1997) stated that a high producing animal could also graze more efficiently by taking heavier bites and spending less time per bite, and he hypothesized that the high producing animal may choose to reduce their mastication rate in favor of prehension biting rate.

Results in (Table 1-b) cleared that type of forage significantly affected the grazing behavior of suckling lambs. During crop residue grazing lambs spent significantly more grazing time, had more number of grazing bouts, more number of bites than in case of barseem grazing. This might attributed to that in case of barseem grazing, lambs get good amount of milk during suckling their dams, while in case of crop residue the milk supply was not enough thus they increase their grazing activities. OReagain et al., (1996) reported that the less available forages , the more time spent grazing, because they get less feed per boli, hence more bites, due to large decrease in bite size. Ruminants can increase the intake of nutrients from low quality roughages by eating more of it.

The effect of type of forage on grazing behavior of ewes (lactating and non lactating) and suckling lambs, is presented in (Tables 1 a & b) it is clear that the type forage grazed by ewes significantly affected the grazing

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Table (3, a): Effect of type of forage grazed by the animals on the % of time doing different behavioral patterns during crop residue grazing:

Behavior	Crop residue		
	Lactating ewes	Non lactating ewes	Lambs
Grazing time	54.34±1.79[a]	42.44±0.67[b]	36.96±1.43[c]
Total rumination time	26.25±1.08[a]	28.05±0.98[a]	18.60±0.47[b]
other activities (walking, playing)	19.05±0.12[c]	29.51±0.95[b]	44.44±0.92[a]

Means within the same row with different superscripts (a, b, c) are significantly different (P≤ 0.05). n =10 suckling lambs, 15 lactating and 15 non lactating ewes.

Table (3, b): Effect of type of forage grazed by the animals on the % of time doing different behavioral patterns during barseem grazing:

Behavior	Barseem		
	Lactating ewes	Non lactating ewes	Lambs
Grazing time	47.51 ± 0.65 [a]	36.47 ± 0.89[b]	27.46 ± 0.98[c]
Total rumination time	35.38 ± 0.33[b]	39.002 ± 0.52[a]	21.55 ± 1.33[c]
other activities (walking, playing)	17.11 ± 1.33[c]	24.53 ± 0.31[b]	50.99 ± 0.79[a]

Means within the same row with different superscripts (a, b, c) are significantly different (P≤ 0.05). n =10 suckling lambs: 15 lactating and 15 non lactating ewes.

Table (4-a): Effect of type of forage grazed by ewes on body weight (kg)

Weeks	Crop residue		Barseem	
	Lactating ewes	Non lactating ewes	Lactating ewes	Non lactating ewes
First	45.38 ± 8.29	45.49 ±15.39	47.25 ± 8.69	45.50 ± 4.28
Second	44.98 ± 6.48	45.44 ± 14.12	47.10 ± 8.64	46.45 ± 5.23
Third	43.72 ± 10.56	43.58 ± 12.45	46.89 ± 11.02	45.80 ± 8.75
Fourth	42.59 ± 9.68	43.15 ± 12.25	47.59 ± 8.67	46.05 ± 9.25
Fifth	42.76 ± 10.25	43.89 ± 9.59	47.98 ± 8.14	47.16 ± 8.78
Sixth	42.63 ± 9.58	43.51 ± 11.57	48.31 ± 9.49	47.81 ± 10.25
Seventh	42.74 ± 9.56	42.57 ± 11.56	48.55 ± 9.58	47.87 ± 9.64
Eighth	42.85 ± 5.89	42.59± 8.75	48.98 ± 8.80	47.98 ± 9.62

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Table (2-a): Effect of type of forage on rumination behavior of ewes (lactating and non lactating):

Behavior	Crop residue		Barseem	
	Lactating	Non lactating	Lactating	Non lactating
Time between stopping grazing and starting of rumination	23.05 ±4.20^{b}	28.40 ±8.55^{a}	33.11 ±11.28^{a}	35.57 ±3.47^{a}
Bolus duration (sec.)	30.34 ±1.82^{b}	35.49 ±3.89^{b}	38.38 ±1.52^{a}	44.25 ±2.97^{a}
Number of chews per boli	38.50 ±6.58	41.32 ±7.57	43.78 ±11.20	48.92 ±9.84
*Rumination bouts (number)	218.03 ±2.35	199.05 ±3.42	232.29 ±1.21	222.12 ±2.25
Rumination during standing (min.)	27.41 ±9.51	27.35 ±8.24	32.58 ±9.45	38.25 ±7.85
Rumination during lying down (min.)	82.84 ±6.88^{b}	90.48 ±11.08^{b}	116.01 ±10.05^{a}	125.56 ±8.91^{a}
Total rumination time (min.)	110.25 ±6.57^{b}	117.83 ±4.58^{b}	148.59 ±11.23a	163.81 ±9.03^{a}

*Rumination bouts = rumination time was multiplied by 60 and divided by bolus duration.

Means within the same row with different superscripts (a, b) are significantly different (P≤ 0.05). n= (15 lactating and 15 non lactating ewes).

