SOYMILK AS BUFFALO MILK SUBSTITUTE IN FEEDING NEW BORN BUFFALO CALVES
1- THE EFFECT OF REPLACEMENT OF WHOLE BUFFALO MILK BY SOYBEAN MILK ON SUCKLING BUFFALO CALVES PERFORMANCE

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Abstract

The present study aimed to evaluate the use of soybean milk (SBM) as a substitute of buffalo milk (BM) in feeding newborn calves.

A feeding experiment was conducted using 32 newborn buffalo calves (16 males and 16 females). Animals were divided into four similar groups, 8 calves in each and fed the respective four feeding treatments :(1) BM + SBM (1:1) till weaning age, (2) BM + SBM (1:2) till weaning age, (3) SBM till weaning age and (4) BM till weaning age. All groups were offered calf starter and berseem hay besides the experimental treatments ad lib from the second week of age till weaning. Fresh water was available all time. Daily feed intake and biweekly body weight for each calf was recorded. Four digestibility trails were carried out during the experiment at the fifteen week of age to determine the nutritive value of the experimental rations. Calves were weaned at 105 days, while. daily intake, weight gain during the suckling were recorded. Feed conversion (TDN/kg weight gain) and the economical efficiency (feed cost /kg weight gain) for each calf were calculated.

Results showed that, calves fed rations containing SBM showed significantly low daily intake than those of the control group. Moreover, the daily gains were similar with control group with non-significant differences among groups during the different experimental periods. The feed conversions as TDN/Kg gain were improved by adding SBM with significant differences between groups suckling SBM and control group. The results also indicated that, values of feed costs for the group received SBM were significantly lower than those fed other groups.

It can be concluded that the artificial rearing using SBM with adding 1% soybean oil helps calves to grow faster with better-feed conversion efficiency and lower cost of growth (G3).

INTRODUCTION

Among the managerial strategies to reduce rearing costs of suckling calves is the early intake of high grain diets besides restricting the consumption of dam's milk to accelerate the development of rumen function. The program allows weaning at 2 to 4 weeks of age with no adverse effects on physical or immunological development. In Egypt, soymilk is produced in small scale. It is not accepted for direct consumption as beverage. Soymilk could be of considerable interest when cow, buffalo, Ewe, milk or milk replace are too expensive or unavailable (Matter *et al.,* 1998). Fats and oils are excellent sources of concentrated energy. Many research workers allover the world used different kinds of fats and oils for feeding suckling calves. Adding different amounts and types of butter to whole milk as described by Sanz *et al.* (1997) led to better utilization of the protein ingested in goats. The current study was conducted to investigate the effect of adding soya oil to soya milk on the performance of buffalo calves during suckling period.

MATERIALS AND METHODS

This work was carried out at Mehallet-Mossa Animal Production Research station, belonging to Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture. Thirty- two newborn buffalo calves (16 males and 16 females) were taken successively within three months to be included in the experiment.

Suckling period (4 days to 105 days old)

After birth, calves (16 males and 16 females) were left to suckle colostrum from their dams for the first three days. The calves were randomly divided into four similar groups (8 calves each) then, they were adapted on the SBM rearing with BM for ten days, then, they were kept in the rearing house to be fed one of the feeding treatments starting from the second week of birth . The liquid replacer (SBM) was supplied by soybean processing Center of Food Technology Research Institute. It was prepared according to the method described by Tanteeratarm (1993) using a ratio of 1:7 dehulled soybean to water. The product was fortified before use by adding both methionine hydroxy analogue at a rate to equivalent 1 g methionine, 1% crude Soya oil/liter SBM and a mixture of vitamins, minerals and amino acids at a rate of 1 g/ liter SBM (Liquid methionine (88%methionine), supplied by IBEX International, LTD, Egypt).Additives were supplied by ROVIGYPT, Egypt, each kg contains Vitamins: A,8.000.000IU D3,1.500.000IU, E,1000 mg, B_1,500 mg, B_2,500 mg, B_6, 200 mg, B_{12} ,8

mg, calcium pantothenate ,4000 mg, nicotinamide, 600 mg, Folic acid ,50 mg, choline chloride ,20000 mg and Minerals: Mn, 400 mg, Zn ,150 mg, Fe ,500mg, Cu ,40mg, Co, 10 mg. and Amino acids: Methionine, 13 mg, Lysine ,61 mg, Aspartic ,92 mg, Glutamine ,166 mg, Cystine, 1mg, Valine, 40 mg, Tyrosine, 9 mg Alanine ,196 mg, Arginine ,117 mg, leucine ,48 mg Phenyle. Alanine, 40 mg.).

