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Effect of Milk, Calf Starter and Berseem Hay Feeding Regimes on Performance of Suckling Friesian and Baladi Calves

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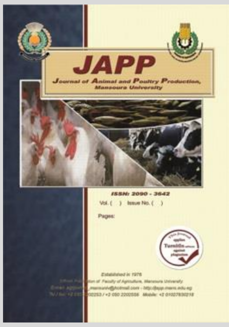

ABSTRACT

Thirty two newly born calves including 16 Friesian calves and 16 Baladi (8 males and 8 females) in each group. Breeds are assigned in two feeding regimes, equalized by breed, sex and birth weight and continued in a feeding trial during suckling period until reached weaning105 days as follows:Regime(I): 78.34% milk + 11.68% calf starter + 9.98% berseem hay, Regime(II): 72.49% milk + 19.62% calf starter + 7.89% berseem hay. Results showed that digestibilities of CF and EE were significantly higher (P<0.05), however digestibilities of DM, OM, NFE were significantly lower (P<0.05) in regime(I). Whereas, CP digestibility, TDN and DCP were nearly similar. Only ruminal TVFA's concentration was significantly higher (P<0.05) with increasing the amount of calf starter in regime(II) compared with regime(I). Whereas, ruminal pH and NH_3-N concentration, all blood serum metabolites and intake of DM, TDN and DCP were nearly similar. WG, TWG, average DG and feed conversion ratio were higher significantly (P<0.05) for calves fed regime(II). However, weight gain output, net output and economic efficiency were higher significantly (P<0.05) in regime(II). Economic efficiency increased by 27.21 and 39.83% for regime II compared with regime(I). Feeding regime(II) improved average DG of Friesian and Baladi calves by 11.88 and 18.40%, respectively, which increased by 6.52% for Baladi calves than Friesian calves. Friesian calves revealed significantly (P<0.05) higher feed conversion ratio compared with Baladi calves. Economic efficiency increased by 13.84 and 22.18% for Friesian compared with Baladi calves. Whereas, there were no any significant differences between male and female calves.

Keywords: Friesian, Baladi, calves, digestibility, performance.

INTRODUCTION

Yet growth rate is a key determinant of whether a heifer is able to breed at thirteen to fifteen months (Brickell *et al*., 2009). Age and Body weight influence the timing of puberty (Wathes *et al.*, 2014). To achieve sexual puberty in ideal time for breeding, a Friesian heifer need average growth rate not less than 0.7 to 0.8 kg/day (Brickell *et al*., 2009 and Soberon *et al*., 2012). Poor daily gain in suckling calf stage delay time at first parturition (Correa *et al*., 1988 and Wathes *et al*., 2014) and always affect the herd milk production (Bach and Ahedo, 2008; Soberon *et al*., 2012 and Cooke *et al*., 2013). The stage of feeding calf milk is very important, this period associated with a lot of contagious disease and high mortality. (Bach, 2011; Khan *et al*., 2011) and costly (Boulton *et al*., 2017). Standard calf need 10% of BW/day divided to two meals (Quigley *et al*., 2006 and Terré *et al*., 2009). Traditionally, dairy calf milk feeding systems have been based on daily feeding rates of 8–10% of body weight (BW) (Jasper and Weary, 2002).

Feeding young calves dry feed in early stage help for enhance rumen development and reduce the suckling period. (Anderson *et al*., 1987a) found that early weaning of suckling calves lead to fast development of digestion tract microflora count and activity related to early hard feed provided. (Anderson *et al*., 1987b) mentioned that enough microbial count seems to be present very early in rumen of suckling and feeding concentrate and dry roughage feed gradually subsequent enhance microbial growth. (Franklen *et al*., 2003) Found that using dry feed and Intake of colostrum by neonatal calves play an important role in this stage.

Misra and Singh (1993) has mentioned that calf starter ration is a combination of grains, premix and antibiotics. Good calf starter should be containing high digestible nutrients, high palatability, and high contain of energy, crude protein 18–20% and not more than 7% CF because high Percentage of CF decrease the intake of calf starter and calf growth and poor quality calf starter is delay early weaning. Calf starter feed enhance the immunity of calf, decrease weaning stress and also help to prevent the inhibitor factors of growth. High CF percentage increase digestives problem associated with diarrhea in calves. Mehra *et al.* (1990) mentioned that suckling buffalo calf used additional calf starter and digested it more usefully with more gains in body weight.

Calves fed on calf starter showed significantly higher weight gain and feed conversion ratio (FCR). Moreover, there was no associated problem like diarrhea in suckling calves and led to calves with good performance during this rearing stage. For that, it may be used to keep the suckling calf up to six months of age to improve the growth rate and to decrease the problem associated with weaning (Ahmed *et al.*, 2004). Nutrition in earlier stage can support the production and health of animals in the future (Lucas, 1991).

Feeding suckling calves solid feed gradually, which reaches the rumen directly, the rumen starts to develop metabolically, physically and a microbial population starts to

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develop fast in the digestive tract. The digestion of carbohydrates into VFA, i.e. acetate, propionate, and butyrate, also help for rumen development (Heinrichs, 2005). Calves start eating starter feed at about fourteen days of age (Khan *et al*., 2008), and intake increases rapidly when milk supply is reduced (Khan *et al.*, 2007). A successful transition from milk to solid feed is of great importance to prevent weight loss and reduce stress. Considering the need to raise the quantity of solid feed consumption of young calves, providing roughage during the milk-suckling stage was shown to enhancing average daily gain and total dry matter intake (Khan *et al.*, 2011). Ground hayor chopped hay provision improved feed intake and digestibility values in young calves (Montoro *et al*., 2013).

Common practice to feed milk at a restricted rate of approximately 10% of a calf's birth weight (approximately 4 to 5 L/d), which is not more than 50% of ad libitum intake (Appleby *et al.*, 2001 and Khan *et al.*, 2011) and, therefore, constrains milk meal patterns (Appleby et al., 2001 and De Paula Vieira *et al.*, 2012). Restricted milk feeding may be increase the quantity of feed intake by calves during weaning stage (Appleby *et al.*, 2001 and Jasper and Weary, 2002).

More recently (Castells *et al.*, 2013) he did not find significant different between calves feeding 0% forage and calves feeding forage 5% of the total solid feed consumption in gut fill. Thus, it can be safely recommended that when forage gives to calf not more than 5% of the total solid feed intake, gut fill is negligible and thus advantages reported in performance and efficiency when supplementing chopped forages to calves are not an artifact due to gut fill. Interestingly (and contrary to what it could be expected a priori), provision of chopped oats hay to calves improved rumen passage rate of digesta and tended to enhance average daily gain over time, without incurring increases in gut fill (in fact, gut fill was reduced by feeding oats hay) when compared to calves that were fed calf starter in a pelleted form (Castells *et al.*, 2013). The increase in passage rate and decreased gut fill can be mainly explained by a substantial increase in total dry matter intake (about 23% more than the intake observed in calves fed a pellet calf starter feed alone (Castells *et al.*, 2012).

The performance of suckling dairy calves is one of the main important factors affect the dairy enterprise profit. In this stage, the nutrients available from milk are always not enough compare to early soild feed intake which, help to improve rumen function and provide weaning early (Bush and Nicholson, 1986). Supporting calves with concentrate before weaning is one of the most interesting options in terms of performance and economic efficiency (Yuste *et al*., 2020).

The objective of this study was to investigate the effect of feeding suckling male and female Friesian and Baladi calves on regime contained high milk and berseem hay and low calf starter vs. regime contained high calf starter and low milk and berseem hay on feed intake, digestibility, fermentation of rumen, blood serum metabolites, growth rate, feed conversion and economic efficiency.

MATERIALS AND METHODS

The current work carried out at Al-Ahram farm, 6 October City, Giza Governorate during the year of 2018.

Animals and experimental groups:

Thirty two newly born calves including 16 Friesian calves (8 male and 8 female) and 16 baladi calves (8 male and 8 female) breeds are assigned in two feeding regimes with 16 calves in each one (8 male and 8 female) equalized by breed, sex and birth weight and continued in a feeding trial during suckling period until reached weaning 105 days as follows:

Regime I: 78.34% milk + 11.68% calf starter + 9.98% berseem hay (as fed basis).

Regime II: 72.49% milk + 19.62% calf starter + 7.89% berseem hay (as fed basis).

Management procedures:

Calves were left with dams to suckle their dam's colostrum during the first three days after calving. After that, calves were housed in separate pins at night and free in backyard at day. Calves were fed their allowance during the suckling period (105 days) to cover their nutritional requirements according to NRC (2001) as shown in Table (1). Calves were individually suckled the whole milk in plastic buckets two times daily at 7 a.m. and 4 p.m. Whereas, they were fed in group feeding on calf starter (CS) once time at 8 a.m. and berseem hay (BH) at 11 a.m. Fresh water was free available for calves all the day round. Chemical compositions of different feedstuffs and experimental rations are shown in Table (2).

Table 1.Allowances of whole milk, calf starter and berseem hay (kg/head/day) for suckling calves used in different regimes.

Age	Regime I			Regime II		
	Whole milk (L)	Calf starter (g)	Berseem hay (g)	Whole milk (L)	Calf starter (g)	Berseem hay (g)
1st-3rd days	Suckling their dams colostrum					
4th-7th days	4	0.50	0	3.5	0.075	0.0
Week 2	4.5	0.100	0.050	4.0	0.150	0.050
Week 3	5	0.150	0.100	4.5	0.250	0.100
Week 4	6	0.200	0.150	5.0	0.250	0.100
Week 5	5.5	0.250	0.200	5.0	0.500	0.200
Week 6	5	0.300	0.250	4.5	0.500	0.200
Week 7	4.5	0.400	0.300	4.0	0.750	0.300
Week 8	4.5	0.500	0.400	3.5	0.750	0.300
Week 9	4	0.600	0.500	3.0	1.000	0.400
Week 10	3	0.700	0.600	2.5	1.000	0.400
Week 11	3	0.800	0.700	2.0	1.250	0.500
Week 12	3	0.900	0.800	1.75	1.250	0.500
Week 13	2	1.000	0.900	1.5	1.500	0.600
Week 14	2	1.100	1.000	1.25	1.500	0.600
Week 15	1	1.200	1.100	1.0	1.750	0.700
Total	387.00	57.60	49.35	318.50	87.10	34.65
Average	3.69	0.550	0.470	3.03	0.830	0.33

Table 2. Chemical composition of tested feedstuffs and experimental rations.

Items	DM %	Composition of DM %					
		OM	CP	CF	EE	NFE	Ash
Feedstuffs							
Whole milk	12.65	94.31	25.30	00.00	30.04	38.97	5.69
Calf starter*	91.70	91.60	17.75	5.80	3.45	64.60	8.40
Berseem hay	89.45	86.35	12.80	28.70	2.65	42.20	13.65
Rations							
Regime I	29.54	90.92	18.79	10.77	12.13	49.24	9.08
Regime II	34.22	91.24	18.75	8.97	10.41	53.11	8.76

*** Calf starter: 15% soya bean meal, 10% linseed cake, 34% ground corn grain, 20% wheat bran, 15% rice bran, 3% molasses, 2% limestone and 1% common salt.**

Live body weight:

Calves were weighed weekly in the morning before drinking and feeding to the nearest 0.1 kg for each animal during the suckling period and the average daily body weight gain were calculated.

Digestibility trials:

Two digestibility trials were conducted at the last week of the suckling period using 3 male and 3 female calves from each breed in each feeding regime to determine nutrient digestion coefficients and feeding values of the experimental rations. Acid insoluble ash (AIA) was used as a natural marker as described by Van Keulen and Young (1977). Feces samples were taken from the rectum of each calf twice daily with 12 hours interval for 7 days collection period. 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 and feces were dried in a forced air oven at 65 °C for 48 hours, ground and representative samples were carried out according to the methods of AOAC (1990). Digestibility coefficient of all nutrients was calculated according to the equation given by Schneider and Flatt (1975).

Rumen liquor samples:

Rumen liquor samples were taken from calves used in digestibility trials at the end week of the suckling period at three hours after the morning feeding using stomach tube and filtered through double layers of cheese cloth. Ruminal pH value was immediately estimated using Orian 680 digital pH meter. The concentration of ammonia-N was determined using saturated solution according to the method of AOAC (1990). The concentration of TVFA's was determined in the rumen liquor by the steam distillation method according to Warner (1964).

Blood samples:

Blood samples were collected from all calves at the end week of suckling period by direct jugular vein puncture into tubes and allowed to clot at room temperature and then centrifuged at 3000 rpm for 30 minutes to separate serum. The harvested blood serum was dispensed into plastic tubes and stored at –20 °C until analyses. Total protein, albumin, globulin (total protein - albumin), creatinine, aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were determined calorimetrically by spectrophotometer (Spectronic 21D, USA) using commercial kits produced by Diagnostic System Laboratories, Inc., USA.

Feed conversion ratio:

Feed conversion ratio was expressed as the amount of DM, TDN and DCP required per one kg weight gain.

Economic efficiency:

Economic efficiency parameters were calculated according to the prices of year 2018. The prices in Egyptian pound (LE) per ton were 5500 LE for calf starter and 3000 LE for berseem hay. Also, the prices per kg were 5 LE for milk and 70 LE for live weight gain.

Statistical analysis:

The data were statistically analyzed using general linear model procedure adapted by IBM SPSS Statistics (2014) for user's guide with one-way ANOVA. Significant differences in the mean values among dietary treatments were analyzed by Duncan's tests within SPSS program set at the level of significance P<0.05 (Duncan, 1955).

RESULTS AND DISCUSSION

Nutrients digestion and feeding values:

Nutrients digestion and feeding values of tested rations by males and females of Friesian and Baladi calves in different feeding regimes are shown in Table (3). The digestibilities of CF and EE were significantly (P<0.05) higher in regime I compared to regime II.

Table 3. Nutrients digestion and feeding values of different feeding regimes rations by male and female of Friesian and Baladi calves at 15 weeks of age.

Items	Digestibility coefficients %						Feeding values %	
	DM	OM	CP	CF	EE	NFE	TDN	DCP
Regime								
I	67.76^{b}	69.11^{b}	68.54	64.67^{a}	75.68^{a}	71.85^{b}	75.87	12.88
II	69.89^{a}	71.29^{a}	68.26	61.99^{b}	73.04^{b}	74.34^{a}	74.95	12.80
Breed								
Friesian	68.71	70.09	68.68	63.23	74.66	72.68	75.32	12.89
Baladi	68.88	70.26	68.26	63.38	74.20	73.30	75.45	12.81
Sex								
Male	68.95	70.33	68.68	63.45	74.66	73.39	75.70	12.89
Female	68.69	70.07	68.12	63.21	74.05	72.80	75.11	12.79
MSE	0.52	0.53	0.48	0.51	0.59	0.57	0.53	0/09

A and b: Values in the same column for each item with different superscripts differ significantly (P<0.05).

However, the digestibilities of dry matter (DM), organic matter (OM), nitrogen free extract NFE were significantly (P<0.05) higher for regime II than these of regime I. Whereas, CP digestibility and the TDN and DCP values were nearly similar for both regimes I and II. Moreover, the digestibility for nutrients and feeding values were nearly similar for Friesian and Baladi calves as well as for male and female calves. Calves provided high quantity of milk tend to stress during transition onto solid feed, and part of the body weight gain achieved before weaning may be lost due to reduce utilization of nutrients, and decrease digestibility (Anderson *et al*., 1987a). High-fiber in forage-supplemented diet may be led to the shortage digestibility of DM, OM, and CP nutrients and high dry matter intake (DMI) haggling digestibility of feed (Zanton and Heinrichs, 2008). Porter *et al*. (2007) found that digestibility of DM in suckling calves fed diets with low percentage of fiber was better than those fed high percentage of fiber feeds, which might be related to the effect of forage on digestibility. The total tract apparent digestibility values of DM (P < 0.05), OM (P < 0.05), and CP (P < 0.01) were less in forage-supplemented calves compared to the non-forage-supplemented calves (Daneshvar *et al*., 2015). Low nutrient digestibility might be decreased by reduced the development of rumen and microbial activation (Terré *et al*., 2007). The calves had higher intake of calf starter, which might encourage the rumen development and microbial population. It is mentioned that calf showed high level of dry matter intake (DMI) from starter increased passage rate and led to decrease nutrient digestibility (Seo *et al*., 2006). The non-liquor feed may have a slow passage rate in digestive gut, and thereby low quantity of feed entering the digestion tract at each meal (Bhatti *et al*., 2008), providing for a better complete digestion by microflora inside the rumen. Importantly, the duration and the rate of ingested milk or milk replacer by suckling calves during the early stage after calving considerably can be effect on the degree of rumen development at weaning time and in turn being affect positively or negatively on nutrients digestibilities of the solid feed meal, throughout what well known as carry over effect at after weaning phases (Shahin *et al.*, 2018). The protein, carbohydrates and fat digestibility is same to monogastric the digestion process is depending on the digestive enzymes secreted by the abomasum and small intestine. As long as dry feed intake increased, the rumen develops and digestive system plays more essentials roles (Diao *et al.*, 2019).

Rumen liquor parameters:

Rumen liquor parameters are presented in Table (4) revealed that only the concentration of (TVFA's) was significantly (P<0.05) higher with increasing the amount of calf starter in regime II compared with those of regime I. Whereas, pH value and ammonia nitrogen (NH_3-N) concentration were nearly similar for regimes I and II. Moreover, pH value and the TVFA's concentration and NH_3-N were nearly similar for Friesian and Baladi calves as well as male and female calves. Early available of dry feed help young calves for rapid development of rumen microorganism growth, which help in raising the efficiency of digestion (Anderson *et al*., 1987a and b). In fact, duodenal microbial flow of calves following an improved-growth feeding system was lower than that of calves fed conventionally (Terré *et al.*, 2007), found that a rich rumen microorganism population may lead to an increase activity of rumen metabolic. The main reason for a greater feed intake results from an improved rumen environment, because of increased rumination and rumen pH value (Castells *et al*., 2012). The digestion of carbohydrates VFA's, i.e. acetate, propionate, and butyrate, also help in rumen improvement (Heinrichs, 2005). Feeding young calf's solid feed support early weaning through encourage early growth of ruminal microbial activity (Anderson *et al.*, 1987a and b).

Table 4. Effect of different feeding regimes on rumen liquor parameters of Friesian and baladi calves.

Items	pH value	TVFA's (mmol/100 ml)	NH_3-N (mg/100 ml)
Regime			
I	6.59	8.95^b	8,98
II	6.44	9.57^a	8.76
Breed			
Friesian	6.50	9.18	8.79
Baladi	6.53	9.30	8.91
Sex			
Male	6.54	9.33	8.94
Female	6.49	9.19	8.80
MSE	0.05	0.09	0.06

A and b: Values in the same column for each item with different superscripts differ significantly (P<0.05).

Blood serum metabolites:

Data of blood serum metabolites in Table (5) revealed that the concentrations of total protein, albumin, globulin, albumin to globulin ratio and creatinine as well as AST and ALT activity were nearly similar for feeding regimes, breed and sex of calves. The presented blood serum parameters are within the normal values of serum indicating a good health calves. Similar results shown by Daneshvar *et al.* (2015) they found that Holstein bull calves fed restricted milk feeding through traditional or step-down ways including or without including forage in calf solid feed didn't affect blood metabolites. Dehghan-Banadaky *et al.* (2012) reported that most blood parameters of suckling Holstein calves were not affected feeding raw fiber concentrate. Wang *et al.* (2020) stated that there was no effect of treatment based upon different concentrate intake on BUN, GLU, or TP concentrations of Southern Chinese Cattle (P>0.05).

Table 5. Blood serum biochemical of Friesian and baladi calves in different feeding regimes.

Items	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	A: G Ratio	Creatinine (mg/dl)	AST (IU/L)	ALT (IU/L)
Regime							
I	6.73	3.48	3.26	1.07	0.97	31.84	17.23
II	6.90	3.53	3.36	1.05	1.01	32.28	16.81
Breed							
Friesian	6.80	3.50	3.30	1.06	0.98	31.88	16.99
Baladi	6.82	3.51	3.31	1.06	0.99	32.15	17.03
Sex							
Male	6.83	3.51	3.32	1.06	0.99	32.19	17.05
Female	6.80	3.50	3.30	1.06	0.99	31.93	16.99
MSE	0.09	0.05	0.05	0.01	0.01	0.44	0.24

Feed intake:

Average daily feed intake by suckling calves in the two feeding regimes is shown in Table (6).

Table 6. Feed intake (kg/head/day) by suckling Friesian and baladi calves in different feeding regimes.

Item	Milk	Calf starter	Berseem hay	Total intake	DM	TDN	DCP
Regime							
I	3.69^a	0.55^b	0.47^a	4.71^a	1.39	1.06	0.179
II	3.03^b	0.82^a	0.33^b	4.18^b	1.43	1.07	0.183
Breed							
Friesian	3.33	0.70	0.39	4.42	1.41	1.06	0.181
Baladi	3.34	0.69	0.39	4.42	1.41	1.06	0.181
Sex							
Male	3.32	0.70	0.39	4.41	1.41	1.06	0.181
Female	3.35	0.69	0.39	4.43	1.41	1.06	0.181
MSE	0.04	0.01	0.01	0.04	0.01	0.009	0.001

A and b: Values in the same column for each item with different superscripts differ significantly (P<0.05).

Milk, berseem hay and total feed intake (as fed basis) were higher (P<0.05) significantly with feeding calves on regime I compared with those of regime II. However, calf starter intake was higher significantly (P<0.05) with feeding regime II compared with I. Whereas, the intake of total DM, TDN and DCP (on DM basis) were nearly similar for both with those of regime I feeding regimes and tended to increase insignificantly in regime II than those of regime I. There were inverse relationships between milk intake and dry feed intake, whereas total DM intake are almost equal for calves fed the different levels of milk (Yavuz *et al.*, 2015). Significant differences in solid feed intake were previously reported when calves were offered restricted or ad lib quantity of milk (Jasper and Weary, 2002 and Khan *et al.*, 2007 a and b). Reduction of calf starter intake in higher level of milk replacer feeding was reported also by Raeth-Knight *et al.* (2009); Cobb and Ballon (2010), Hengst *et al.* (2010) and Paula *et al.*, (2012). Increased calf starter consumption compensating for lower milk intake and growth in LW was similar for calves receiving different level of milk in the experiment Carlson *et al.* (2009).

Live body weight and body weight gain:

Live body weight (LBW), total weight gain (TWG) and average daily gain (ADG) of suckling calves fed the different regimes are presented in Table (7).

Table 7. Live body weight (kg) and total weight gain (kg) and average daily gain (kg/day) of suckling calves in different feeding regimes.

Items	No. of calves	Birth weight	Weaning weight	Total weight gain	Average daily gain	Improvement %
Regime						
I	16	31.55	81.74[b]	50.19[b]	0.478[b]	100.00[b]
II	16	31.79	89.23[a]	57.44[a]	0.547[a]	115.14[a]
Breed						
Friesian	16	33.47[a]	91.68[a]	58.20[a]	0.554[a]	111.88[b]
Baladi	16	30.31[b]	81.30[b]	50.99[b]	0.486[b]	118.40[a]
Sex						
Male	16	32.80	87.00	54.19	0.516	114.92
Female	16	30.60	84.61	54.01	0.514	115.36
MSE		0.28	0.79	0.57	0.005	0.98

A and b: Values in the same column for each item with different superscripts differ significantly (P<0.05).

Birth weight was nearly similar for the two feeding regimes. Whereas, weaning weight, total (WG) and (ADG) improvement were higher significantly (P<0.05) for calves fed regime II compared to these of regime I. (ADG) of calves fed regime II increased by 15.14% compared to regime I. Moreover, birth weight, weaning weight, total (WG) and (ADG) were higher significantly (P<0.05), but average daily gain improvement was lower significantly (P<0.05) for Friesian calves in comparison with Baladi calves. Feeding regime II improved (ADG) of Friesian and Baladi calves by 11.88 and 18.40% compared these of regime I, which increased by 6.52% for Baladi calves than that of Friesian calves. These results attributed to than Friesian breed was more growing and heavy weight than Baladi breed. However, birth and weaning weight were insignificantly higher for male than those of female calves. Total weight gain, (ADG) and daily gain improvement were nearly the same for male and female calves. Pre-weaning supplementation with concentrates is the most interesting option in term of performance (Yuste *et al.*, 2020). Misra and Singh (1993) suggested that good calf starter benefits calf growth. Mehra *et al.* (1990) mentioned that suckling buffalo calves fed more calf starter ration showed more gains in body weight similar to (Ahmed *et al.*, 2004) found that higher weight gain was shown by suckling calves fed on calf starter ration. A successful transition from liquid to solid feed is great importance to prevent weight loss and stress. Considering the need to increase solid feed consumption of young calves, introducing roughage during the milk-feeding period was shown to improve average daily gain (Khan *et al.*, 2011).

Feed conversion ratio:

Feed conversion ratio (FCR) of suckling calves in different feeding regimes are shown in Table (8). Feed conversion ratio was higher significantly (P<0.05) for regime II, recorded the lower amounts of DM, TDN and DCP per kg weight gain compared with these of regime I. The FCR of DM, TDN and DCP in regime II improve by 10.58, 11.66 and 11.11% compared with these of regime I, respectively. Moreover, Friesian calves revealed significantly (P<0.05) higher FCR compared with that of Baladi calves, which the amounts of DM, TDN and DCP per kg weight gain for Friesian calves decreased significantly (P<0.05) by 12.97, 13.12 and 12.77% compared with those of Baladi calves, respectively. Higher FCR for Friesian calves than Baladi calves might be due to higher ADG in Friesian than those of Baladi calves (Table 7). Whereas, the amounts of DM, TDN and DCP per kg weight gain were almost the same for male and female calves. These results are in agreement with those obtained by Mehra *et al.* (1990) found that suckling buffalo calves is more better to utilize meals with more calf starter ration. (Ahmed *et al.*, 2004) reported that Significantly higher FCR was recorded in calves fed on calf starter ration Calves fed raw fiber concentrate (RFC) had better feed efficiency (Dehghan-Banadaky *et al.*, 2012). Feeding suckling calves concentrate can help to encourage the ability to the transitional from sucking period to solid feed, with advantages for feed utilization (Wang *et al.*, 2020).

Table 8. Feed conversion ratio of suckling Friesian and Baladi calves in different feeding regimes.

Item	DM (kg/kg gain)	TDN (kg/kg gain)	DCP (kg/kg gain)
Regime			
I	2.93[a]	2.23[a]	0.378[a]
II	2.62[b]	1.97[b]	0.336[b]
Breed			
Friesian	2.55[b]	1.92[b]	0.328[b]
Baladi	2.93[a]	2.21[a]	0.376[a]
Sex			
Male	2.77	2.08	0.355
Female	2.77	2.09	0.355
MSE	0.035	0.027	0.007

A and b: Values in the same column for each item with different superscripts differ significantly (P<0.05).

Economic efficiency:

Economic efficiency parameters of suckling calves in different feeding regimes are shown in Table (9). Average daily feed cost and feeding cost per kg weight gain were higher significantly (P<0.05) for regime I compared with these of II. However, weight gain output, net output and economic efficiency were higher significantly (P<0.05) for regime II in comparison with those of regime I. Economic efficiency expressed as the ratio between output of weight gain and average daily feed cost increased by 27.21% for regime II compared with regime I. Also, economic efficiency expressed as the percentage of net output to average daily feed cost increased by 39.83% for regime II compared with regime I.

Moreover, average daily feed cost was nearly the same for Friesian and Baladi calves. Whereas, feed cost per kg gain was lower significantly (P<0.05), but output of weight gain, net output and economic efficiency were higher significantly (P<0.05) for Friesian compared with Baladi calves. Economic efficiency expressed as the ratio between weight gain output and average daily feed cost increased by 13.84% for Friesian compared to Baladi calves. Also, economic efficiency expressed as the percentage of net output to average daily feed cost increased by 22.18% for Friesian compared with Baladi calves. Better economic efficiency for Friesian calves than Baladi calves might be due to higher ADG in Friesian than those of Baladi calves (Table 7). All economic parameters were nearly similar for male and female calves.

Table 9. Economic efficiency parameters of suckling calves in different feeding regimes.

Item	Cost of feed (LE/day)	Cost of feed (LE/ kg gain)	Weight gain output (LE/day)	Net output (LE/day)	Economic efficiency[1]	Economic efficiency[2] %
Regime						
I	22.89^{a}	48.23^{a}	33.46^{b}	10.58^{b}	1.47^{b}	47.03^{b}
II	20.64^{b}	37.95^{b}	38.29^{a}	17.66^{a}	1.87^{a}	86.86a
Breed						
Friesian	21.66	39.33^{b}	38.80^{a}	17.15^{a}	1.81^{a}	81.12^{a}
Baladi	21.68	45.23^{a}	33.99^{b}	12.31^{b}	1.59^{b}	58.94^{b}
Sex						
Male	21.63	42.57	36.13	14.50	1.69	69.14
Female	21.72	42.80	36.01	14.29	1.68	67.90
MSE	0.21	0.71	0.38	0.49	0.03	2.74

A and b: Values in the same column for each item with different superscripts differ significantly (P<0.05).
Economic efficiency[1] = Weight gain output / feed cost.
Economic efficiency[2] % = Net output x 100 / feed cost.

Growth efficiency of suckling calves is important to make profit from dairy enterprise (Bush and Nicholson, 1986). The infection of calves and death, which may differ depending on calves take milk direct from the mother or using calf feeders to give milk, also the viability of management system affect the economics of enterprise (Krohn, 2001). Det kongelige landbruksdepartement (2002) stated that cost of suckling process might also play role in the way of management. Systems that depend on feeding calves from their mothers are more profitable and this is due to the lower costs of feeding systems, as consumers tend to buy the product at higher prices. Combellas and Tesorero (2003) reported that in a longer run, female calves that were suckled mothers may have improve strangeness and enhance economic life time, leading to in reduce costs of replacement. Giving suckling calves the necessary nutrients to support high growth rates (>750 g/d) at the frist two months, not only should result in more efficient economically (Bach, 2014). Often the economic and practical plays the main role in determining the method and length of the suckling period for dairy and fattening business. Also, in over the circumstances of the experiment this stage needs to allow the calves to take more milk. However, allowing calves to suckling for longer periods, compared to the common durations, is more to effect on all production economies by increasing the average body weight in addition to raising the immunity of calves and improving health status nursing calves and animals in the future. Even with great caution and taking into account the insincerity of the results, suckling for some weeks is considered an economic factor in the care of calves for such farms (Asheim *et al*., 2016). Giving the suckling calves quantities of concentrated feed is one of the most important ingredients to achieve economic efficiency and profitability (Yuste *et al*., 2020).

CONCLUSION

Considering these results it could be concluded that feeding regime with high calf starter and low milk and berseem hay led to improving digestibility, rumen fermentation, weaning weight, body weight gain, feed conversion and economic efficiency of suckling Friesian and Baladi calves. Also, suckling Friesian calves recorded higher birth and weaning weight, body weight gain, feed conversion and economic efficiency than those of Baladi calves. Whereas, all parameters were nearly similar for male and female calves.

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تأثير نظم التغذية على اللبن والعلف البادىء ودريس البرسيم على أداء العجول الفريزيان والبلدية الرضيعة

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أجريت هذه الدراسة على عدد 32 عجل وعجلة حديث الولادة 16 فريزيان و 16 بلدى كل سلالة تحتوى على (8 ذكور و 8 إناث) تم تقسيمهم إلى مجموعتين متماثلتين طبقا للسلالة والجنس ووزن الميلاد غذيت خلال فترة الرضاعة على أحد النظامين الغذائيين التاليين:- النظام الأول: 78.34% لبن + 11.68% علف بادئ + 9.98% دريس برسيم (على أساس المادة الطازجة) النظام الثانى: 72.49 % لبن + 19.62% علف بادىء + 7.99% دريس برسيم (على أساس المادة الطازجة) أظهرت النتائج ارتفاع هضم الألياف والدهن الخام عند مستوى (0.05)، بينما أنخفض هضم كل من المادة الجافة والمادة العضوية والنستخلص الخالى من الأزوت عند مستوى (0.05) مع التغذية على النظام الأول مقارنة بالنظام الثانى، فى حين أن قيم هضم البروتين الخام ومجموع المركبات الكلية المهضومة والبروتين المهضوم كانت متقاربة لكلا النظامين زيادة تركيز الأحماض الدهنية الطيارة فى الكرش عند مستوى (0.05) مع زيادة كمية العلف البادىء فى النظام الثانى مقارنة بالنظام الأول فى حين كانت قيم درجة الحموضة و تركيزنيتروجين الأمونيا فى سائل الكرش و مقاييس سيرم الدم والمأكول من المادة الجافة والمركبات الكلية المهضومة و البروتين المهضوم متقاربة لكلا النظامين ارتفاع وزن الفطام والزيادة الكلية فى الوزن ومعدل الزيادة اليومية عند مستوى (0.05) للعجول المغذاة على النظام الثانى عن النظام الأول حققت العجول المغذاة على النظام 2 زيادة فى معدل النمو اليومى قدرها 15.14% مقارنة بالعليقة 01 ارتفاع معدل التحويل الغذائى فى النظام الثانى عند مستوى (0,05) حيث انخفضت كميات المادة الجافة و المركبات الكلية المهضومة والبروتين المهضوم اللازمة لكل كجم نمو مقارنة بالنظام الأول حدث تحسن معدل تحويل كل من المادة الجافة و المركبات الكلية المهضومة والبروتين المهضوم فى النظام 2 بمعدل 10.58, 11.66, 11.11% مقارنة بالعليقة 1 على التوالى حدث زيادة فى تكلفة التغذية اليومية، تكلفة لكل كجم نمو مع التغذية على العليقة 1، بينما زادت الكفاءة الاقتصادية بمعدل 27.21 و 39.38% للعليقة 2 مقارنة بالعليقة 01 ارتفاع وزن الميلاد و وزن الفطام ومعدل الزيادة اليومية، بينما قل معدل التحسن فى الزيادة اليومية عند مستوى (0.05) للعجول الفريزيان مقارنة بالعجول البلدى بمعدل 11.88 و 18.40% على التوالى والتى زادت بمعدل 6.52% للعجول البلدى, ارتفاع معدل التحويل الغذائى مع العجول الفريزيان مقارنة بالعجول البلدى، حيث انخفضت كميات المادة الجافة والمركبات الكلية المهضومة و البروتين المهضوم اللازمة لكل كجم نمو للعجول الفريزيان بقدار 12.97, 13.12, 12.77% مقارنة بالعجول البلدية على التوالى كما انتخفضت تكلفة التغذية لكل كجم نمو، بينما زاد العائد الكلى والعائد الصافى من الزيادة فى الوزن والكفاءة الأقتصادية للعجول الفريزيان عنه فى العجول البلدية، حيث زادت الكفاءة الأقتصادية للعجول الفريزيان بقدار 13.84 و 22.18 % مقارنتا بالعجول البلدية. فى حين لم توجد أي اختلافات معنوية بين الذكور والاناث فى الصفات ألمدروسة تستخلص من هذه الدراسة أن التغذية على النظام الذى يحتوى على مستوى مرتفع من العلف البادئ ومستوى منخفض من اللبن ودريس البرسيم أدت الى تحسن الهضم وتخمرات الكرش و وزن الفطام و الزيادة فى الوزن ومعدل التحويل الغذائى والكفاءة الاقتصادية للعجول الفريزيان والبلدى الرضيعة0 ارتفاع وزن الميلاد و وزن الفطام والزيادة فى الوزن ومعدل التحويل الغذائى والكفاءة الاقتصادية للعجول الرضيعة الفريزيان عن العجول البلدية0 فى حين كانت كل الصفات المدروسة متماثلة تقريبا للذكور والاناث