Table (2-b) Effect of type of forage on rumination behavior of lambs:

Behavior	Crop residue	Barseem
Time between stopping grazing and starting of rumination	18.30 ± 1.09	21.28± 0.56
Bolus duration (sec.)	27.18 ± 3.51	30.71 ± 2.45
Number of chews per boli	31.02 ± 0.49^{b}	38.47 ± 1.63^{a}
*Rumination bouts (number)	172.43 ± 1.95	176.87 ± 2.56
Rumination during standing (min.)	24.40 ± 5.23	24.11± 2.45
Rumination during lying down (min.)	53.71 ± 5.73	66.42 ± 3.56
Total rumination time (min.)	78.11 ± 2.95^{b}	90.53 ± 1.24^{a}

*Rumination bouts = rumination time was multiplied by 60 and divided by bolus duration.

Means within the same row with different superscripts (a, b) are significantly different (P≤ 0.05). n =10 suckling lambs.

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Konoff and Heinrichs (2003) defined the ruminating bouts as regular activity pattern characterizes with5 or 10 seconds period between boli when no jaw movements occurred. While animals in the field, the grazing behavior was interrupted by other behavioral activities as playing, walking, and lying down. To study the effect of type of forage grazes on body weight, 10 lactating ewes , 10 non lactating ewes and 10 suckling lambs were weighted at the beginning of the experiment, then weekly till the end of the experiment. Data sets were analyzed by using the statically analysis software (SAS, SAS institute Inc Release 8.1).

RESULTS

Table (1-a): Effect of type of forage on grazing behavior of ewes (lactating and non lactating)

Behavior	Crop residue		Barseem	
	Lactating	Non lactating	Lactating	Non lactating
Grazing time (min.)	228.23±3.45^{a}	178.24±5.14^{b}	199.56 ±7.23^{b}	153.17±6.47^{b}
Grazing bouts (number)	60.12 ±5.38	55.48 ± 5.12	57.23 ± 8.56	51.26 ± 6.85
Number of bites	3838.96±4.78^{a}	2650.43±2.49^{b}	2582.51±10.03^{b}	1689.51±6.23^{c}
*Biting rate	16.82±4.14	14.78±6.21	12.94 ±3.57	11.03±5.77
Number of chews per bite	30.73±8.16^{b}	33.18 ± 5.43^{b}	39.48 ± 4.50^{a}	36.52 ± 3.25^{a}
**Bout duration (min.)	3.80± 4.25	3.21± 5.28	3.47 ± 6.52	2.99 ± 2.78

*biting rate = number of bites divided by the grazing time.
** Bout duration (min.)= grazing time divided by the number of grazing bouts.
Means within the same row with different superscripts (a-c) are significantly different (P≤ 0.05). n= 15 lactating and 15 non lactating ewes.

Table (1-b): Effect of type of forage on grazing behavior of suckling lambs:

Behavior	Crop residue	Barseem
Grazing time (min.)	155.25± 6.58^{a}	115.34 ± 5.89^{b}
Grazing bouts (number)	63.12 ± 2.64	52.47 ± 7.50
Number of bites	1547.24 ±8.40^{a}	1047.29 ± 5.81^{b}
*Biting rate	10.14 ± 3.46	9.08 ± 7.35
Number of chews per bite	21.88 ± 5.84^{b}	30.456 ± 7.14^{a}
**Bout duration (min.)	2.45 ± 6.58	2.20 ± 6.41

*biting rate = number of bites divided by the grazing time.
** Bout duration (min.)= grazing time divided by the number of grazing bouts.
Means within the same row with different superscripts (a, b) are significantly different (P≤ 0.05). n =10 suckling lambs.

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activities), the effect of physiological state of ewes on grazing behavior, and the effect of different forages grazed by animals on body weight.

MATERIALS AND METHODS

This work was carried out at the faculty of Agriculture department of animal production, Moshtohor, Benha University to evaluate the influence of the type of forages grazed by animals on grazing behavior of lactating and non lactating ewes and suckling lambs. Eighty adult ewes (lactating and non lactating) , nearly of the same age, and 20 suckling lambs (age ranged between 40 and 60 days), lambs stayed with their dams till weaning, were used in this study. Animals were treated as one group, during crop residue grazing (after harvesting of corn and cotton), animals went out to the grazing field at 7.30 A.M and returned to their pens at 2.30 P.M., the atmospheric temperature ranged between 29-38° C (summer).While during barseem grazing, they get out from their pens at 8.30 A.M and returned at 3.30 P.M. the atmospheric temperature ranged between 17-25° C (winter). Animals had access to water at 7.00 A.M and at 2.30 P.M during crop residue grazing, and at 8.00 A.M and at 3.30 P.M during barseem grazing. After returning of animals to their pens, they were fed their normal diet. When forages were not sufficient (during crop residue grazing), animals were moved from one pasture to another. The observations covered the entire period of grazing by using of video camera from a distance of 3-5 meters. During recording, animals grazed undisturbed. The data were analyzed by using of focal sampling (one animal at a time as he grazes with the others), each focal animal was closely followed and his behaviors were recorded. Both the number and time of bites during grazing before swallowing (a bite was taken as the acts of breaking or picking up a piece of forage were studied. Direct and continuous bites taken by one individual was used to record the instantaneous ingestive behavior (Agreil and Mueuret, 2004). Number of chewing movements of bite before swallowing and time consumed, (Odo et al., 2001) defined the chewing activity as the primary mechanism to reduce feed particles, grazing bouts (grazing activity in one spot before moving to another). Eating bouts was defined as easting activity occurring for at least 5 minutes in cows (Konoff and Heinrichs, 2003). Phillips and Rind (2002) defined the grazing bout in cattle as the time spent by each animal grazing, actively prehend herbage with the head lowered.

