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EFFECT OF PARTIAL REPLACEMENT OF CONCENTRATE FEED MIXTURE WITH MORINGA DRY LEAVES ON PRODUCTIVE PERFORMANCE OF ZARAIBY GOATS

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SUMMARY

The present work was carried out to study the effect of partial replacement of concentrate feed mixture (CFM) with *Moringa* dry leaves (MDL) at the levels of 5 and 10% in rations of Zaraiby goats on digestibility, milk yield and composition and body weight and mortality rate of their born kids. Eighteen Zaraiby goats with average live body weight of 39 kg and aged 4 years were used in this study starting from one month pre-partum to end of lactation (January - August). Goats were assigned according to live body weight, age and milk yield in previous lactation to three similar groups (6 does in each) and fed a ration consisted of 40% CFM + 60% berseem hay (BH). The first one was unsupplemented and served as control group (T1), while in the second and third ones, 5 and 10% of CFM was replaced with MDL for T2 and T3, respectively. Moringa dry leaves was higher in CP and EE contents, and so the contents of OM, CP and EE increased, however CF, NFE and ash contents decreased in CFM as well as in experimental rations with increasing the level of MDL supplement. Moringa dry leaves was rich in alanine, glutamic and tyrosine and have considerable amounts of arginine, aspartic, glycine, isoleucine, lysine, phenylalanine, proline, serine, threonine and valine, however, it was poorest in cysteine and methionine. Does in T3 showed significantly ($P<0.05$) the highest digestibility coefficients of DM, OM and NFE followed by T2, however T1 had the lowest values. Moreover, the digestibility coefficients of CP and EE as well as TDN and DCP values were significantly higher ($P<0.05$) in T2 and T3 compared to T1. Average daily milk yield was significantly higher ($P<0.05$) for T3 (1115.55 g) compared with T1 (910.18 g), while T2 (990.48 g) was intermediate insignificant differences with T1 and T3. Milk composition and yield for all components (fat, protein, lactose, TS, SNF and ash) increased significantly ($P<0.05$) with increasing the level of MDL supplement. Goats weight increased gradually post-partum up to the end of lactation (6^{th} month), and the increase seems to be higher in T2 and T3 than that of T1. The higher values of total protein and its fractions (albumin and globulin) were detected in serum of does in T3, however the lower values of total protein and albumin were found in T1 and globulin in T2. However, ALT concentration decreased significantly ($P<0.05$) with feeding diets containing MDL. Total DM intake was nearly the same for the different groups, whereas, TDN and DCP intakes were significantly higher ($P<0.05$) in T3 followed by T2, while T1 had the lowest values. Does in T3 recorded the lowest DM, TDN and DCP per kg milk followed by T2, however T1 had the highest values ($P<0.05$). Birth weight of born kids tended to increase with increasing the level of MDL, while, body weight of suckling kids at 30, 60 and 90 days was significantly higher ($P<0.05$) for T3 than that of T1 and T2 was intermediate. Mortality rate born kids during suckling period was significantly lower ($P<0.05$) in T2 and T3 than T1. Total feed cost tended to increase, while, the prices of milk yield and body weight of weaning kids as well as total and net income and economic efficiency increased significantly ($P<0.05$) with increasing the level of MDL supplementation. The present study concluded that Moringa can be good quality feeds and therefore replaced CFM with *Moringa* leaves at the levels of 5 or 10% for Zaraiby goats improved digestibility, milk yield and composition, feed intake and conversion, economic efficiency and growth rate of born kids and reduced mortality rate during suckling period.

Key words: *Moringa dry leaves, doe goats, digestibility, milk yield and composition, kids weight, mortality rate.*

INTRODUCTION

Livestock production is a very important part of the agricultural sector in many countries, representing up to 40% of the agricultural gross domestic product (Steinfeld *et al.*, 2006). In Egypt, there is a great developing gap between demand and available resources of animal protein. Meanwhile, high prices of concentrate feeds (oil seeds meal and grains) and insufficiency of good quality green fodders all over the year are the main factors constrain animal production development.

Moringa oleifera Lam (syns. *Moringa pterygosperm*, family Moringaceae) is a multipurpose tree, which was thought, could substitute L. Leucocephala as it possesses useful characteristics as multipurpose tree species. Its leaves and green fresh pods are used as vegetables by humans and are rich in carotene and ascorbic acid with a good quality protein rich of essential amino acids which can enhance dietary N utilization and improve animal productivity (Makkar and Becker, 1996). It is also used as livestock feed and its twigs are reported to be very palatable to ruminants. They also reported that *Moringa* forage is rich in most nutrients as its addition to low quality diets is useful to increase their dry matter intake and nutrients digestibility. Moreover, Newton *et al.* (2010) indicated that, *Moringa* leaves are rich in nutrients like iron, potassium, calcium and multivitamins which are essential for livestock gaining and milk production. Moringa can be also dried and used in the form of Moringa leaf meal.

Nadir *et al.* (2005) showed that the inclusion of *Moringa* as a protein supplement to low quality diets improved DM intake and digestibility of the diet and increased milk production and composition. It is considered as one of the World's most useful trees, as almost every part of the Moringa tree can be used for food, medication and industrial purposes (Khalafalla *et al.*, 2010).

In animals, nutrition plays a major role in animal's ability to overcome the detrimental effects of parasitism and diseases (Anwar *et al.*, 2007). A well-nourished animal resists diseases even when exposed to infection than the one, which is already weakened through malnutrition. When an animal is exposed to pathogens, the animal's immune system mounts a response to fight off infection. This includes raising antibodies to fight the infection, as well as using white blood cells to attack pathogens (FAO, 2002). To gain immunity, the animal needs energy, proteins for manufacture of antibodies and cells, minerals (zinc, copper and iron) and vitamins (A and E) in communicating messages in parts of the animal's body to fight infections (Conroy, 2005).

The present study was conducted to investigate the effect of partial replacement of concentrate feed mixture (CFM) with Moringa dry leaves (MDL) at the levels of 5 and 10% in rations of Zaraiby goats on digestibility, milk yield and composition and body weight and mortality rate of their born kids.

MATERIAL AND METHODS

The present work was carried out at Sakha Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture. Eighteen Zaraiby goats with average live body weight of 39 kg and aged 4 years were used in this study starting from one month pre-partum up to the end of lactation (January - August). Goats were assigned according to live body weight, age and milk yield in previous lactation to three similar groups (6 does in each) and fed a ration consisted of 40% concentrate feed mixture (CFM) + 60% berseem hay (BH). The first one was unsupplemented and served as control group (T1), while in the second and third ones, 5 and 10% of CFM was replaced with Moringa dry leaves (MDL) for T2 and T3, respectively.

Animals were fed to cover their recommended requirements to NRC (1985) feeding allowances for dairy goats and adjusted every month based on the average body weight and milk production. Concentrate feed mixture, berseem hay and *Moringa* leaves were offered twice daily at 8 a.m. and 4 p.m. Born kids were weighed at birth, and monthly thereafter up to the weaning at 90 days of age.

The branches with Moringa leaves and soft twigs collected from Moringa trees by cutting leaves. The harvested material was sun-dried for 24 h and partially dried leaves were removed by threshing and then sun-dried on black plastic sheets. The dried leaves were finely ground in a hammer mill, packed in sacks and stored in a well-ventilated storeroom. Amino acids content of dried Moringa leaves was determined in Research Oceanography, Fac. Sci., Mansoura Univ. by amino acid analyzer (Dionex ICS-300, USA) as described by Bassler and Buchholz (1993).

Three digestibility trials were done at the end of the feeding experiment using three animals from each treatment groups to determine the digestibility and nutritive values of the experimental rations. Acid insoluble ash (AIA) was used as a natural marker (Van keulen and Young, 1997). Feces samples were taken from the rectum of each animal twice daily with 12 hrs interval for 5 days, composited and representative samples were taken. Samples of feedstuffs were taken at the beginning, middle and end of the period, composited and representative samples were taken. Representative samples of CFM, MDL, BH and feces were dried at 60 ^{o}C for 48 hrs, ground and carried out for chemical analysis according to the methods of AOAC (2000). Nutrient digestibility was calculated from the equation stated by Schneider and Flat (1975) as follows:

$$\text{DM digestibility \%} = 100 - \left(\frac{\text{AIA \% in feed}}{\text{AIA \% in feces}} \times 100\right)$$

$$\text{Nutrient digestibility \%} = 100 - \left(100 \times \left(\frac{\text{AIA \% in feed}}{\text{AIA \% in feces}} \times \frac{\text{Nutrient \% in feces}}{\text{Nutrient \% in feed}}\right)\right)$$

After parturition, kids were allowed to suckle their dams up to weaning at 12 weeks of age. During the suckling period, all does were milked by hand twice daily at 6 a.m. and 5 p.m. every month and milk yield was measured individually, recorded and samples were taken for chemical analysis. During the day of milking, kids were removed from their dams and allowed to suckle other goats. While after weaning, does mechanically milking twice daily up to the end of lactation. Milk yield was individually measured at each milking time using Tru-Test milk meter. Milk samples were taken monthly by means of such milk meter for chemical analysis. Composite milk samples were analyzed for fat, protein, solids not fat (SNF), lactose and total solids (TS), and ash by Milkoscan, Model 133 B.

Blood samples were collected from the jugular vein at the end of experiment period from does and their kids. The blood samples were centrifuged at 4000 rpm for 15 minutes. Clear serum was separated and stored at (- 20 ^{0}C) for biochemical assays. Blood plasma protein, albumin, globulin (by difference), Asparagine aminotransferase (AST) and Alanine aminotransferase (ALT) were determined calorimetrically using commercial diagnostic kits (Test- combination-Pasteur Iap.).

All data were analyzed using the general linear models procedure of SAS (2000), data of percentages were subjected to arc-sin transformation to approximate normal distribution before being analyzed. Significant differences in the mean values among dietary treatments were analyzed by Duncan's tests (Duncan, 1955) within SAS program set at the level of significance ($P<0.05$).

The model used was:

$Y_{ij} = \mu + A_i + e_{ij}$ Where,

Y_{ij} = is the vector of observation; μ = the overall means;

A_i = the effect of i^{th} treatment, i = 1, 2, 3 e_{ij} = the effect of random error.

RESULTS AND DISCUSSION

Composition of Moringa dry leaves:

The composition of Moringa dry leaves in Table (1) showed higher content of CP (28.50%) and EE (4.88%) and lower ash content (9.28%). The contents of OM, CP and EE increased, however CF, NFE and ash contents decreased in CFM as well as in experimental rations with increasing the level of MDL supplement. These results are in accordance with the findings of El-Esawy (2015). Other studies have reported variable protein contents ranging between 16 and 40% (Oduro *et al.*, 2008 and Sanchez-Machado *et al.*, 2009).

Amino acids contents in Moringa dry leaves are presented in Table (2). Moringa dry leaves was rich in alanine (3.012%), glutamic (2.44%) and tyrosine (2.48%) and have considerable amounts of arginine (1.66%), aspartic (1.22%), glycine (1.42%), isoleucine (1.16%), lysine (1.55), phenylalanine (1.53%), proline (1.28%), serine (1.15%), threonine (1.30%) and valine (1.35%), however, it was poorest in cysteine and methionine. Moringa is reported to have high quality protein which is easily digested and that is influenced by the quality of its amino acids (Foidl *et al.*, 2001). In this study, the dried Moringa leaves contained 18 amino acids as reported by Foidl *et al.* (2001), while, slightly differ from the findings of Sanchez-Machado *et al.* (2009) who reported 16 amino acids. Cystine and HO-proline had the least values followed by methionine, which is commonly deficient in green leaves. Methionine and cystine are powerful antioxidants that help in the detoxification of harmful compounds and protect the body from radiation. In addition to each amino acid has a specific function in the animal's body. In general, amino acids are required for the production of enzymes, immunoglobulins, hormones, growth and repair of body tissues and form the structure of red blood cells (Brisibe *et al.*, 2009).

Table (1): Chemical composition of tested feedstuffs and experimental rations.

Item	Chemical composition (on DM basis)						
	DM	OM	CP	CF	EE	NFE	Ash
CFM T1	89.91	87.73	14.42	12.11	3.51	57.69	12.27
CFM T2	90.17	87.86	15.12	12.06	3.58	57.10	12.14
CFM T3	90.43	87.98	15.83	12.00	3.65	56.50	12.02
BH	90.43	89.16	12.84	27.92	3.07	45.33	10.84
MDL	95.13	90.23	28.50	11.01	4.88	42.13	9.28
Experimental rations:							
Ration T1	90.22	88.55	13.47	21.60	3.25	50.23	11.45
Ration T2	90.33	88.64	13.75	21.58	3.27	50.04	11.36
Ration T3	90.43	88.69	14.04	21.55	3.30	49.80	11.31

Table (2): Amino acids composition of Moringa dry leaves.

Amino acid	%	Amino acid	%
Alanine	3.012	Lysine	1.547
Arginine	1.660	Methionine	0.241
Aspartic	1.220	Phenylalanine	1.530
Cysteine	0.011	Proline	1.278
Glutamic	2.440	Serine	1.152
Glycine	1.423	Threonine	1.296
Histidine	0.814	Tryptophan	0.452
Ho-Proline	0.083	Tyrosine	2.480
Isoleucine	1.156	Valine	1.354

Digestion coefficients and feeding values of the experimental rations:

Results in Table (3) showed the digestion coefficients and feeding values of the experimental rations. Does in T3 fed ration contained high level of MDL (10%) showed significantly (P<0.05) the highest digestibility coefficients of DM, OM and NFE followed by T2, however T1 had the lowest values. Moreover, the digestibility coefficients of CP and EE as well as TDN and DCP values were significantly higher (P<0.05) in T2 and T3 compared to T1. While, CF digestibility was not significantly (P>0.05) affected by MDL supplement. This may probably be due to interference of protein with microbial attachment or depressing cellulolytic bacterial population (McSweeney *et al.*, 1998).