After two weeks from birth, all animal groups received one of the following feeding treatments

1- Buffalo milk + soy bean milk (SBM) (1: 1) till weaning (G1).
2- Buffalo milk + SBM (1:2) till weaning (G2).
3- Soy bean milk till weaning (G3).
4- Buffalo milk till weaning (control group) (G4).

The calves were individually fed the milk by bucket twice daily from 1 to 10 weeks of age at 8.30 a.m. and 16.30 p.m. daily from 11 to 15 weeks they fed once daily. Daily requirements of calves were according to 10 % of calf body weight (Abou Selim *et al.* (1991) .The calf starter and berseem hay were offered ad lib once daily at the morning with beginning of 2 nd week of birth till weaning, while, the residuals of starter and hay were recorded. A supply of clean drinking water was always available freely at all times. No health problems were recorded with calves of the different groups during the whole experimental period. Chemical composition of feed stuffs consumption are presented in Table 1. Fasting live body weights (LBW) were weekly recorded and the average daily gains (ADG) were calculated. Digestibility trail was conducted during the experiment at the fifteen week of age to estimate total digestible nutrients (TDN) using the acid insoluble ash (AIA) as a natural marker (Van Kulen and Young, 1977). Representative samples from feces, clover hay, buffalo milk, soy bean milk and starter were analyzed to determine DM, CP, EE, CF, and ash according to AOAC (1990) methods ,while, NFE contents were calculated by difference.

Data concerning feed intake, average daily gain (ADG), feed conversion and feed costs were statistically analyzed according to SAS (1988). The differences among treatment means were compared using Duncan's multiple range Test (1955).

RESULTS AND DISCUSSION

Chemical composition of experimental diets

Chemical composition of BM, SBM, starter and berseem hay on dry matter (DM) basis are shown in Table 1. Data show differences between

soybean milk (SBM) and buffalo milk (BM) in chemical composition. SBM was higher than BM in CP and CF, while, it was low in DM and EE. The chemical composition of SBM was found to be different from that obtained by Matter *et al.* (1998) who reported values of 33.89 % for CP, 24.77% for EE and 31.02 for NFE. Differences could be attributed to the differences of soybean source and the method of preparation.

Digestibility coefficients and nutritive values

Results in Table 2 showed that the CP and CF digestibility values were significantly higher ($P<0.05$) for calves fed SBM (G3) than control group. There results agreed with those reported by Ezequiel *et al.* (1988) who showed that replacing cow milk with 40 or 60% SBM did not affect digestibility of nutrients during the first 2 months of age. Alimov *et al.* (1991) found the digestibility and flavour of the sofa milk was similar to that of whole milk. The results obtained indicated that TDN were significantly ($P<0.05$) increased for calf group fed control ration (G4). The DCP values of group 2 and 3 were very similar. Steinke 1979 showed that it is not deficient in any one of the essential amino acids, consequently, the protein quality of SBM could be considered as good as BM.

Feed intake

Data of DM intake (Table 3) showed that replacement of BM with SBM (G1, G2, and G3) decreased daily DM intake compared to control group during suckling period. The relative intake values for G1, G2, G3 were found to be 90, 88 and 82%, respectively (relative to the control group) .Differences in DM intakes may be attributed to the variation in weight gain of the calves received different treatments. During suckling period (105 d) where starter and clover hay were available ad libitum, calf group (4) showed the highest consumption calculated per calf per day, while group (3) showed the minimum daily DM and TDN intake. The results obtained indicated that DM and TDN intake were significantly ($P<0.05$) increased in calves fed control ration.

The results showed clearly that the total daily intake as DM and TDN decreased markedly with SBM treatments because the DM in BM is more about three times than that of SBM. The best treatment, which could maintain daily intake close to G4 was G3. These results are almost within the same range as reported by Matter (1998) on buffalo calves. These data were in agreement with those reported by

Aleksandrov *et al.* (1994) who found that using soymilk could save 40% of dairy feeds in calves diets.

Body weight changes

Results of performance during suckling buffalo calves are found in Table (4). Mean initial birth weights of the four experimental groups was 35.63 kg with no significant differences between different groups.

From birth to 5 weeks of age, calves of group 3 which received SBM were heavier and rapidly gained than the control which received BM by about 11.29% From 6-10, weeks of age, control group showed the highest mean daily gain, while, group (3) showed the lowest mean daily gain being about 84.31% of the control

From 11-15 weeks of age, groups (1) which received SBM: BM (1:1) gained significantly ($P<0.05$) more weight than those of other groups. The present values are lower than those reported by Podobed (1990) on cow calve which were 616 grams at 95 days old .

Moreover, the overall means of weight gain for calves fed SBM (G1 and G3) through the whole experimental period (from birth to 15 weeks) were higher than those of control group, while, G2was similar to those of control group. The differences were insignificant between different groups .Generally the SBM groups (G1, G2, and G3) showed better relative growth compared to control group during the periods from birth to 5 weeks and from birth to 15 weeks, but, it decreased during the period from 6 to 15 weeks of life.

Despite the higher weight gain till weaning of calves were in groups 1 and 3 compared to the control. However lack of significance among treatments may be due to large within treatment variations.

Over the entire experimental period, the changes in BW during the overall period are presented in Table 4. It can be seen that average initial body weights (birth weight) of the calves were similar being 35.25, 35.63, 35.75 and 35.88 kg for G1, G2, G3 and G4, respectively. The final body weights at the end of the experimental period were very similar being 87.63,87.38,88.75 and87.13 kg G1 ,G2 ,G3 and G4, respectively. The data of Table 4 showed the highest ADG on the overall period 0.50 kg per day for G1 and G3, while the other groups gave 0.49 kg/d with insignificant differences between groups. Results of daily body gain (DBG) of buffalo calves given whole milk (G4), SBM (G3), SBM: BM (2:1) (G2) and SBM: BM1:1 (G1) appear in

Table 4. Calves fed G3 were rather heavier than the control calves (G4) through the suckling period .The increase relative to control was 102% for the whole suckling period . Similar results were reported by Sanz *et al.* (1997) who added 400 gram fat/kg milk replacer for goat feeds and showed a better utilization of the feedstuffs as daily weight gain. This may be due to a slower liberation of its different components to the intestine with higher protein retention, which is the so called protein sparing effect of fats and carbohydrates.

Feed conversion

Concerning feed conversion (Table 5), it could be noticed that the feed utilization efficiency as kg TDN/kg gain for calves fed ration (4) (control group) had the worst efficiency when compared with other groups (G1, G2 and G3) with significant differences ($P<0.05$) between groups during the first five weeks and during the whole suckling period (from birth to 15 weeks). On the other hand, the present results indicated that calves fed SBM with or without BM were more efficient than those fed the control ration (BM).

From the results of different experimental period, control group gave the poorest feed conversion value, whereas, group (3) gave the best value. The overall results from birth to 15 weeks of age indicated that the use SBM in feeding buffalo calves improved feed conversion efficiency (kg TDN/kg gain) by 14.3, 16.8, and 28.6% over the control for G1, G2, and G3, respectively.

Economical efficiency

The data in Table 5 showed the feeding costs per calf during the different experimental periods according to their prevailing prices. It is obvious from the results obtained that the least feed cost per calf was associated with supplemented SBM (group 1, 2 and 3) compared to control group within the different periods (0-5, 6-10, 11-15 or 0-15 weeks of age).

On the other hand, the total cost was reduced by replacing BM with SBM. Also, values of feed cost as% from the control was the lowest for group (3) being 36.6% of control (Table 5).

Differences among groups were significant ($P<0.05$) in different periods. The present results agreed with those of Alimov *et al.* (1991) who found that the soya milk feed is therefore recommended as a cost effective alternative to whole milk replacer for calf feeding.

The data in Table 5 showed that feeding costs per kg gain on the basis of the total feedstuffs consumed during the different periods according to their prevailing prices. It is obvious from the results obtained that the least feed cost per kg gain was associated with the level of supplemented SBM (G3 followed by G2 then G1) than control group within the different periods (0-5, 6-10, 11-15 or 0-15 weeks of age). Also, least values of feed cost/kg gain (economical efficiency) (absolute or as % from control) was recorded for group (3) . Differences between groups were significant ($P<0.05$) in all experimental periods.

It could be concluded from the present study that using SBM by adding 1% soybean oil for suckling buffalo calves improved growth performance.

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Table 1.Chemical composition of buffalo milk, soybean milk, starter and berseem hay (on DM basis).

Item	DM%	CP%	EE%	CF%	NFE%	Ash %
Buffalo milk	17.11	24.25	38.99	-	31.52	5.25
Soy bean milk	6.96	41.29	29.45	5.63	19.13	4.50
Starter	91.22	19.42	4.69	5.76	62.16	7.97
Berseem hay	92.08	12.78	2.42	29.36	43.37	12.07

Table 2. Digestibility coefficients % of experimental rations.

Item	G1 SBM:BM (1:1)	G2 SBM:BM (2:1)	G3 SBM	G4 BM
Digestion coefficients %				
DM	71.47	71.36	73.45	71.43
CP	78.61^{BC}	83.81^{A}	81.76^{AB}	75.97^{C}
CF	26.08^{AB}	32.59^{AB}	34.16^{A}	32.99^{B}
EE	75.57	72.02	76.64	76.49
NFE	81.29	82.17	83.42	85.90
Nutritive values %				
TDN	83.44^{AB}	81.32^{B}	77.86^{C}	85.59^{A}
DCP	17.34	18.80	18.81	17.82

A, B,and C : Averages not followed by the some litters in the same row are significantly different ($P<0.05$).

Table 3. Effect of the experimental treatments on the feed intake (kg/day) during suckling period.

Item	G1 BM:SBM (1:1)	G2 BM:SBM (1:2)	G3 (SBM)	G4 (BM)
Daily feed intake (kg/calf) from birth to 5 weeks old:				
Buffalo milk	2.17^{B}	1.47^{C}	-	4.43^{A}
Soy bean milk	2.17^{C}	2.95^{B}	4.17^{A}	-
Starter	0.20	0.20	0.20	0.18
Berseem hay	0.12	0.13	0.13	0.12
Total diets	4.66	4.75	4.50	4.73
DM	0.82^{B}	0.76^{B}	0.65^{C}	1.03^{A}
TDN	0.68^{B}	0.62^{C}	0.51^{D}	0.88^{A}
Daily feed intake (kg/calf from 6 to 10 weeks old:				
Buffalo milk	1.59^{B}	1.05^{C}	-	3.17^{A}
Soy bean milk	1.59^{C}	2.10^{B}	3.39^{A}	-
Starter	0.49^{A}	0.51^{A}	0.51^{A}	0.40^{B}
Berseem hay	0.32	0.33	0.34	0.32
Total diets	3.99	3.99	4.24	3.89
DM	1.13^{AB}	1.09^{BC}	1.02^{C}	1.20^{A}
TDN	0.94^{B}	0.89^{B}	0.79^{C}	1.03^{A}
Daily feed intake (kg/calf from 11 to 15 weeks old:				
Buffalo milk	0.81^{A}	0.54^{B}	-	1.60^{C}
Soy bean milk	0.81^{A}	1.08^{B}	1.65^{C}	-
Starter	0.56^{AB}	0.57^{AB}	0.60^{A}	0.50^{B}
Berseem hay	0.37	0.38	0.40	0.37
Total diets	2.55	2.57	2.65	2.47
DM	1.05	1.04	1.03	1.07
TDN	0.88^{AB}	0.84^{AB}	0.80^{B}	0.91^{A}
Daily feed intake (kg/calf from birth to 15 weeks old:				
Buffalo milk	1.53^{C}	1.02^{B}	-	3.07^{A}
Soy bean milk	1.53^{C}	2.04^{B}	3.08^{A}	-
Starter	0.42^{A}	0.43^{A}	0.44^{A}	0.36^{B}
Berseem hay	0.27	0.28	0.29	0.27
Total diets	3.75	3.77	3.81	3.70
DM	1.00^{B}	0.97^{BC}	0.90^{C}	1.10^{A}
TDN	0.83^{B}	0.79^{B}	0.70^{C}	0.94^{A}

A, B,and C : Averages not followed by the some litters in the same sow are significantly different ($P<0.05$).

Table 4 .Effect of the experimental treatments on buffallo calf performance during the experimental period.

Item	G1 BM:SBM (1:1)	G2 BM:SBM (1:2)	G3 (SBM)	G4 (BM)
No of calves	8	8	8	8
Average body weight (kg):				
At birth	35.25	35.63	35.75	35.88
At week 5	57.63	58.13	61.63	55.38
At week 10	72.88	75.25	76.63	73.25
At week 15	87.63	87.38	88.75	87.13
Average daily gain (kg/day):				
Week 0-5	0.64	0.68	0.74	0.56
(% from control)	41.03	43.59	47.44	100
Week 6-10	0.44	0.49	0.43	0.51
(% from control)	86.27	96.08	84.31	100
Week 11-15	0.42^{A}	0.35^{AB}	0.35^{B}	0.40^{AB}
(% from control)	105	87.5	87.5	100
Week 0-15	0.50	0.49	0.50	0.49
(% from control)	102.04	100	102.04	100

A, B, and C : Averages not followed by the some litters in the same row are significantly different ($P<0.05$).

Table 5. Feed and economical efficiency of buffalo calves from birth to 15 weeks of age.

Item	G1	G2	G3	G4
	1	2	3	4
Feed conversion (kg TDN /Kg gain):				
Week 0-5	1.12^{B}	0.96^{BC}	0.73 c	1.69^{A}
week 6 -10	2.21	2.07	1.88	2.13
week 11 - 15	2.14	2.27	2.36	2.34
week 0 - 15	1.68^{B}	1.63^{B}	1.40^{C}	1.96^{A}
Costs of feeds (LE/Calf).				
Week 0-5	160.69^{B}	133.27^{C}	88.91^{D}	255.06^{A}
Week 6 - 10	131.04^{B}	108.72^{C}	68.97^{D}	193.11^{A}
week 11 - 15	78.27^{B}	67.38^{C}	46.52^{D}	108.50^{A}
week 0 - 15	370.04^{B}	309'37^{C}	204.39^{D}	556.66^{A}
Economical efficiency (LE/Kg gain):				
Week 0-5	7.53^{B}	5.82^{BC}	3.61^{C}	14.05^{A}
(% from control)	53.59	41.42	25.69	100
week 6 - 10	8.77^{B}	7.13^{B}	4.68^{C}	11.35^{A}
(% from control)	77.27	62.52	41.23	100
week 11 - 15	5.46^{B}	5.94^{B}	3.90^{C}	7.94^{A}
(% from control)	68.77	74.81	49.12	100
week 0 - 15	7.11^{B}	6.05^{C}	3.89^{D}	10.98^{A}
(% from control)	64.75	55.10	35.43	100

A,B,and C: Averages not followed by the some litters in the same sow are significantly different ($P<0.05$).
Costs feeding according to 2002 prices in Egyptian pounds (LE) on the basis of a price of BM, SBM, Starter and berseem hay were 1.5 litter, 0.42 - litter 0.75/kg and 0.40/kg selectively.

لبن فول الصويا كبديل للبن الجاموس الكامل فى تغذية عجول الجاموس الرضيعة

١- تأثير احلال اللبن الجاموسى الكامل بلبن فول الصويا على أداء العجول الجاموسى الرضيعة

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استخدم فى هذه الدراسة ٣٢رأساً من عجول الجاموس حديثي الولادة (١٦ ذكورا و١٦إناثا) لدراسة تأثير استخدام لبن فول الصويا كبديل للبن الجاموس الكامل الأداء الإنتاجى للعجول.

تم تقسيم العجول بعد رضاعة لبن السرسوب مباشرة (عمر ٣-٤ أيام) إلى ٤ مجاميع متماثلة (١،٢،٣،٤) كل مجموعة مكونة من ٨ عجول . تم أقلمة العجول حديثة الولادة على شرب خليط من لبن فول الصويا ولبن الجاموس بالتدريج لمدة أسبوع ثم وزعت لتتغذى على إحدى المجاميع الغذائية الآتية :

المجموعة (١) : لبن جاموس + لبن صويا بنسبة ١:١ .

المجموعة (٢) : لبن صويا+ لبن جاموس (١:٢).

المجموعة (٣) لبن فول صويا.

المجموعة (٤) لبن جاموس كمجموعة مقارنة.

تم حساب كمية اللبن الذى يتناولة العجل بمعدل ١٠ % من وزن الجسم وكانت التغذية خلال فترة الرضاعة على اللبن الجاموسى أو لبن فول الصويا حيث تقدم فى جرادل الرضاعة مرتين يوميا الساعة ