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Use of Colostrum, Nonsalable and Fermented Milk in Feeding Calves

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FORTY-FOUR Friesian x Baladi crossbred calves at the age of 4-6 days were assigned to 4 groups fed on:1) whole milk (WM), 2) nonsalable milk (NSM), 3) nonsalable milk plus colostrum (NSM + C) and 4) naturally fermented milk (NFM). The NSM included mastitic milk, milk from the antibiotic treated animals, rejected milk because of the rise in acidity and milk refused by the calves and remained in the feeding pots. Surplus colostrum (C) was collected from the first 6 post partum milkings. Both NSM and C were preserved with. 5% benzoic acid and NSM was neutralized with 6% $NaHCO_3$ at the time of feeding. The colostrum was mixed with NSM at the ratio of 20: 80 (v/v) just before feeding. The NFM was prepared by inoculating WM with 2-4% of fermented milk. The calves were fed the liquid diets at the rate of 3 Kg/calf daily, with calf starter given ad libitum. The calves were weaned at 45 days of age and given calf starter alone for additional one month.

Daily gains during the liquid feeding period were 0.27, 0.24, 0.32 and 0.28 kg for WM, NSM, NSM + C and NFM groups, respectively. The corresponding values during the postweaning period were. 0.41, 0.40, 0.52 and 0.48 kg. Addition of colostrum to NSM was effective in raising daily gains and feed efficiency and in reducing frequency and severity of scours.

Feed efficiency values in the liquid feeding period were 2.17, 2.71, 1.82 and 2.10 and in the post weaning period 2.41, 2.40, 1.98 and 2.05 kg DM/Kg gain for WM, NSM, NSM+C and NFM groups, respectively.

The gains and efficiency of the NSM were not different from that of WM. Using NSM or NSM+C feeding appreciably reduced costs of feeding calves. It is advised to add surplus colostrum to nonsalable milk in feeding suckling calves.

Keywords: Friesian X Baladi crossbred, feeding calves, milk, non salable milk, fermented milk, daily gain and feed efficienc.

Nonsalable milk (NSM) includes surplus colostrum, mastitic milk, milk from antibiotic treated cows, and milk rejected by Dairies due to its high acidity. Such NSM is often produced in large amounts in dairy farms presenting economic loss and disposal problem. As the newnatal calf consumes only 1/4 to 1/3 of the produced colostrum with the remainder being available as NSM (Foley and Otterby, 1978). The surplus colostrum cannot be mixed with salable milk for legal and technological considerations in spite of its high nutritive and immunological values. Production of mastitic milk on dairy farms ranges from 22 to 45 kg/cow annually (Janzen, 1970). Mastitic milk cannot be sold as it contains high numbers of somatic cells and antibiotic residues. Chardavoyne *et al.*, (1979) suggested that milk from cows treated with antibiotics must be withheld from the market until it is free from drug residues.

Use of NSM in feeding suckling calves offers a good economical alterative, provided that performance or health of the calves are not impaired. Surplus clostrum has been used in feeding calves, beyond the first days of life, either fresh, frozen or preserved with chemicals (Drevjany *et al.*, 1975; Polzin *et al.*, 1977; Jenny *et al.*, 1980 and Otterby *et al.*, 1980) with essentially similar results to normal milk. Calves fed mastitic milk, in quantities comparable to normal milk or fermented colostrum, showed similar performance. It is concluded (Keith *et al.*, 1983) that feeding calves on waste milk, from cows treated with antibiotics show no determintal effects. Different systems of raising suckling calves were utilized in Egypt. Milk replacers were used in feeding calves either as imported (Lasheen, 1983 and Khattab *et al.*, 1989) or local formed replacers (El-Ashry *et al.*, , 1975 and El-Serafy *et al.*, , 1980). Early weaning was practised successfully in rearing calves (Khoury *et al.*, , 1967; Abou Hussein *et al.*, 1989 and Salama *et al.*, 1989). However, studies are lacking on the use of various forms of discarded milk like colostrum, nonsalable and fermented milk in feeding suckling calves. Therefore the objective of the present work was to utilize nonsalable milk, alone or mixed with surplus colostrum and naturally fermented milk in feeding systems of suckling calves.