Table (3): Digestibility coefficients and nutritive values of experimental rations.

Item	Experimental rations			MSE
	T1	T2	T3	
Digestibility coefficient, %:				
DM	60.02^{c}	61.23^{b}	63.02^{a}	0.26
OM	65.08^{c}	68.01^{b}	70.29^{a}	0.12
CP	59.25^{b}	62.18^{a}	64.85^{a}	0.08
CF	57.24	58.02	59.22	0.74
EE	60.35^{b}	64.18^{a}	66.15^{a}	0.85
NFE	70.47^{c}	73.21^{b}	75.05^{a}	0.18
Nutritive values (% on DM basis)				
TDN	60.15^{c}	62.43^{b}	64.15^{a}	0.35
DCP	7.98^{b}	8.55^{ab}	9.10^{a}	0.22

a, b and c: Means in the same row with different subscripts differed significantly (P<0.05).

There are many different reasons for those variations. Fujihara *et al.* (2005) reported a decrease of 22% in CP concentration when soft twigs were included along with leaves in leaf meal compared with leaves alone. Other authors reported 254 g kg^{-1} DM when only leaves were used in leaf meal and 120 g kg^{-1} DM when leaves and branches were used (Afuang *et al.*, 2003). Mohamed *et al.* (2014) indicated that rations contained *Moringa* had higher nutrients digestibility values and nutritive values expressed as TDN or DCP.

Milk yield and composition:

Milk yield (g) and composition (%) for lactating does fed the experimental rations are presented Table (4). Average daily milk yield was significantly higher (P<0.05) for T3 (1115.55 g) compared with T1 (910.18 g), while T2 (990.48 g) was intermediate insignificant differences with T1 and T3. Milk yield for T2 and T3 increased by 8.82 and 22.56% compared to T1, respectively. The current results obtained are in agreement with those reported by Reyes –*Sanchez et al.*, (2006) who reported an increase (P<0.05) in milk production from 3.1 to 4.9 and 5.1 kg/day when *Moringa oleifera* was supplemented by 2 or 3 kg DM, respectively. Likewise, Sarwatt *et al.* (2004) reported that the milk yield in cows was increased (p<0.05) due to feeding of *Moringa oleifera*. They view that *Moringa oleifera* has a positive effect on the rumen environment, leading to increased rumen microbial output or to the fact that the protein in *Moringa oleifera* also has good rumen by-pass characteristics. Mohamed *et al.* (2014) found that milk yield were higher (P<0.05) with rations contained either 20 or 40% *Moringa* than those fed 40% berseem ration.

Table (4): Average body weight, milk yield, milk composition and milk constituents yield of Zaraiby goats fed experimental rations.

Item	Experimental rations			MSE
	T1	T2	T3	
Body weight (kg)	39.10	39.20	39.10	0.01
Milk yield (g/day)	910.18^{b}	990.48^{ab}	1115.55^{a}	45.13
Milk composition, %:				
Fat	2.99^{b}	3.20^{a}	3.24^{a}	0.02
Protein	2.53^{c}	2.85^{b}	3.01^{a}	0.03
Lactose	4.23^{b}	4.44^{ab}	4.78^{a}	0.11
Total solid (TS)	10.32^{b}	11.23^{a}	11.65^{a}	0.15
Solid not fat (SNF)	7.33^{c}	7.99^{b}	8.43^{a}	0.12
Ash	0.57^{b}	0.70^{a}	0.64^{ab}	0.14
Milk constituents yield (g/day):				
Fat	27.21^{c}	31.69^{b}	36.14^{a}	2.01
Protein	23.02^{c}	28.22^{b}	33.57^{a}	1.57
Lactose	38.50^{b}	43.97^{ab}	53.32^{a}	3.00
Total solids	93.93^{b}	110.83^{ab}	130.18^{a}	6.59
Solid not fat	66.71^{b}	79.13^{ab}	94.04^{a}	5.01

a, b and c: Means value in the same row with different subscripts differed significantly (P<0.05).

Milk composition and yield for all components (fat, protein, lactose, TS, SNF and ash) increased significantly (P<0.05) with increasing the level of MDL supplement as shown in Table (4). The highest contents and yield of fat, protein, lactose, TS and SNF were detected in T3. The contents of fat, protein, lactose, TS and SNF in milk of T2 and T3 increased by 7.02, 8.36; 12.65, 16.67; 4.96, 13.00; 8.82, 12.89 and 9.00, 15.01% compared to T1, respectively. The increase of milk constituents yield in T2 and T3 attributed to the increase of milk yield as well as milk composition. These results were confirmed with results of nutrients digestibility (Table 3). These results agreed with those obtained by Basitan and Emma, (2013) who found that feeding *Moringa* supplemented rations had higher (P<0.05) percentage of fat and fat yield than cows fed free *Moringa* ration. Reyes –*Sanchez et al.* (2006) described the similar findings that cows supplemented with *Moringa oleifera* yielded more milk fat and milk CP than cows fed hay alone or with sorghum silage as a basal diet. Mohamed *et al.* (2014) who found that the milk lactose, TS and SNF in milk were higher (P<0.05) with rations contained either 20 or 40% *Moringa* than those fed 40% berseem ration.

Body weight of does:

Data in Figure (1) showed that goats on all treatment groups have average body weight of 39 kg at one month pre-partum (start of experiment) and decreased at partum to 28.80, 29.17 and 28.20 kg for T1, T2 and T3; respectively. Goats weight increased gradually post-partum up to the end of lactation (6^{th} month) and the increase seems to be higher in T2 and T3 than that of T1 (34.22 and 34.03 vs. 32.17 kg, respectively). The increase in body weight with increasing levels of Moringa leaves could be due to increased total DM and CP intake, some body protein reserves were probably mobilized to support maintenance requirement of the does. The values for live weight loss or gain in lactating goats with minor modifications (AFRC, 1998). Thus it was assumed that goats lose 1.0 kg/week for the first 4 weeks of lactation but none in weeks 5–8 compared with losses of 0.5 kg/week adopted by INRA (1988).

Sarwatt *et al.* (2002) found loss body weight with control treatment than does fed Moringa leaves and indicates that protein supplementation is necessary for growth and development. Supplemented goats had an average BW gain of 86 and 78 g/day while nonsupplemented goats gained only 55 g/day (Aregheore, 2002). When bullocks were stall-fed with only star grass hay (Cynodon dactylon) or hay supplemented with Moringa leaves at 0.6% of BW in DM, significant differences in weight gain, 0.045 vs. 0.380 kg/day, respectively.

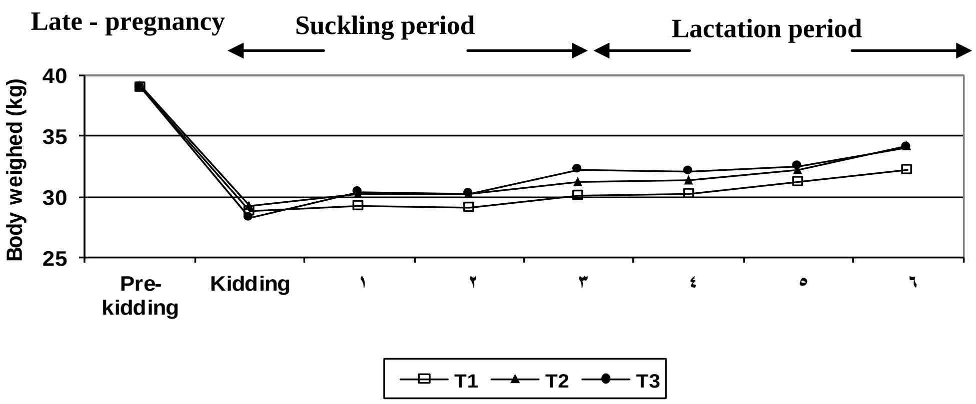

Fig. (1): Effect of experimental rations on body weight (kg) of Zaraibi treatment groups.

Blood parameters:

Blood serum parameters for does fed the different levels *of Moringa* dry leaves are presented in Table (5). Serum biochemical parameters revealed significant differences (P<0.05) among the treatment groups. The higher values of total protein and its fractions (albumin and globulin) were detected in serum of does in T3 (10% MDL), however the lower values of total protein and albumin were found in T1 (control) and globulin in T2 (5% MDL). On the other side, ALT concentration decreased significantly (P<0.05) with feeding diets containing MDL. While, AST concentration was not affected by MDL supplement. These results are in agreement with those reported by Mohamed *et al.* (2014) who reported that total protein, albumin and globulin were highly significant with *Moringa* feeding. While, AST and ALT were comparable among groups. Like other animals, serum level of AST in conjunction with other enzymes may be useful indicator for hepatic or muscular damage, but Kerr (1989) considers AST as non specific index for liver investigations. According to Maxwell *et al.* (1990) blood parameters are important in assessing the quality and suitability of feed ingredients in farm animals.

These results indicated that feeding on Moringa leaves (T2 and T3) to lactating goats rations did not negatively affected liver activity or animal's health, these results may be due to the improvements occurred in metabolic process as a response to the Moringa leaves which stimulation of rumen micro flora activity through saving some micro factors to rumen microflora such as microelements, vitamins, hormones and enzymes which are required to the efficient digestion, absorption and metabolism (Ali *et al.*, 2005 and EL Ashry *et al.*, 2006).

The concentration of biochemical indicators exclusively in healthy goats and did not observe any aberrations from the physiological values (Nazifi *et al.*, 1999). Others investigated healthy goats and presented biochemical indicators in relation to age, sex, breed, reproduction cycle, season of the year, influence of stress, and maintenance conditions.

Table (5): Blood serum parameters of Zaraiby goats affected by fed experimental rations.

Item	Experimental rations			MSE
	T1	T2	T3	
Total protein(g/dl)	6.41^{b}	6.48^{b}	7.88^{a}	0.51
Albumin (g/dl	3.90^{b}	4.65^{a}	4.88^{a}	0.14
Globulin (g/dl)	2.51^{ab}	1.83^{b}	3.00^{a}	0.17
AST (U/L)	27.28^{a}	23.33^{b}	17.12^{c}	2.81
ALT (U/L)	26.13	25.01	24.24	3.02

a, b and c: Means in the same row with different subscripts differed significantly (P<0.05) .

Feed intake and feed conversion ratio:

Feed intake as shown in Table (6) revealed that total DM intake was nearly the same for the different groups. Whereas, TDN and DCP intakes were significantly higher (P<0.05) in T3 followed by T2, while T1 had the lowest values. These results attributed to the differences in TDN and DCP values presented in Table (3). These results agreed with those obtained by Elaidy *et al.* (2017) who found that the intake of TDN and DCP increased significantly with DMOL supplementation for suckling calves.

Also, data in Table (6) indicated the feed conversion ratio improved significantly (P<0.05) with MDL supplement. Does in T3 recorded the lowest DM, TDN and DCP per kg milk followed by T2, however T1 had the highest values (P<0.05). These results are in the reflection with milk yield (Table 4) and the intake of DM, TDN and DCP (Table 6). These results are in accordance with those obtained by El-Esawy (2015) who found that feed conversion efficiency improved with Moringa dry leaves inclusion in rations of dairy cows.

Table (6): Feed intake and feed conversion ratio for different treatment groups.

Item	Experimental rations			MSE
	T1	T2	T3	
Feed intake (g/day):				
CFM	600	570	540	
BH	900	900	900	
MDL	-	30	60	
Total DM intake	1353.33	1354.90	1356.46	1.56
TDN	814.03^{c}	845.86^{b}	870.17^{a}	4.74
DCP	108.00^{b}	115.84^{ab}	123.44^{a}	0.25
Feed conversion ratio:				
DM kg/ kg milk	1.49^{a}	1.37^{b}	1.22^{c}	0.12
TDN kg/ kg milk	0.89^{a}	0.85^{ab}	0.78^{b}	0.07
DCP g/ kg milk	118.66^{a}	116.95^{a}	110.65^{b}	3.24

a, b and c: Means in the same row with different subscripts differed significantly (P<0.05) .

Body weight of born kids:

Body weight of born kids from birth until weaning was showed in Table (7). Birth weight of born kids tended to increase with increasing the level of MDL in rations without significant differences among the treatment groups. While, body weight of suckling kids at 30, 60 and 90 days was significantly higher (P<0.05) for T3 (10% MDL) than that of T1. Moreover, body weight of kids in T2 was intermediate between T1 and T3 without significant differences. Weaning weight of kids in T2 and T3 increased by 1.35 and 3.52 kg or 12.15 and 31.68% compared with T1. These results indicates that including *M. oleifera* leaves in the diets of does improved the growth performance of suckling kids, which might be attributed to the increase of milk yield and composition (Table 4). Growth rate seems to be influenced by feed availability, milk supply and climate conditions. With the nutritional management of the doe treatment groups, the kid management program has the greatest effect on the long-term productivity of the dairy goat herd with attention to the nutritional needs of the gestating doe in lactation. These findings are consistent with, and slightly better than earlier results on crossbred goats involving the same breeds and breed levels (Ruvuna *et al.*, 1992; Okeyo *et al.*, 1999). Elaidy *et al*. (2017) reported that replacing up to 15% of calf starter by dry *Moringa olefira* leaves improved growth performance of suckling buffalo calves.

Table (7): Body weight (kg) of born kids during suckling period.

Age (day)	Experimental rations			MSE
	T1	T2	T3	
0 (birth)	2.03	2.11	2.24	0.09
30	7.15^{b}	8.42^{ab}	9.16^{a}	0.52
60	9.77^{b}	10.40^{ab}	12.80^{a}	0.34
90 (weaning)	11.11^{b}	12.46^{ab}	14.63^{a}	0.23

a and b: Means value in the same row with different subscripts differed significantly (P<o.o5).

Mortality rate of born kids:

Mortality rates of produced kids was 0% in all treatments at birth; 12.5% (1/8), 10.0% (1/10) and 11.1% (1/9) in T1, T2 and T3 at 30 days of age; 12.5% (1/8), 0% (0/10) and 0% (0/9) T1, T2 and T3 at 60 days of age and 0% (0/8), 10% (1/10) and 0% (0/9) in T1, T2 and T3 at 90 days of age and the total mortality rate during the suckling period was 25% (2/8), 20% (2/10) and 11.1% (1/9) in T1, T2 and T3, respectively as shown in Table (8).

A relatively high mortality rate was recorded during the first 30 days of age 11.1 (3/27), and tended to decrease thereafter with the advancing age. The differences in mortality rate for the whole suckling period was significant (P<0.05), which T1 had the highest rate, followed by T2, while the lowest rate was in T3. Heavy loss of kid might be due to milk suckling, with larger frequency leading to high sensitivity to stress and susceptibility to infection. The decrease in mortality rate might be due to the fact that *M. oleifera* is rich in amino acids, vitamins and minerals particularly iron (Faye, 2011). Diets rich in amino acids help to boost the immune system (Kyriazakis and Houdijk, 2006). Kids at young age are very susceptible to Pasteurella haemolyrica and Salmonella typhimurium which cause pneumonia and pneumoenteritis and septecaemia. High mortality rates might be due to large number of kids born in winter when it became difficult to handle all of them in a short span of time, particularly at birth (Snyman, 2010)

Table (8): Effect of experimental rations on mortality rate of kids from does fed experimental rations.

Treatment group	N	Type of kids birth		Total	Mortality rate (%)				
		Single (%)	Twine (%)		at birth	30 d	60 d	90 d	Total
T1	6	4 (66.7)^{a}	2 (33.3)^{b}	8	0 (0)	1 (12.5)	1 (12.5)	0 (0)	2 (25.0)^{a}
T2	6	2 (3.33)^{c}	4 (66.7)^{a}	10	0 (0)	1 (10.0)	0 (0)	1 (10.0)	2 (20.0)^{b}
T3	6	3 (50.0)^{b}	3 (50.0)^{c}	9	0 (0)	1 (11.1)	0 (0)	0 (0)	1 (11.1)^{c}
Overall	18	9 (50.0)	9 (50.0)	27	0 (0)	3 (11.1)	1 (3.7)	1 (3.7)	5 (18.5)

a, b, c and d: Means denoted within the same column with different superscripts are significantly different at P<0.05.
N: Number of kidded does.

Economic efficiency:

Results of economic efficiency in Table (9) revealed that total feed cost tended to increase with increasing the level of MDL supplementation, which might to higher price of MDL than CFM (5 vs. 4 LE). Moreover, the prices of milk yield and body weight of weaning kids as well as total and net income and economic efficiency increased with increasing the level of MDL supplementation. These results attributed to increase milk yield (Table 4) and body weight of kids at weaning (Table 7) with increasing the level of MDL supplementation. These results agreed with those obtained by El-Esawy (2015) who found that economic efficiency improved with Moringa dry leaves inclusion in rations of dairy cows. Elaidy *et al.* (2017) reported that economic efficiency increased significantly with DMOL supplementation for suckling buffalo calves.

The results of the present study concluded that Moringa can help small and medium-scale farmers overcome shortages of good quality feeds and therefore sustain and improve their livestock systems. Replaced CFM with *Moringa* leaves as a source of protein at the levels of 5 or 10% in rations of Zaraiby doe goats improved digestibility, milk yield and composition, feed intake, feed conversion ratio, economic efficiency and growth rate of born kids and reduced their mortality rate during suckling period. *Moringa oliefera* is a potential plant protein supplement and could be included at 10% to substitute the concentrate feed mixture protein in the diet of goats.

Table (9): Economic efficiency for goats in different treatment groups.

Item	Treatment groups		
	T1	T2	T3
No. of Dams	6	6	6
Experimental period	210	210	210
Feed cost:			
CFM (4 LE/kg):			
Quantity (kg)	756	718.2	680
Price (LE)	3024	2872.8	2721.6
BH (1 LE/kg)			
Quantity (kg)	1134	1134	1134
Price (LE)	1134	1134	1134
MDL (5 LE / kg)			
Quantity (kg)	-	37.8	75.6
Price (LE)	-	189	378
Total cost (LE)	4158	4195.8	4233.6
Income:			
Milk yield (4 LE/ kg)			
Quantity (kg)	655.3	713.1	803.2
Price (LE)	2621.2	2852.4	3212.8
Kids born weight (at weaning):			
No. of kids	6	8	8
Body weight (kg)	11.11	12.46	14.63
Price (40 LE/ kg)	2666.4	3987.2	4681.6
Total income (LE)	5287.6	6839.6	7894.4
Net income (LE)*	1129.6	2643.8	3660.8
Economic efficiency**	1.27	1.63	1.86

** Net income = total income – total cost.*
*** Economic efficiency = total income/ total cost.*
The prices of the first half of 2017.