Rumination behavior was also studied as the time consumed in rumination, time and number of chewing of the regurgitated cud. Also the rumination behavior both during standing and lying down was estimated.

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INTRODUCTION

One of the most important factors affecting animal performance is grazing behavior. Grazing behavior of animals is directly related to forage intake. Any factor influencing the grazing behavior of an animal may cause big economic gain or loss. Corn residue offers unique opportunities for livestock producers and provides a cheap feed source. Monitoring grazing behavior requires an estimate of grazing time, number of bites (movements that severe forage), number of ingested boli, and ingested boli weight (Demment et al., 1987). The time allotted for feeding varies depending on number of factors including forage availability, quality of feed and production stage of the animal. Penning et al. (1991) stated that animals on the clover sward spent significantly less time grazing and ruminating, and longer idling than those on grass. Grazing time depends on consumption behavior and level of nutrient demand. When ruminants are restricted to one grazing area long enough, they have to satisfy their requirements by consuming a resource that dwindles in time as a result of grazing (Agreil et al., 2005). It is well established that increasing forage particle size increase chewing activity. Konoff and Heinrichs (2003) defined the chewing activity as the primary mechanism to reduce feed particle size and are central to both the natures and digestion and passage through the gastrointestinal tract. The circadian patterns in eating jaw movements are in fact reflecting patterns in bite mass (Champion et al., 1994). Also Hadjigeorgiou et al., (2003) stated that the voluntary intake by sheep was increase as the size of the forage particles decreased and the total chewing activity was reduced. Most researchers have recorded a wide range of grazing time for sheep, most falls between (5-10 hours per day) penning et al., (1995), found that lactating sheep fed on grass had more grazing time 1 hr / 24 hours more than clover. Intake rate is determined from the ingestive behavior components (Ungar, 1998). Cazarra and Petit (1995) stated that bite weight was lower, both grazing time and biting rate were greater and organic matter intake of grass was higher on shorter swards. Edwards et al., (1995) suggested that it was easier for sheep to gather the clover than grass; this gives rise to differences in apparent bite areas and thus bite masses even though the bulk density of clover dry matter in the grazed horizon was slightly less than that of grass.

The grazing bout was defined as a period of at least 10 minutes grazing activity separated from preceding and subsequent periods of grazing activity by at least 30 minutes non grazing activity (Thornely et al., 1994).

The present investigation was carried out to clarify the effect of type of forages on different behavioral patterns (grazing, rumination, and other

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EFFECT OF TYPE OF FEED AND PHYSIOLOGICAL STATE OF EWES ON GRAZING BEHAVIOR UNDER EGYPTIAN CONDITIONS

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ABSTRACT

This study was conducted at the faculty of Agriculture department of animal production, Moshtohor, Benha University to evaluate the influence of the type of forages grazed by animals on grazing behavior of lactating and non lactating ewes and suckling lambs. Eighty adult ewes (lactating and non lactating) and 20 suckling lambs were used in this study. Animals were grazed on crop residue or barseem, they went out from their pens to the fields at 7.30 A.M and returned to their pens at 2.30 P.M. during crop residue while during barseem grazing, they get out from their pens at 8.30 A.M and returned at 3.30 P.M. Observations covered the entire period of grazing by using of video camera. To determine the body weight during grazing, 10 lactating and 10 non lactating ewes and 10 suckling lambs were weighed weekly. the overall results showed that the total grazing time, number of bites and grazing bouts , walking, and playing were more in case of crop residue than barseem grazing. The physiological state of ewes significantly affected the grazing and ruminating behavior. Ewes (lactating and non lactating) spent more time grazing, had more grazing bouts, more frequently bites, more chewing movements than lambs. At the same time, the lactating ewes spent more time grazing, had more bites and biting rate, but had lower rumination time than non lactating ones. The time between stopping grazing and starting of rumination, total rumination time increase among barseem grazing animals. Bolus duration was longer in case ob barseem grazing. All animals ruminated more during lying down. Lambs had higher percentage of walking and playing. Lambs gained weight in both crop residue and barseem grazing, but they gained more weight on barseem. During crop residue grazing ewes lost weight, but in case of barseem grazing, they lost weight at the beginning, and then started to regain weight after 4 weeks.

Keywords: Feed, Physiological, Ewes, Grazing Behavior.

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