Material and Methods

This experiment was carried out at Youssifia Farm station, belonging to Dakahlia Governorate; effective October, 1988.

Animals

Forty four newly born male and female Friesian Baladi crossbred calves were used in this experiment. The calves were allowed to suckle their dams for the first 4-6 days of life. The calves were divided according to sex into four equal groups of nearly similar body weight. The groups were assigned at random to the four experimental feeding treatments .

Feeding and Management

The feeding treatments used were: group 1, whole milk (WM); group 2, nonsalable milk (NSM); group 3, nonsalable milk plus colostrum (NSM + C) and group 4, naturally fermented milk (NFM).

The nonsalable milk (NSM) was composed of mastitic milk, milk from antibiotic treated cows, rejected milk by the manufacturer because of its acidity and milk remained in the feeding pots after allowing the calves sufficient time to drink. Surplus colostrum (C) was collected from the first 6 post partum milkings. Both NSM and C were preserved with 0.5% (w/w) benzoic acid into plastic containers with lids and was gently agitated once daily to prevent floating of fat. The NSM was neutralized with 0.6% (w/w) sodium bicarbonate at the time of feeding to improve its accessibility by calves. The naturally fermented milk (NFM) was prepared by inoculation of whole milk with 2-4% fermented milk as a starter. The NFM was kept in plastic containers at room temperature.

The calves were given their liquid diets at the rate of 3 kg/calf daily in two equal portions at 6.00 and 17.00 hr. Calves to receive NSM, NSM + C and NFM were changed gradually to their assigned diets within 3-4 days. In the NSM+C group, C was mixed with NSM at the ratio of 20:80 just before feeding. Calf starter (Table 1) was offered free choice to all groups during the experiment. Vitamin and mineral supplements were added to the starter as follows per ton of the starter: vitamin A, 20 million IU, D_3 2 million IU, E 400000 IU, Zn, 45 g, Mn, 40 g, Cu, 3 g, I, .3, Se, 0.1 g, and Fe, 30 g. The calves were weaned at the age of 45 days and continued to receive calf starter for one month after weaning.

TABLE 1 . **Chemical composition, pH and titratable acidity of whole milk (WM), colostrum (C), nonsalable milk (NSM), naturally fermented milk (NFM) and calf starter.**

Items	Whole milk	Colostrum	Non-salable milk	Naturally fermented milk	Calf starter
No of samples	10	10	10	10	3
Dry matter (%)	12.52	15.85	12.51	12.50	88.80
± SD	0.15	1.17	0.19	0.19	1.30
Protein (%)	3.33	5.00	3.32	3.29	16.03
± SD	0.10	0.63	0.09	0.11	0.19
Fat (%)	3.63	4.19	3.39	3.29	2.71
± SD	0.189	0.251	0.179	0.082	0.165
ASH (%)	0.76	0.86	0.75	0.73	8.58
± SD	0.01	0.01	0.02	0.02	0.75
Fiber (%)	-	-	-	-	9.70
± SD	-	-	-	-	0.76
Titratable acidity (%)	0.18	1.30	1.00	0.93	-
± SD	0.01	0.45	0.43	0.10	-
pH	6.60	4.80	5.10	4.45	-
± SD	0	0.48	0.38	0.12	-

The calves were kept in individual pens with wooden slats floor. Aluminium pots fastened to front of the pens were used for introducing liquid diets, calf starter and drinking water.

Measurements

The calves were weighed at birth, at their assignment to groups and at weekly intervals throughout the experiment. Consumption of the starter was determined 2 or 3 times weekly observations on general health including scouring were recorded daily. Samples from WM were taken weekly, while samples from every batch of C, NSM and NFM were saved. pH and titratable acidity of the samples were measured immediately. The remainder of the samples were kept frozen until desired for chemical analysis.