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تأثير الاستبدال الجزئى من العلف المركز بأوراق المورينجا الجافة على الأداء الانتاجى للماعز الزرايبى

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اجريت هذه الدراسه لدراسة مدى تأثير استبدال جزء من العلف المركز بأوراق المورينجا الجافه بمعدل 5% ،10% للماعز الزرايبى على كفاءه الهضم وانتاج اللبن وتركيبه ومعدل النفوق فى مواليد هذه الماعز. تم استخدام 18 عنزة زرايبى حيث كانت بدايه التجربه قبل شهر من الولاده (يناير) واستمرت حتي نهايه التجربه (اغسطس) تم تقسيم العنزات بصوره عشوائيه الى ثلاثه مجموعات بكل مجموعه سته امهات وكان متوسط الوزن 39 كجم / رأس، وعمر 4 سنوات. العنزات فى المعامله الاولى (المجموعه المقارنة) كانت تغذى على علائق مكونه من 40 % علف مركز و 60 % علف مالئ (دريس برسيم) بينما العنزات فى المعامله الثانيه والثالثه تم استبدال جزء من العلف المركز باوراق المورينجا بنسبه 5 % للمجموعه الثانيه و 10 % للمجموعه الثالثه. وجد ان أوراق المورينجا الجافه كانت عالية فى نسبة البروتين (28,50%) الدهن (4,88%) وكانت اعلى قيمه للأحماض الامينيه فى اوراق المورينجا الجافه للحامض الامينى الالنين بينما كان اقل محتوى للحامض الاميني السيستئين والمثيونين . كذالك اظهرت المعامله الثانيه والثالثه ارتفاع معنوي فى المعاملات الهضمية للبروتين والمستخلص الاثيرى عن مجموعة المقارنة بينما كانت المعامله الثالثه الاعلى معنويا فى مجموع المواد الغذائيه المهضومة عن المعامله الثانيه والاولى وسجلت نتائج محصول اللبن اليومي اعلى معنويه للمعامله الثالثه 1115,55 جم بالمقارنه بالمعامله الثانيه 990,48 جم والمعامله الاولى 910,18 جم ولم يكن هناك فروق معنويه بين المعامله الثانيه والثالثه. كما حدث زياده معنويه لبروتين الدم الكلي بشقيه الالبيومين والجلوبيولين عند التغذيه على اوراق المورينجا ضمن العلائق بالمقارنه بعليقه المقارنة بينما انخفض تركيز انزيمات الكبد (ALT –AST). بينمالم يلاحظ اى فروق معنوية بين الثلاث معاملات فى وزن النتاج عند الميلاد بالرغم من ان معدل الوزن للمواليد عند الولاده للمعامله الثالثه والمضاف لها اعلى مستوى من المورينجا 2,24 كجم كان اعلى من المعامله الثانيه 2,11 كجم والمعامله الاولى 2,03 كجم. أما معدل النفوق للمواليد عند الولاده اظهر انه لم يكن هناك اى حالات نفوق للنتاج للمعامله الاولى والثانيه والثالثه عند الميلاد (صفر%) بالمقارنه بنسبه 12,5% – 10% و 11,1% للمعامله الاولى والثانيه والثالثه عند عمر 30 يوم وكانت النسبه 12,5 للمعامله الاولى صفر % للمعامله الثانيه والثالثه عند عمر 60 يوم بينما كانت نسبه النفوق عند عمر 90 يوم من الولاده صفر% للمعامله الاولى والثالثه بينما المعامله الثانيه كانت بنسبه 10% ليصبح معدل النفوق الكلى عند الفطام 25% للمعامله الاولى 20% للمعامله الثانيه و 11,1 للمعامله الثالثه.وبالتالى انعكس ذلك على الكفاءة الاقتصادية فزادت بزيادة نسبة الاستبدال بأوراق المورينجا الجافة فى العليقة.

ونستخلص من هذه الدراسه ان المورينجا يمكن ان تكون غذاء عالى الجوده وان استبدالها بجزء من العلف المركز بنسبه 5% او 10% للماعز الزاريبى يؤدى الى تحسن فى عمليات الهضم وانتاج وتركيب اللبن والمأكول اليومى ومعدل التحويل الغذائى ومعدلات النمو للمواليد والكفاءة الاقتصادية وكذلك انخفاض معدل النفوق للمواليد . بدون اى تأثير سلبى على صحة الحيوان.