Effect of Replacing Berseem Hay by Dried Sugar Beet Tops on Performance of Friesian Calves

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Received: *5/8/2021*

Abstract: The current work was carried out to investigate the effect of replace different percentages of berseem hay (BH) by dried sugar beet tops (DSBT) on the performance of suckling and post weaning Friesian calves. Twenty newly born Friesian calves (10 males and 10 females) with live body weight (LBW) of 41.3±0.5 kg were used after suckling their dam's until 15 days of age, and then divided into five similar groups. The whole experimental period was lasted for 165 days where it staged for consecutive two periods, the first one (P1) was serves as suckling period from the 15th days of age until the weaning and the second one (P2) was continued from 106 to 180 days of age (post weaning period). All claves were fed a basal diet consisted of whole milk, calf starter (CS), BH and DSBT during P1. Consecutively, CS, BH and DSBT during P2. Calves were assigned randomly on the following treatment groups, G1: 50% CS + 50% BH, G2: 50% CS + 37.5% BH + 12.5% DSBT, G3: 50% CS + 25% BH + 25% DSBT, G4: 50% CS + 12.5% BH + 37.5% DSBT and G5: 50% CS + 50% DSBT. Results showed that replace of BH by DSBT improved (P<0.05) the digestibility coefficients of DM, OM, CP, CF, EE and NFE as well as nutritive values represented as TDN and DCP during the different experimental periods, where, the G3showed the highest (P<0.05) values. Also, ruminal pH value and ammonia-N were decreased (P<0.05) with G3, however, TVFA's was increased (P<0.05). But, there were no differences among G1 and G2 or G4 and G5. Moreover, the effect of replace of BH by DSBT on plasma total protein, albumin, creatinine, urea-N, liver enzymes (AST and ALT) activity, Cholesterol, Triglycerides and glucose of Friesian calves during different experimental periods were improved with G3 and G2. The values which obtained in this study are with the normal range. Calves in G3 recorded the highest LBW, WG and ADG followed by calves in G2, G1, G4 and G5 during the different periods. Also, G3 and G2 showed the highest total and net revenue compared to other groups. It could be concluded that there place 50% of BH by DSBT (G3) for Friesian calves rations improved the Friesian calves performance and economic efficiency.

Keywords: Friesian calves, dried sugar beet tops, digestibility, feed intake, growth performance

INTRODUCTION

Under Egyptian conditions there is potential for increased livestock production through use of agricultural by-products as a supplement in ruminant diets. The need to have alternative source of animal feed and/or sustainable supplementation Cereal and legume crop residues and agro-industrial by-products have played a major role in supplying supplemental nutrients (Haile *et al.,* 2016). Ruminant nutrition is one of the most important factors which determine their productivity and performance in terms of milk and meat production. But matter of fact is that there is a dire need to diversify the sources for digestible nutrients as well as protein for sustainable milk and meat production. In this context, a variety of by-products produced by sugar beet industries may find their use in addition with forage sorghum to fulfill the nutritional needs of ruminants during periods of forage scarcity (Iqbal *et al.,* 2015). Sugar beet is planted for sugar production and significant amounts of sugar beet leaves are obtained as a by-product. While some of the leaves obtained during the harvest of sugar beet are considered as a source of fresh roughage, a significant part of it is left in the field and mixed with the soil as an organic fertilizer (Pimlott, 1991). It is reported that 80-85% of sugar beets root yield has been obtained from sugar beet leaves, however, approximately 80% of these beet leaves remain in the field and only 20% are ensiled (Przybyl, 1994). In Egypt, there is a shortage of available fed for ruminant. So that a growing attention is being focused on the use of crop by-products such as sugar beet by-products. Using of these by-products will decrease the feed cost as well as limitation the environmental pollution. In 2017 a large area was about 545000 acres cultivated with sugar beet in Egypt, which produced about 650000 tons of dried sugar beet pulp (DSBP) as a by-product of' sugar beet. It also produced about 6.8 million tons of fresh sugar beet tops (FSBT) as an agricultural by-product (MALR, 2017). Sugar beet is one of the main crops cultivated in Egypt. Sugar beet tops (SBT), which include the crowns and the leaves, are residues from harvested sugar beet. A normal crop of sugar beets produces from 40 to 50% its weight in SBT. Going by this estimate, it is evident that several tons of SBT are produced from sugar beet cultivation and they could be an additional source of revenues for the farmer. SBT are valuable livestock feed (*Ohuchi et al.,* 2015). There are some problems in using fresh sugar beet tops (FSBT) because it's high in moisture, potassium and oxalic acid content which lead to diarrhea and must be taken in consideration when used in animal feeding and ration formulation (Bendary *et al.,* 1992; Senara, 2006). So drying or ensilage of SBT is a method for conservation which may contribute in solving some of the problems as resource of animal feeding shortage and minimize pollution especially in the summer season (Ali and Darwish, 2001).

The main objective of this study was to replace different percentages of berseem hay by dried sugar beet tops and to find out the effect of this on the digestibility, rumen fermentation activity, some blood parameters, growth performance, feed conversion ratio and

economic efficiency of Friesian calves during suckling and post weaning periods until 6 month of age.

MATERIALS AND METHODS

The current work was carried out at Karada Animal Production Research Station belonging to Animal Production Research Institute (APRI), Agricultural Research Center-Ministry of Agriculture in co-operation with Department of Animal Production, Faculty of Agriculture- Damietta University during the period from April to November 2018.

1- Experimental animals:

Twenty newly born Friesian calves (10 males and 10 females) with average live body weight of 41.3±0.5 kg were used after suckling their dam's colostrum for three days then suckling until 15 days of age. Calves were divided into five similar groups (2 males and 2 females in each group) according to live body weight and month of birth.

2- Experimental rations and periods:

Sugar beet tops (SBT) were collected after harvesting sugar beet crop and spread on ground, then turning it from time to time (before sunrise and after sun down) till drying (the drying period was about 7 days) then ground limestone (sodium carbonate) was added at 3 kg per ton of sugar beet tops to compensatory calcium binding with oxalate then material was collected and stored. The whole experimental period was lasted for 165 days where it staged for consecutive two periods, the first group (P1) was serves as suckling period from the 15th days of age until the weaning at 105 days of age (suckling period) and the second group (P2) was continued from 106 to 180 days of age (post weaning period). All claves were fed a basal diet consisted of whole milk (WM), calf starter (CS), berseem hay (BH) and dried sugar beet tops (DSBT) during suckling period (P1). Calf starter (CS), berseem hay (BH) and dried sugar beet tops (DSBT) during the post weaning period (P2). Calves were assigned randomly on the following treatment groups,

Group 1 (G1): 50% calf starter (CS) + 50% berseem hay (BH) (control).