Total solids of different types of milk were determined by oven drying at 60°C overnight then for additional 3 hours at 105°C. Protein was determined by Kjeldahl procedure. Fat was assayed by Gerber's method (Ling, 1963). For titratable acidity, 10 ml milk was titrated with. 0.1 N NaOH in the presence of phenolphthalein indicator.

Statistical analysis

The data were subjected to analysis of variance as randomized complete one way design (Steel and Torrie, 1980).

Results and Discussion

Composition, titratable acidity and pH of WM, C, NSM and NFM are given in Table 1. The colostrum had considerably higher contents of DM, protein, fat and ash then other types of milk which had similar composition. Composition of colostrum in this work lies within the ranges found by Muller and Smallcombs (1977), Jenny *et al.*, (1984) and Nocek *et al.*, (1984). The values of NSM composition reported herein were higher than those of NSM acidified with propionic acid (Ottery *et al.*, , 1980). Titratable acidity of C, NSM and NFM was noteciably higher than WM. Whole milk (WM) had the highest pH values whereas NSM had higher pH values than C and the lowest values were noticed in NFM. The pH values found here were within the ranges reported by Otterby *et al.*, (1980) and Jenny *et al.*, (1980).

Data of growth performance are presented in Table 2.

Liquid feeding period

Daily gains during the first week of the experiment were generally low in all groups, even, calves in the NSM group lost some weight during the first week. This might be due to the refusal of NSM at the first 2-3 days of its introduction as a result of its high acidity. Thus it was found necessary to neutralize NSM and NSM+C diets just prior to feeding. Chardavoyne *et al.*, (1979) reported that scouring plus reluctance to accept waste milk accounted for poor initial gain of calves fed formalin treated waste milk. Eppard *et al.*, (1982) found that sodium bicarbonate was effective in improving intake of acidified colostrum early in the feeding period.

TABLE 2. Average daily gain of calves fed whole milk (WM), nonsalable milk (NSM), nonsalable milk plus colostrum (NSM + C) and naturally fermented milk (NFM) at the suckling and at the post weaning periods.

Items	WM	NSM	NSM+C	NFM	SE
No of calves	10	10	10	10	1.061
Average birth weighr, kg	30.39	32.35	33.18	31.29	1.030
Average weightr at start of experiment, kg	30.35	32.29	32.55	30.82	
Average weaning weight, kg	40.54	41.59	44.73	41.72	
Average final body weight, kg	53.64	55.07	61.54	56.91	
Average daily gain (kg/day/calf)					
a) liguid feeding period (days)					
7-14 (1 st wk)	0.06^{a}	-0.01^{a}	0.01^{a}	0.08^{a}	0.051
15-21(2 nd wk)	0.27^{a}	0.28^{a}	0.30^{a}	0.27^{a}	0.051
22-28 (3 rd wk)	0.43^{a}	0.29^{a}	0.40^{a}	0.35^{a}	0.051
29-35 (4 th wk)	0.30^{a}	0.31^{a}	0.35^{a}	0.33^{a}	0.051
36-24 (5 th wk)	0.33^{a}	0.32^{a}	0.36^{a}	0.33^{a}	0.051
43-45 (6th wk)	0.36	0.32^{a}	0.51^{b}	0.46^{ab}	0.051
7-45	0.27^{a}	0.24^{a}	0.32^{a}	0.28^{ab}	0.013
b) Post weaning period (days)	0.29^{a}	0.32^{a}	0.51^{b}	$0.42^{b}c$	0.042
46-49 (1 st wk)	0.35^{a}	0.41^{b}	0.53^{b}	0.47^{b}	0.042
50-56 (2 nd wk)	0.40^{a}	0.39^{a}	0.54^{b}	0.51^{ab}	0.042
57-63 (3 rd wk)	0.44^{a}	0.40^{a}	0.52^{a}	0.49^{a}	0.042
64-70 (4 th wk)	0.50^{a}	0.44^{a}	0.52^{a}	0.46^{a}	0.042
71-77 (5 th wk)	0.41	0.40^{a}	0.52^{b}	0.48^{b}	0.042
46-77	0.33^{ac}	0.32^{a}	0.41^{b}	0.37^{c}	0.015
c) Whole period					
7-77					

a,b,c means in the same row bearing different leters are significantly different ($P<0.05$).

* Only data from calves that completed the II weeks trial are included.

Daily gains were improved during the second and third week. There were no significant differences among groups in daily gains during the first five weeks of the experiment. with the tendency for better gains for the NSM + C group.In the last days

of the liquid feeding period (43-45 days)the NSM + C group attained higher growth rates than WM and NSM groups (0.51 versus 0.36 and 0.32 kg/day, respectively). When taking the whole liquid feeding period into account, the gains were .27, .24, .32 and 0.28 kg/day for WM, NSM, NSM + C and NFM groups, respectively. The only significant difference was between NSM and NSM + C groups ($P< 0.05$). The values observed here were lower than the values observed by El-Ayouty *et al.*, (1988) for calves fed whole milk, milk replacer or milk replacer plus colostrum. Thus it could be deduced that addition of colostrum is more effective with NSM than with milk replacer, which had better quality than NSM. The daily gains were similar to gains obtained by Otterby *et al.*, (1980) for calves fed on acidified colostrum, acidified nonsalable milk or acidified colostrum followed by acidified nonsalable milk. There were no significant differences in gains between WM and NSM which is in agreement with the results of Keith *et al.*, (1983) who found that feeding waste milk from antibiotic treated cows, either fresh, fermented or fermented and neutralized with $NaHCO_3$ had resulted in body gains similar to calves fed normal milk up to 42 days of age.

Post weaning period

During the short period following weaning (46-49 days), the daily gains in the WM and NFM groups showed a small decrease than the levels observed just before weaning. The NSM + C group tended to show higher gains in the period (46-56 days) than in the other groups, whereas WM had the lowest gains in the period (50-56 days). Group NSM +C had higher gains than either WM or NSM groups in the period (57-63 days).The daily gains in the post weaning period (46-77 days) were higher for NSM+C and NFM group than WM or NSM groups ($p< 0.05$).

In the whole experimental (Liquid feeding and post weaning) period, the daily gains were 0.33, 0.32, 0.41 and 0.37 kg/day for WM, NSM, NSM+C and NFM groups, respectively. The highest gains were observed in the NSM+C group followed by the NFM group. It is worthynoting that addition of colostrum to NSM increased gains from 0.32 kg/day in NSM to 0.41 kg/day in NSM+C group. It is also interesting that NFM seemed to give better gains than WM group.

Feed consumption and efficiency

Consumption of liquid diets and calf starter and feed efficiency during the liquid feeding and postweaning periods are given in Table 3. The NSM+C group had higher liquid consumption than other groups ($p < 0.05$), whereas NSM group consumed significantly ($p< 0.05$) higher amounts of calf starter than either WM or NSM+C group in the liquid feeding period. However, the total intake during the liquid feeding period was not different amoung groups. The NSM+C group consumed the highest amount ($p< 0.05$) of calf starter in the post weaning period, with no differences among other groups. Total intake of dry matter during the whole period (7-77 days) was about the same in different groups.

TABLE 3. Average consumption (liquid diets and calf starter and feed efficiency of calves fed whole milk (WM), nonsalable milk (NSM), nonsalable milk plus cxolostrum (NSM +C) and naturally fermented milk (NFM).

Items	WM	NSM	NSM+C	NFM	SE
No of calves	10	10	10	10	
Liquid intake (kg DM/day):					
7-45 days	0.36^{a}	0.35^{a}	0.38^{b}	0.36^{a}	0.007
Calf starter intake (Kg DM/day):					
7-45 days	0.22^{a}	0.29^{b}	0.20^{a}	0.24^{ab}	0.022
46-77 days	0.93^{a}	0.92^{a}	1.04^{b}	0.94^{a}	0.035
7-77 days	0.54^{a}	0.58^{a}	0.58^{a}	0.56^{a}	0.019
Total intake (kg/DM/day):					
7-45 days	0.58^{a}	0.63^{a}	0.57^{a}	0.59^{a}	0.024
46-77 days	0.93^{a}	0.92^{a}	1.04^{b}	0.94^{a}	0.035
7-77 days	0.74^{a}	0.76^{a}	0.74^{a}	0.75^{a}	0.019
Feed efficiency, (kg DM/kg gain):					
7-45 days	2.17^{a}	2.71^{b}	1.82^{a}	2.10^{a}	0.148
46-77 days	2.41^{a}	2.40^{a}	1.98^{a}	2.05^{a}	0.147
7-77 days	2.24^{ac}	2.50^{a}	1.91^{b}	2.04^{bc}	0.101

a,b,c Means in the same row. bearing different letters are significantly different ($P<0.05$).

Number of calves which continued until the end of the treatment, data of dead calves were discarded.

Feed efficiency of the NSM group was the worst among all groups during the liquid feeding period. Inclusion of colostrum with NSM was effective in improving feed efficiency. In the post weaning period, there were no significant differences among groups in feed efficiency.

When taking the whole experimental period into consideration, it was found that feed efficiency of the NSM group was not statistically different from WM group but it was significantly worse than either NSM+C or NFM groups.

The feed efficiencies reported herein were within the ranges, or better, than those found by Muller *et al.*, (1976) and Jenny *et al.*, (1980). Keith *et al.*, (1983) reported that feed efficincy of the calves fed milk from antibiotic treated cows were similar to that of calves fed whole milk.

General health

Mortalities, health disorders and liquid diet refusals are shown in Table 4. Two animals died in the NSM and other two died in the WM group. One death in the NSM group resulted from pneumonia and the other occurred in the postweaning period as a result of bloat. In the WM group the cause of death was severe diarrhea for the two calves. Most of the liquid refusals were observed in the NSM group during the first week of the trial. When sodium bicarbonate was added to NSM, the refusals became essentially nil.

TABLE 4 . Summary of health problems and liquid refusals of calves fed whole milk (WM), nonsalable milk (NSM), nonsalable milk plus colostrum (NSM+C) naturally fermented milk (NFM).

Items	WM	NSM	NSM+C	NFM
No of calves started	12	12	10	10
No of calves finished	10	10	10	10
Scours :				
No of calves	6	6	4	6
Average scour day / calf *	1. 8	1. 98	0.7	1.00
Liquid refusal :				
No of calves refusing	6	10	4	6
Days refusal / calf *	1. 8	4.5	0.7	1.00
Amount refused / calf (kg)	3	4.5	1.75	1.67

* Based on all calves receiving diet .

Economical evaluation

The total consumption and coast of WM, NSM, NSM+C, NFM and calf starter are given in Table 5. The cost of raising one calf conventionally on WM and on NFM were almost the same (48.5 and 47.97 L.E/calf, respectively. Using NSM in the NSM group and NSM +C groups reduced the feed costs of one calf to only about 15 L.E. The NSM+C group however showed the lowest mortality and was better in general health and total gain.

TABLE 5 . Average total feed consumption and cost of calf feeding until 77 days of age .

Items	Consumption WM (kg)	Cost L.E.	Consumption NSM (kg)	Cost L.E.	Consumption NSM+C (kg)	Cost L.E.	Consumption NFM (kg)	Cost L.E.
Whole milk	108.00	40.50						
Colostrum					20.30			
NFM							108.5	39.75
NSM			105		88.50		43.96	8.22
Calf starter	42.96	8.03	45.36	8.48	45.72	8.55		
Benzoic acid			0.52	6.82	0.55	7.20		
Total cost		48.53		15.30		15.75		47.97

* Costs was calculated as 1987 - 1988 prices which were :
Whole milk (WM) or naturally formented milk (NFM) : L.E. 375 / ton liquid
Starter : L.E. 187 / ton powder
Surplus colostrum (C) and non - salable milk (NSM) : had no commercial values.
Benzoic acid : L.E. 13 / kg

It is concluded that nonsalable milk including mastitic milk, milk from the antibiotic treated cows, milk rejected by dairies as a result of its high acidity can be efficiently used in feeding suckling calves provided that it is appropriately preserved. Surplus colostrum, with its high nutritive and immunological value, is advised to be mixed with nonsalable milk in feeding calves.

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استخدام السرسوب والألبان غير المباعة والألبان المتخمرة فى تغذية العجول

السيد أحمد العيوطى، زهير مصطفى كامل إبراهيم وأحمد مطية يونس

كلية الزراعة – جامعة المنصورة – المنصورة – مصر.

استخدم فى هذه التجربة ٤٤ مجلا من خليط الفريزيان x البلدى فى عمر ٤–٦ أيام. وزعت هذه العجول على أربع مجموعات غذيت على (١) اللبن الكامل (٢) الالبان غير المباعة (٣) الالبان غير المباعة + السرسوب (٤) اللبن المتخمر.

وكانت الالبان غير المباعة تشمل الالبان من الحيوانات المعاملة بالمضادات الحيوية والالبان المستبعدة بسبب ارتفاع الصمومة والالبان المتبقية فى أوانى التغذية بعد اعطاء العجول وقتا كافيا للشرب أما السرسوب فأتى من الست حلبات الاولى بعد الولادة.

وحفظت الالبان غير المباعه والسرسوب بحمض البنزويك ٥ر٪ وكانت الالبان غير المباعة تعادل بيكربونات الصوديوم (٦ر٪) عند التغذية. وخلط السرسوب بالالبان غير المباعة بنسبة ٢٠ : ٨٠ (جم / جم) قبل التغذية . أما اللبن المتخمر فأضيف باضافة ٢-٤٪ من اللبن المتخمر الى اللبن . وكانت العجول تعطى ٣كجم لبن يوميا على مرتين مع اعطاء بادئ العجول حتى الشبع . وقد فطمت العجول على ٤٥ يوما وقد أعطيت بادئ العجول لمدة شهر اخر وكانت معدلات النمو فى فترة التغذية السائلة هى ٢٧ر، ٢٤ر، ٣٢ر، ٢٨ر كجم/ يوم لعجول المجاميع ١ ، ٢ ، ٣ ، ٤ على الترتيب وكانت الارقام المقابلة فى فترة ما بعد الفطام ٤١ر، ٤٠ر، ٥٢ر، ٤٨ر كجم. أما الكفاءة الغذائية فكانت ١٧ر٢، ٧١ر٢ ، ٨٢ر١، ١٠ر٢ كجم مادة جافة / كجم نمره فى فترة التغذية السائلة و ٤١ر٢، ٤٠ر٢، ٩٨ر١و ٠٥ر٢ كجم مادة جافة / كجم نمو للمجاميع ١، ٢، ٣، ٤ على الترتيب . حيث اتضح أن إضافة السرسوب إل الالبان غير المباعة ، كان لها تاثير إيجابى على معدلات النمو والكفاءة الغذائية وكذلك فى تقليل عدد مرات وحدة حالات الإسهال. وكانت معدلات نمو العجول المعطاة ألباناً غير مباعة لا تختلف معنويا عن تلك المغذاه على اللبن الكامل.

وقد أتضح أن استخدام الالبان غير المباعة وحدها أو بعد خلطها مع السرسوب تقلل كثيرا تكاليف تغذية العجول ولذلك ينصح بإضافة فائض السرسوب إلى الالبان غير المباعة عند استخدامها فى تغذية العجول.