Group 2 (G2): 50% calf starter (CS) + 37.5% berseem hay (BH) +12.5% dried sugar beet tops (DSBT).

Group 3 (G3): 50% calf starter (CS) + 25% berseem hay (BH) + 25% dried sugar beet tops (DSBT).

Group 4 (G4): 50% calf starter (CS) + 12.5% berseem hay (BH) + 37.5%dried sugar beet tops (DSBT).

Group 5 (G5): 50% calf starter (CS) + 50% dried sugar beet tops (DSBT).

3- Management procedures:

Friesian calves were fed individually their allowance during the suckling and post weaning periods to cover their nutritional requirements according to NRC (2001). During suckling period, calves were daily suckled the whole milk in plastic buckets in two equal parts at 6 am and 4 pm, berseem hay (BH) and dried sugar beet tops (DSBT) once time at 8 am. and calf starter (CS) was offered once time at 10am. During the post weaning period, berseem hay (BH) and dried sugar beet tops (DSBT) were offered once time at 8 am and calf starter (CS) was offered at two times 9 am and 3 pm daily. Fresh water was free available for calves at all times. Calf starter was consisted (as fed) of 24% soybean meal, 42% ground yellow corn grain, 28% wheat bran, 3% molasses, 2% limestone and 1% salt, while the composition of the whole milk was 3.52% fat, 2.73% protein, 4.35% lactose, 7.64% solids not fat (SNF), 11.16% total solids (TS) and 0.68% ash.

4- Weighting procedure:

Calves were weighed in the morning before drinking and feeding (fasting 16 hours) at the beginning of the trial and weekly thereafter during the suckling period and biweekly after weaning to the nearest kg for each animal.

5- Feed intake:

Average daily feed intake was calculated as the amounts of average whole milk, calf starter (CS), berseem hay (BH) and dried sugar beet tops (DSBT), total DM and CP intake during suckling period; the amounts of average calf starter (CS), berseem hay (BH) and dried sugar beet tops (DSBT), total DM, TDN, CP and DCP intake during the post weaning period.

6- Digestibility trials:

Five digestibility trials were conducted at the end week of post weaning period using all calves to determine nutrients digestibility coefficients and nutritive values of the experimental rations. Acid insoluble ash (AIA) was used as a natural marker as described by Van Keulen and Young (1977). The AIA was determined with a weight of 5.0 g duplicate sample in into a tarred 50ml ash crucible and dry overnight at 100^{o}C. Allow crucibles to cool in desiccator and reweigh. Ash for 6 hours at 600^{o}C. Transfer ash to 600 ml Berzelius beaker adding 100 ml of 2N HCl. Boil 5 minutes on fiber rack. Filter hot hydrolysate through Whatman 41 filter paper and wash with hot distilled water. Transfer filter paper back into crucible and ash 6 hours at 600^{o}C. Heat crucible in 100^{o}C oven to dry. The crucibles are returned to the desiccator, cooled, and weighed.

$$\text{Acid Insoluble Ash \%} = \left[\frac{[(\text{Wt. of Crucible} + \text{Ash}) - \text{Wt. of Crucible}]}{\text{Sample Dry Weight}} \times 100 \right]$$. Nutrients digestibility was calculated from the equations stated by Schneider and Flatt (1975) as follows: DM digestibility %

$$= 100 - \left[100 \text{ x } \frac{\text{AIA\% in feed}}{\textit{AIA}\% \text{ in feces}} \right]$$. While, Nutrient digestibility %

$$= 100 - \left[100 \text{ x } \frac{\text{AIA\% in feed}}{\text{AIA\% in feces}} \right] \text{x} \left[\frac{\text{Nutrient \% in feces}}{\text{Nutrient \% in feed}} \right].$$

Samples of whole milk were taken at the beginning, middle and end of suckling period. Samples of calf starter, berseem hay and sugar beet tops hay were taken at the beginning, middle and end of collection period for each digestibility trial. At the end of collection period composite samples of calf starter, berseem hay and dried sugar beet tops (DSBT) were dried in a forced air oven at 65ºC for 8 hours, then ground and kept for chemical analysis. Fresh feces samples were taken from the rectum of each calf twice daily 7 am and 7 pm with 12 hours interval during the collection period of each digestibility trial and dried in a forced air oven at 65°C for 48 hours. Dried samples were composted for each calf and representative samples were taken, ground and kept for chemical analysis. Milk samples were analyzed for fat, protein, lactose, solids not fat (SNF), and total solids (TS) by Milko-Scan (model 133B), and ash by difference. While, samples of calf starter, berseem hay, hay sugar beet tops and feces were carried out to determine DM, CP, CF, EE, ash according to the methods of AOAC (2000). Acid insoluble ash was determined according to the method of Van Keulen and Young (1977). Chemical analysis (%) of calf starter (CS), berseem hay (BH), dried sugar beet tops (DSBT) and formulate the experimental rations are shown in Table (1).

Table (1): Chemical analysis of feedstuffs and calculated composition of basal rations (% on DM basis)

Items	DM	OM	CP	CF	NFE	EE	Ash	AIA
Chemical composition of feedstuffs as 100% DM								
CS	90.34	91.42	18.27	5.65	64.35	3.15	8.58	1.71
BH	89.14	88.69	13.08	28.16	44.48	2.97	11.31	1.93
DSBT	87.7	84.83	13.7	16.01	52.76	2.36	15.17	2.48
Chemical composition of the rations formulation as 100% DM								
G1	89.74	90.05	15.68	16.91	54.42	3.04	9.95	1.82
G2	89.56	89.57	15.75	15.39	55.45	2.98	10.43	1.89
G3	89.38	89.09	15.83	13.87	56.49	2.90	10.91	1.96
G4	89.20	88.61	15.91	12.35	57.52	2.83	11.39	2.03
G5	89.02	88.12	15.99	10.83	58.56	2.74	11.88	2.10

Calf starter (CS), berseem hay (BH) and dried sugar beet tops (DSBT)
G1: 50% CS+50% BH, G2: 50% CS+37.5% BH + 12.5% DSBT, G3:50% CS + 25% BH + 25% DSBT, G4: 50% CS + 12.5% BH + 37.5% DSBT and G5:50% CS +50% DSBT.

7- Rumen liquor samples:

Rumen liquor samples were taken at the end week of post weaning period from Friesian calves at three hours after the morning feeding by using a stomach tube and filtered through double layers of cheese cloth. The samples were stored after pH determination in dry clean glass bottles with addition of few drops of saturated mercuric chloride solution to kill microorganisms and kept in deep freezer for chemical analysis.

PH value was directly determined using Orian digital pH meter. The concentration of TVFA's was determined in rumen liquor by the steam distillation method (Warner, 1964) using Markham micro-distillation apparatus. The concentration of NH_3-N was determined using saturated solution of magnesium oxide distillation according to the method of AOAC (2000).

8- Blood samples:

Blood samples were taken at the last week of each period from the jugular vein of each calf by clean sterile needle in clean dry glass tubs using heparin. These samples were centrifuged for 15 minutes at 4000 rotations per minute to obtain plasma. Plasma samples were kept in deep freezer at -20°C until chemical analysis was carried out. Total protein and albumin concentrations were determined using commercial kits supplied by Randox (Randox Laboratories Ltd, Crumlin, Co, Antrim, UK) according to Henry *et al*. (1974). Globulin concentration was estimated by subtracting the values of albumin from the corresponding values of total protein per sample. Also, plasma samples were analyzed for determinations blood activities of aspartate amino transferase (AST) and alanine amino transaminase (ALT) according to Hafkenscheid and Dijt (1979) and creatinine concentration according to Chasson *et al*. (1961) and urea nitrogen concentration according to DiGiorgia (1974) using commercial kits (Bio-Merieux Laboratory Reagents and Products, France) according to the manufacturer procedure. Also, Cholesterol concentration according to Allain *et al*. (1974) and Triglycerides concentration according to Fossati and Prencipe (1982).

9- Feed conversion ratio (FCR):

Feed conversion ratio was calculated as the amounts (kg) of DM, TDN, CP and DCP required producing 1kg live body weight gain.

10- Economic evaluation:

1- Average daily feed cost was calculated from the amounts of daily feedstuffs intake x price (LE) of one kg for each.
2- Total revenue of average daily gain was calculated from average daily gain x price (LE) of one kg live body weight.
3- Net revenue = total revenue of average daily gain – average daily feed cost.

Where: Price of one ton was 4750 LE for calf starter, 3000 LE for berseem hay and 500 LE for hay sugar beet tops. While the price of one kg was 4.4 LE for whole milk, 70 LE for live body weight according to the prices of the period from April to November 2018.

11- Statistical analysis:

The data were statistically analyzed by one way ANOVA using IBM SPSS Statistics (2014). The significant differences in the mean values among dietary treatments were tested by Duncan's new multiple range test (Duncan, 1955) set at the level of significance $P \leq 0.05$.

RESULTS AND DISCUSSION

1- Nutrients digestibility coefficients:

The effect of replace different percentages of berseem hay by dried sugar beet tops on nutrients digestibility coefficients by Friesian calves during different periods are presented in Table (2). The replace different percentages of berseem hay by dried sugar beet tops improved significantly ($P<0.05$) the digestibility coefficients of all nutrients during different periods with feeding G2 and G3 rations. The apparent digestibility of dry matter DM, organic matter OM, crud protein CP, crud fiber CF, nitrogen free extract NFE and ether extract EE were significantly ($P<0.05$) higher with feeding on G3 (25% DSBT), G2 (12.5% DSBT) and G1 (control) than G4 (37.5% DSBT) and G5 (50% DSBT). However, the apparent digestibility of all nutrients was not significantly between G1, G2 and G3, also, between G4 and G5. The highest values were reported with feeding G3, while the lowest values were reported with feeding G5. These results are in accordance with those obtained by Ali and El-Saidy (2003) concluded that DSBT could be used successfully as a replacer to 50% from BH in ration of growing lambs without any detritus effects on productive performance. Abo El-Maaty *et al.* (2017 and 2018) found that the digestibility coefficients of dry matter (DM), crude protein (CP), ether extract (EE) and NFE of 12-week old NZW rabbits were improved by feeding diets containing SBT. Bendary *et al.* (2000) reported that no significant differences among experimental ration in digestibility coefficient of all nutrients when cow fed rations containing different forms of sugar beet tops and berseem silage compared with those fed dry summer ration.

Table (2): Digestibility coefficients and feeding values (% on DM basis) of the experimental rations

Items	Experimental groups					MSE
	G1	G2	G3	G4	G5	
DM	72.90^{a}	73.84^{a}	74.44^{a}	70.29^{b}	69.57^{b}	0.606
OM	72.12^{a}	72.99^{a}	73.95^{a}	69.82^{b}	68.99^{b}	0.597
CP	68.15^{ab}	68.95^{a}	70.83^{a}	65.37^{b}	63.50^{c}	0.966
CF	65.08^{b}	67.48^{a}	69.94^{a}	63.32^{bc}	61.93^{c}	0.721
NFE	75.53^{a}	75.81^{a}	75.93^{a}	72.53^{b}	71.90^{b}	0.626
EE	70.69	70.34	71.50	68.19	66.78	0.763
Feeding values (% on DM basis)						
TDN	67.65^{a}	68.00^{a}	68.48^{a}	64.28^{b}	63.10^{b}	0.659
DCP	10.68^{ab}	10.86^{a}	11.21^{a}	10.40^{b}	10.15^{b}	0.142

a, b, c: Values in the same row for each item with different superscripts differ significantly ($P<0.05$)

2- Nutritive values:

Feeding values for the different groups as affected by replace different percentages of berseem hay by dried sugar beet tops are shown in Table (2). Nutritive values in terms of the percentages of total digestible nutrients TDN and digestible crude protein DCP were significantly ($P<0.05$) higher with feeding on G3, G2 and G1 than G4 and G5, while there was no significant effect when feeding on the control G1 or G4 or G5. Also, there was no significant effect when feeding on the control G1 or G2 or G3. These results were similarly with those found by Eweedah *et al.* (2004) when used 9 Rahmani rams aged about two years and weighed 45-50 to evaluate the following tested roughage: 100% berseem hay (BH) (control), R2: 50% BH + 50% DSBT, R3: 100% DSBT. They found that the nutritive value expressed as TDN and DCP for R3 (100% DSBT) was significantly lower ($P<0.05$) than for R1 (0% DSBT) and R2 (50% DSBT) but there is no significant differences between R1 and R2 were observed. Gaafar *et al.* (2011) reported that the TDN and DCP values increased ($P<0.05$) with increasing the level of sugar beet tops silage in the rations when feeding lactating buffaloes after 8 weeks of calving.

3- Rumen fermentation activity:

Data in Table (3) showed the effect of replace different percentages of berseem hay by dried sugar beet tops on rumen fermentation activity of Friesian calves.

The ruminal pH values at 3 hrs. post-feeding were significantly (P<0.05) lower with G3 compared with other groups, while there was no significant effect when feeding on the control G1 or G4 or G5. The pH values were ranged between 6.73-7.03 with different treatments. The pH values as shown were always with a normal range of 6-7. Such range is suitable for the growth and activity of cellulytic bacteria (Prasad *et al.,* 1972). Ali *et al.* (2019) found that the pH values were nearly similar for the different groups and the pH values of all rations were between 6.47and6.60whichwere with the normal range. No significant differences in rumen pH values were detected. Ruminal ammonia-N (NH_3-N) concentrations at 3hrs post-feeding was ranged from 15.48 to 18.39 mg/100 ml rumen liquor with different treatments, the ruminal NH_3-N concentrations at 3hrs post-feeding were significantly (P<0.05) lower with G3 compared with all groups, while there was no significant effect when feeding on the control G1 or G4, also, there was no significant effect when feeding on the G4 or G5. Mahmoud *et al.* (2001) indicated that the ruminal NH3-N concentration (P<0.05) decreased significantly by increasing DSBT in complete pelleted rations (50 and 100% of BH were replaced by DSBT) using 9 Rahmani rams. Ruminal total volatile fatty acid (TVFA`s) concentrations at 3hrs post-feeding was ranged from 19.34 to 22.08 mleq/100 ml rumen liquor with different treatments, ruminal TVFA`s concentrations at 3 hrs. post-feeding were significantly (P<0.05) higher with G3 compared with the other groups, while there was no significant effect when feeding on the control G1 or G2, also, there was no significant effect when feeding on the G4 or G5. These results are in agreement with those reported by Abd El Tawab *et al.* (2015) and Saleh (2012) reported that the rumen parameter refer that ruminal TVFA's and acetic acid concentration for treated sugarbeet leaves groups were increased. These may be microbiological treatment had positive effects on oxalate and fiber degradations which showed as TVFA s and acetic acid concentration. There was a high negative correlation between pH values and TVA's concentration; however there was a positive correlation between pH values and NH_3-N concentration. These results agreed with those obtained by Van Soest (1982) who stated that the optimum pH value for growth of cellulolytic microorganisms for normal condition ranged from 6.2 to 7.2. Moreover, Hungate (1966) and Mehrez *et al.* (1983) reported that the acidity of cellulolytic bacteria during ruminal fermentation may be inhibited when pH value of rumen liquor is below 6. Hungate (1966) demonstrated that rumen microorganisms utilize more NH_3-N when more energy sources are fermented. Russell and Dombrowski (1980) indicated that ruminal VFA production was closely related to ruminal pH, which can be considered as an important regulator of microbial yield.

Table (3): Rumen fermentation activity of Friesian calves with feeding the experimental rations

Items	G1	G2	G3	G4	G5	MSE
pH value	6.95^{a}	6.84^{b}	6.73^{c}	7.0٣^{a}	7.01^{a}	0.030
NH_3-N (mg/100 ml)	17.29^{b}	16.35^{c}	15.48^{d}	18.01^{ab}	18.39^{a}	0.303
TVFA's (ml eq/100 ml)	20.85^{b}	20.87^{b}	22.08^{a}	19.98^{c}	19.34^{c}	0.262

a, b, c,d: Values in the same row for each item with different superscripts differ significantly (P<0.05)

4- Blood parameters:

The effect of replace different percentages of berseem hay by dried sugar beet tops on plasma total protein (TP), albumin (ALB), globulin (GLB), creatinine, urea-N concentrations, liver enzymes aspartate aminotransferase (AST) and alanine aminotransferase (ALT) activity, Cholesterol, Triglycerides and plasma glucose of Friesian calves during different experimental periods are presented in Table (4) of Friesian calves during different experimental periods.

The plasma total protein, albumin and globulin values (g/100 ml) were not significantly affected by feeding in different presented experimental rations to Friesian calves during different experimental periods (suckling and post weaning periods). The TP ranged between 6.33-7.21 (g/100 ml) during suckling period and ranged between 6.02-6.85 (g/100 ml) during post weaning period, the average values was the highest with G3. The ALB was ranged between 3.07 and 3.40 (g/100 ml) during suckling period and ranged between 2.91 and 3.23 (g/100 ml) during post weaning period, the average values was the highest with G3.The GLB was ranged between 3.27 and 3.77 (g/100 ml) during suckling period and ranged between 3.11 and 3.62 (g/100 ml) during post weaning period, the average values was the highest with G3. The values of total protein, albumin and globulin obtained in this study are with the normal range in cattle being 5.7-8.1 g/dl for total protein, 2.1-3.6 g/dl for albumin and 2.9-5.1 g/dl for globulin as stated by Radostits *et al.* (2000). Also, the results obtained in this study are in agreement with those reported by Senara (2010) and Mohiel-din (1998) found that there were no significant differences concerning concentrations of TP, albumin, globulin in blood plasma with fed on sugar beet tops or hay or silage form.

Table (4): Blood plasma biochemical of different experimental groups and periods

Items	G1	G2	G3	G4	G5	MSE
Suckling period						
Total protein(g/dl)	6.90	7.07	7.21	6.53	6.33	0.135
Albumin (ALB)g/dl	3.23	3.30	3.40	3.13	3.07	0.054
Globulin (GLB)g/dl	3.67	3.77	3.81	3.40	3.26	0.918
Creatinine (mg/dl)	1.12^{b}	1.08^{b}	1.05^{b}	1.22^{a}	1.30^{a}	0.311
Urea-N (mg/dl)	19.5^{b}	19.3^{b}	18.4^{b}	21.4^{a}	22.1^{a}	0.398
AST (U/L)	37.2^{b}	36.5^{b}	36.2^{b}	38.8^{a}	40.2^{a}	0.465
ALT (U/L)	17.2^{b}	16.7^{b}	16.3^{b}	18.3^{a}	18.8^{a}	0.314
Cholesterol mg%	101.7	100.3	98.3	103.3	105.7	2.113
Triglycerides mg%	30.3	29.7	28.3	32.3	34.3	1.134
Glucose mg%	91.3^{b}	94.7^{b}	99.3^{a}	88.7^{c}	87.3^{c}	1.274
Post weaning period						
Total protein(g/dl)	6.56	6.71	6.85	6.21	6.02	0.129
Albumin (ALB)g/dl	3.07	3.14	3.23	2.98	2.91	0.051
Globulin (GLB)g/dl	3.49	3.57	3.62	3.23	3.11	0.087
Creatinine (mg/dl)	1.19^{b}	1.16^{b}	1.12^{b}	1.30^{a}	1.39^{a}	0.033
Urea-N (mg/dl)	20.2^{b}	20.1^{b}	19.2^{b}	22.3^{a}	23.0^{a}	0.415
AST (U/L)	38.6^{b}	37.9^{b}	37.5^{b}	40.3^{a}	41.7^{a}	0.487
ALT (U/L)	17.9^{b}	17.4^{b}	17.0^{b}	19.1^{a}	19.6^{a}	0.322
Cholesterol mg%	106.8	105.5	103.3	108.6	111.0	2.350
Triglycerides mg%	31.8	31.2	29.8	34.0	36.1	1.178
Glucose mg%	97.1^{b}	100.6^{b}	105.6^{a}	94.2^{c}	92.8^{c}	1.412

a, b, c: Values in the same row for each item with different superscripts differ significantly ($P<0.05$)

Kidney function in terms of plasma creatinine and urea-N concentrations of Friesian calves during suckling, and post weaning periods affected by replace different percentages of berseem hay by dried sugar beet tops. The plasma creatinine concentrations (mg/100 ml) were significantly ($P< 0.05$) affected by feeding in different rations and ranged between 1.05 and 1.30 during suckling period and ranged between 1.12 and 1.39 during post weaning period, the lowest value was recorded with G3. The plasma urea-N concentrations (mg/100 ml) were significantly ($P< 0.05$) affected by feeding in different rations and ranged between 18.4 and 22.1 during suckling period and ranged between 19.2 and 23.0 during post weaning period, the lowest value was recorded with G3. These results are in agreement with those reported by Abd El Tawab *et al.* (2017) concluded that the plasma urea-N significantly increased inT2 (50% CFM, 30% untreated sugarbeet leaves silage and 20% rice straw) group compared with the other two groups. Plasma creatinine significantly increased ($p<0.05$) between T2 compared with T1 (control).

Liver enzymes aspartate aminotransferase (AST) and alanine aminotransferase (ALT) activity (U/L) during suckling and post weaning periods improved with replace different percentages of berseem hay by dried sugar beet tops. The plasma AST activity (U/L) were significantly ($P< 0.05$) affected by feeding in different rations and ranged between 36.2 and 40.2 during suckling period and ranged between 37.5 and 41.7 during post weaning period, the best average value was recorded with G3. The plasma ALT activity (U/L) were significantly ($P< 0.05$) affected by feeding in different rations and ranged between 16.3 and 18.8 during suckling period and ranged between 17.0 and 19.6 during post weaning period, the best average value was recorded with G3. Plasma AST and ALT activity presented in this study ranged from 36.2 to 41.7 and 16.3 to 19.6 U/L and are lower than the critical levels of AST and ALT being 70 and 45 U/L, respectively (Kaneko *et al*., 2008). Similar results with the present results reported by Bendary *et al.* (2000) found that SBTS group had the normal activity of transaminase (GOT and GPT) in blood plasma reflected normal

protein metabolism and normal liver function. Also, Mohiel-din (1998) and Abo El-Maaty *et al.* (2018) concluded that the feeding SBT containing diets did not alter plasma concentrations of AST and ALT activity.

The plasma cholesterol mg % and triglycerides mg % were not significantly affected by feeding in different presented experimental rations to Friesian calves during different experimental periods. The mean values showed that the plasma cholesterol mg % ranged between 98.3 and 105.7 during suckling period and ranged between 103.3 and 111 during post weaning period, the best average value was recorded for G3. The triglycerides mg % concentration ranged between 28.3 and 34.3 during suckling period and ranged between 29.8 and 36.1 during post weaning period, the best average value was recorded with G3. Similar results with the present results reported by Abo El-Maaty *et al.* (2017) and Senara (2010) concluded that the effect of the tested rations on concentration of cholesterol mg% and triglycerides mg % in blood serum of lambs were not significant.

The plasma glucose % with different treatments were significantly (P<0.05) higher with G3 compared with other groups. The plasma glucose% was ranged between (87.3 and 99.3) during suckling period and ranged between (92.8 and 105.6) during post weaning period; the best average value was recorded with G3. Senara (2010) and Ali and El-Saidy (2003) studied effects of the replacement of BH by DSBT in rations of lambs at rate of 50 and 100% on blood parameters of lambs. The results indicated that the differences among the lambs fed three tested rations were not significant in plasma glucose concentration. El–Barody *et al*. (1998) and Fouad *et al.* (2002) found that the increase in plasma glucose may be attributed to the increase of carbohydrate metabolism and the increase the rate of intestinal glucose absorption.

5- Feed intake:

Average daily feed intake by Friesian calves as affected by replace different percentages of berseem hay by dried sugar beet tops during suckling, post weaning and the whole periods are shown in Table (5). All groups received equal quantities of whole milk and calf starter, but berseem hay was replaced by the following percentages of dried sugar beet tops (G1, 0%; G2, 25%; G3, 50%; G4, 75% and G5, 100%), respectively during suckling and post weaning periods.

Table (5): Feed intake (kg/head/day) by Friesian calves for different groups and periods

Items	Experimental groups					MSE
	G1	G2	G3	G4	G5	
Suckling period						
Whole milk Kg/d	3.5	3.5	3.5	3.5	3.5	-
Calf starter Kg/d	0.72	0.72	0.72	0.72	0.72	-
Berseem hay Kg/d	0.72	0.54	0.36	0.18	0.00	-
Sugar beet hay Kg/d	0.00	0.18	0.36	0.54	0.72	-
Total DM Kg/d	1.725	1.723	1.720	1.717	1.715	0.001
CP Kg/d	0.271	0.271	0.272	0.273	0.274	0.001
Post weaning period						
Calf starter Kg/d	2.20	2.20	2.20	2.20	2.20	-
Berseem hay Kg/d	2.20	1.65	1.10	0.55	0.00	-
Sugar beet hay Kg/d	0.00	0.55	1.10	1.65	2.20	-
Total DM Kg/d	3.949	3.941	3.933	3.925	3.917	0.003
TDN Kg/d	2.671 [a]	2.680[a]	2.693[a]	2.523[b]	2.471[b]	0.027
CP Kg/d	0.619	0.621	0.623	0.624	0.626	0.001
DCP Kg/d	0.422[ab]	0.428[a]	0.441[a]	0.408[b]	0.398[b]	0.006
Whole period						
Whole milk Kg/d	1.91	1.91	1.91	1.91	1.91	-
Calf starter Kg/d	1.39	1.39	1.39	1.39	1.39	-
Berseem hay Kg/d	1.39	1.04	0.70	0.35	0.000	-
Sugar beet hay Kg/d	0.000	0.35	0.70	1.04	1.39	-
Total DM Kg/d	2.736	2.731	2.726	2.721	2.716	0.002
CP Kg/d	0.429	0.430	0.431	0.433	0.434	0.001

a, b: Values in the same row for each item with different superscripts differ significantly (P<0.05)

Intake of the total DM and total CP kg/day were not significantly affected by feeding in different presented experimental rations. The intake of the total DM kg/day ranged between 1.715 and 1.725 during suckling period, ranged between 3.917 and 3.949 during post weaning period and ranged between 2.716 and 2.736 during the whole periods. The intake of the total CP kg/day ranged between 0.271 and 0.274 during suckling period, ranged between 0.619 and 0.626 during post weaning period and ranged between 0.429 and 0.434 during the whole periods. While, during the post weaning period the intake of the total TDN and DCP kg/day were significantly (P<0.05) higher with G3, G2 and G1 compared with G4 and G5. The intake of the total TDN kg/day ranged between 2.471 and 2.693, also the intake of the DCP kg/day ranged between 0.398 and 0.441during post weaning period. These effects may be due to the apparent digestibility of dry matter DM and crud protein CP were significantly (P<0.05) higher with feeding on G3, G2 and G1 than G4 and G5. However, the apparent digestibility of DM and CP were not significantly higher between G1 and G4, but the lowest value reported with G5. Gaafar *et al.* (2011) and Bahira, Mohamed (2002) who found that the percentages of total digestible nutrients TDN and digestible crude protein DCP were improved by feeding on rations containing different forms of sugar beet tops.

6- Live body weight and weight gain:

Live body weight (LBW), total weight gain (TWG) and average daily gain (ADG) of male and female calves in different groups during suckling, post weaning and the whole periods are presented in Table (6). The replace different percentages of berseem hay by dried sugar beet tops incresed significantly (P<0.05) LBW, TWG and ADG during the experimental periods. Calves in G3 and G2 showed significantly (P<0.05) the highest LBW, TWG and ADG followed by calves in G1 and G4, where the lowest values was detected with calves in G5. Also, TWG and ADG tended to increase with advancing age of calves. Sallam *et al.* (2013) reported that improved of ramlambs and concluded that inclusion of 25% dried sugar beet tops and 25% dried sugar beet pulp could be used successfully as a replacement of 25% of berseem hay and 25% of concentrate feed mixture in diet of ramlambs. Bendary *et al*. (1999) found that feeding growing calves in ration containing sugar beet tops silage led to increase daily body weight gain, the better feed efficiency attained by feeding growing calves in ration containing sugar beet tops. Also, Mahmoud *et al.* (2001) studies the effect of inclusion growing lambs rations with DSBT at the rate of 0, 50 and 100% in the complete pelleted rations to replace BH and they found that no significant differences in the average daily gain (ADG) of lambs in three groups fed on three different complete pelleted rations.

Table (6): Live body weight (kg) of calves in different groups from birth up to 6 month of age

Items	G1	G2	G3	G4	G5	MSE
Live body weight (kg) during suckling period						
Initial body weight (at 15th day)	41.0	41.76	41.50	40.50	41.75	0.392
Weaning (at 3.5 months)	91.88^{a}	93.0^{a}	95.13^{a}	86.75^{b}	85.88^{b}	0.933
TWG (Kg)	50.88^{a}	52.24^{a}	53.63^{a}	46.25^{b}	44.13^{b}	0.441
TWG improvement %	100^{a}	102.2^{a}	105.4^{a}	90.9^{b}	86.^{b}	2,247
ADG (Kg)	0.565^{a}	0.581^{a}	0.598^{a}	0.51٤^{b}	0.50^{b}	0.0125
ADG improvement %	100^{a}	102.2^{a}	105.4^{a}	90.9^{b}	86.7^{b}	2.247
Live body weight (kg) during post weaning period						
Weaning (at 3.5 months)	91.88^{a}	93.0^{a}	95.13^{a}	86.75^{b}	85.88^{b}	0.933
Final weight (Kg)	149.88^{a}	152.63^{a}	156.38^{a}	137.63^{b}	135.51^{b}	1.735
TWG (Kg)	58.0^{a}	58.63^{a}	61.25^{a}	50.88^{b}	49.63^{b}	0.523
TWG improvement %	100^{a}	101.1^{a}	105.6^{a}	87.7^{b}	85.6^{b}	2.313
ADG (Kg)	0.773^{a}	0.782^{a}	0.817^{a}	0.678^{b}	0.662^{b}	0.019
ADG improvement %	100^{a}	101.1^{a}	105.6^{a}	87.7^{b}	85.6^{b}	2.313
Live body weight (kg) during whole period						
TWG (Kg)	108.88^{a}	110.87^{a}	114.88^{a}	97.13^{b}	94.76^{b}	1,227
TWG improvement %	100^{a}	101.8^{a}	105.5^{a}	89.2^{b}	87.0^{b}	2.191
ADG (Kg)	0.669^{a}	0.681^{a}	0.706^{a}	0.596^{b}	0.582^{b}	0.014
ADG improvement %	100^{a}	101.8^{a}	105.5^{a}	89.2^{b}	87.0^{b}	2.191

a, b: Values in the same row for each item with different superscripts differ significantly (P<0.05)

7- Feed conversion ratio:

Feed conversion ratio for Friesian calves as affected by replace different percentages of berseem hay by dried sugar beet tops during suckling, weaning and the whole periods are shown in Table (7). The replace different percentages of berseem hay by dried sugar beet tops improved significantly (P<0.05) feed conversion ratio expressed as DM, CP, TDN and DCP required per one kg live weight gain. Calves in G3 and G2 received 25% and 50% of HSBT recorded significantly (P<0.05) the lowest amounts of DM, CP, TDN and DCP (kg/kg gain) during the different months of agepost weaning period followed by control G1, while the highest amounts of DM, CP, TDN and DCP (kg/kg gain) was detected with calves in G4 and G5 received 75% and 100% of HSBT.

Table (7): Feed conversion ratio (kg/kg gain) for calves fed experimental diets during the deferent stages of the trail

Items	G1	G2	G3	G4	G5	MSE
Suckling period						
DM (kg/kg gain)	3.052^{ab}	2.967^{b}	2.887^{b}	3.۴42^{a}	3.420^{a}	0.063
CP (kg/kg gain)	0.4۷9^{b}	0.467^{b}	0.4۰7^{b}	0.532^{a}	0.547^{a}	0.011
Post weaning period						
DM (kg/kg gain)	5.108^{ab}	5.041^{b}	4.816^{b}	5.786^{a}	5.920^{a}	0.133
TDN (kg/kg gain)	3.454^{ab}	3.428^{b}	3.289^{b}	3.719^{a}	3.735^{a}	0.064
CP (kg/kg gain)	0.801^{b}	0.784^{b}	0.762^{b}	0.921^{a}	0.947^{a}	0.022
DCP (kg/kg gain)	0.545	0.547	0.540	0.602	0.601	0.011
Whole period						
DM (kg/kg gain)	4.146^{b}	4.064^{b}	3.915^{b}	4.622^{a}	4.729^{a}	0.087
CP (kg/kg gain)	0.650^{b}	0.640^{b}	0.620^{b}	0.735^{a}	0.756^{a}	0.015

a, b: Values in the same row for each item with different superscripts differ significantly (P<0.05)

The obtained results are in agreement with those given by Bendary *et al*. (1992 and 1999) showed that generally the best feed conversion with feeding growing calves or lambs rations containing sugar beet tops (dried or silage). Also, Eweedah *et al.* (2004) showed that feed efficiency (kg feed DM/kg gain) was nearly similar when fed crossbred ewe lambs on rations containing DSBTasa replacement of BH (0,50 and 100% DSBT) and were no significant differences for all groups.

7- Economic efficiency:

The effect of replace different percentages of berseem hay by dried sugar beet tops in economic efficiency of Friesian calves are presented in Table (8). Replace different percentages of berseem hay by dried sugar beet tops showed not significantly differences in average daily feed cost (LE/day) among the different groups from the 1st month until 6th month of age. Average daily feed cost (LE/day) decreased with increasing replace percentages, which control G1 recorded the highest feed cost followed by G2, G3 and G4, while G5 showed the lowest value. These results attributed to increase feed cost berseem hay more than with dried sugar beet tops due to the high price of BH than DSBT (3.0 vs. 0.5 LE/kg).

Price of one ton was 4750 LE for calf starter, 3000 LE for berseem hay and 500 LE for dried sugar beet tops. While the price of one kg was 4.4 LE for whole milk and70 LE for live body weight according to the prices of the period from April to November 2018.

However, replace different percentages of berseem hay by dried sugar beet tops showed significant differences (P<0.05) in feed cost per one kg live body weight gain (LE/kg gain) among the different groups from the 1st month until 6th month of age. However, at feeding in different presented experimental rations to Friesian calves during different periods there was significant improved when feeding on G2 and G3 compared with the control G1 or G4 or G5. The best average values were recorded with G3 (during suckling, weaning and the whole periods), these results may be attributed to the improvement of ADG with G2 and G3 (12.5 and 25% DSBT). Moreover, total and net revenue increased significantly (P<0.05) with replace different percentages of berseem hay by dried sugar beet tops. Group 3 showed the highest total revenue and net revenue followed by G2, G1 and G4, where G5 had the lowest values. Finally, The net revenue improvement (% of net revenue of G1) of calves in G3 and G2 increased by 18.4 and 9.1% during suckling period, 15.6 and 5.3% during post weaning period and 17.0 and 7.2% during the whole experimental period compared with control group (G1), respectively. Will, the net

revenue improvement (% of net revenue of G1) of calves in G5 and G4 decreased by 14.1 and 11.6% during suckling period, 5.9 and 6.4% during post weaning period and 10.0 and 9.0% during the whole experimental period compared with control group (G1), respectively. The obtained results are in agreement with those given by Ghanem *et al*. (2000) indicated that feeding growing calves in ration containing sugar beet tops silage reduced the feed coast per kg gain and subsequently increased economic efficiency. Mahmoud *et al.* (2001) found that the feed cost decreased by 11.78 and 20.67% and the economic efficiency improved by 13.51 and 26.13% for R2 (25% DSBT) and R3 (50% DSBT), respectively by increasing the incorporation of DSBT in complete pelleted rations. Also, Ali and El-Saidy (2003) concluded that DSBT could be used successfully as a replacer to 50% from BH in ration of growing lambs without any detritus effects on productive and reproductive performance.

Table (8): Economic efficiency for calves fed experimental diets during suckling and post weaning stage

Items	G1	G2	G3	G4	G5	MSE
Suckling period						
Feed cost (LE/day)	20.95	20.51	2٠.06	19.61	19.16	0.152
Feed cost (LE)/kg gain)	38.12^{ab}	36.33^{b}	34.65^{b}	38.92^{a}	38.89^{a}	0.655
Total revenue (LE/day)	39.57^{b}	40.64^{b}	41.71^{a}	35.97^{c}	35.10^{c}	0.948
Net revenue (LE/day)	18.62^{b}	20.13^{ab}	21.65^{a}	16.36^{c}	15.93^{c}	0.865
Net revenue %	100^{b}	109.1^{ab}	118.4^{a}	88.4^{c}	85.9^{c}	3.180
Post weaning period						
Feed cost (LE/day)	17.05	15.68	14.30	12.93	11.55	0.520
Feed cost (LE)/kg gain	21.27^{a}	19.79^{b}	17.21^{c}	18.82^{bc}	17.32^{c}	0.624
Total revenue (LE/day)	54.13^{b}	54.72^{b}	57.17^{a}	47.48^{c}	46.32^{c}	1.202
Net revenue (LE/day)	37.08^{b}	39.04^{ab}	42.87^{a}	34.56^{c}	34.77^{c}	1.015
Net revenue %	100^{b}	105.3^{ab}	115.6^{a}	93.6^{c}	94.1^{c}	2.545
Whole period						
Feed cost (LE/day)	19.00	18.09	17.18	16.27	15.36	0.335
Feed cost (LE)/kg gain	29.94^{a}	28.06^{b}	25.94^{c}	28.87^{ab}	28.09^{b}	0.417
Total revenue (LE/day)	46.19^{b}	47.04^{b}	48.73^{a}	41.20^{c}	40.20^{c}	0.883
Net revenue (LE/day)	27.85^{b}	29.59^{ab}	32.26^{a}	25.46^{c}	25.35^{c}	0.693
Net revenue %	100^{b}	107.2^{ab}	117.0^{a}	91.0^{c}	90.0^{c}	2.839

a, b, c: Values in the same row for each item with different superscripts differ significantly (P<0.05)

CONCLUSIONS

From these results it could be concluded that replace different percentages of berseem hay by dried sugar beet tops at the 50% (G3) for Friesian calves during suckling and post weaning period until 6 month of age improved the digestibility coefficients, nutritive values, rumen fermentation activity, blood biochemical parameters, feed intake, live body weight, total and daily weight gain, feed conversion ratio and economic efficiency.

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تأثير استبدال دريس البرسيم بعروش بنجر السكر المجفف على أداء العجول الفريزيان

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تم إجراء هذه الدراسة لمعرفة تأثير استبدال نسب مختلفة من دريس البرسيم بعرش بنجر السكر المجفف على أداء العجول الفريزيان أثناء الرضاعة وبعد الفطام وتم استخدام عشرين عجل فريزيان حديثي الولادة (١٠ ذكور و ١٠ إناث) بمتوسط وزن حي يبلغ ٤١.٣ ± ٠.٥ كجم بعد رضاعة لبن السرسوب لمدة ثلاثة أيام ثم الرضاعة حتى عمر ١٥ يومًا و تم تقسيم العجول إلى خمس مجموعات متساوية ٤ بكل مجموعة (٢ ذكور و ٢ إناث في كل مجموعة) حسب وزن الجسم الحي وشهر الميلاد واستمرت فترة التجربة بأكملها لمدة ١٦٥ يومًا حيث تم تقسيمها لفترتين متتاليتين ، الأولى كانت بمثابة فترة الرضاعة وتبدأ بعد اليوم الخامس عشر من عمر العجول حتى الفطام عند ١٠٥ يومًا من العمر (فترة الرضاعة) والثانية استمرت من ١٠٦ إلى ١٨٠ يومًا من العمر (فترة ما بعد الفطام). تم تغذية جميع حيوانات التجربة بنظام غذائي أساسي يتكون من اللبن البقرى، العلف البادئ، دريس البرسيم وعروش بنجر السكر المجففة (خلال فترة الرضاعة)، العلف البادئ ودريس البرسيم وعروش بنجر السكر المجففة (خلال فترة ما بعد الفطام) وتم توزيع العجول بشكل عشوائي على المجموعات التجريبية وغذيت كالتالي: (ج١) ٥٠٪ العلف البادئ + ٥٠٪ دريس البرسيم، (ج٢) ٥٠٪ العلف البادئ + ٣٧.٥٪ دريس البرسيم + ١٢.٥٪ عرش بنجر السكر المجفف ، (ج٣) ٥٠٪ العلف البادئ + ٢٥٪ دريس البرسيم + ٢٥٪ عرش بنجر السكر المجفف ، (ج٤) ٥٠٪ العلف البادئ + ١٢.٥٪ دريس البرسيم + ٣٧.٥٪ عرش بنجر السكر المجفف، (ج٥) ٥٠٪ العلف البادئ + ٥٠٪ عرش بنجر السكر المجفف. وأظهرت النتائج أن استبدال نسب مختلفة من دريس البرسيم بعرش بنجر السكر المجفف أدى إلى تحسن معنوي عند مستوى (٠,٠٥) في معاملات هضم كل من المادة الجافة، المادة العضوية، البروتين الخام، الألياف الخام، المستخلص الايثيرى، المستخلص الخالي من الأزوت وقيم المركبات الكلية المهضومة والبروتين المهضوم أثناء الفترات المختلفة، حيث أظهرت ج٣، ج٢ أعلى القيم. حدث انخفاض في درجة حموضة الكرش (**pH**) وتركيز نيتروجين الأمونيا (**NH3**)، بينما ارتفع تركيز الأحماض الدهنية الطيارة الكلية (**VFA's**) معنويا عند مستوى (٠,٠٥) في سائل الكرش في مجموعتي ج٣،ج٢ مقارنة بباقي المجموعات ، كما لوحظ زيادة معنوية عند مستوى (٠,٠٥) في كمية المادة الجافة المأكولة، المركبات الكلية المهضومة، البروتين الخام، البروتين الخام المهضوم في مجموعتي ج٣، ج٢ مقارنة بباقي المجموعات، سجلت العجول في ج٣، ج٢ زيادة معنوية عند مستوى (٠,٠٥) بالنسبة لوزن الجسم ، الزيادة الكلية والزيادة اليومية في الوزن بالكجم ، كما حدث تحسن معنوي عند مستوى (٠,٠٥) في معدل التحويل الغذائي، حيث انخفضت كميات المادة الجافة المأكولة، المركبات الكلية المهضومة، البروتين الخام، البروتين الخام المهضوم اللازمة لكل كجم زيادة في وزن الجسم الحي، بينما سجلت ج٣ أقل تكلفة تغذية لكل كجم نمو وعلاوة على ذلك أظهرت ج٣ أعلى عائد كلى وأعلى صافى ربح. من هذه الدراسة يستنتج أن استبدال نسب مختلفة من دريس البرسيم بعرش بنجر السكر المجفف حتى نسبة ٥٠٪ (ج٣) للعجول الفريزيان أثناء الرضاعة وفترة ما بعد الفطام حتى عمر ستة أشهر أدى إلى تحسين معاملات الهضم والقيم الغذائية وتخمرات الكرش، بعض مقايس الدم، وزن الجسم الحي، زيادة الوزن الكلي واليومي، نسبة تحويل العلف والكفاءة الاقتصادية.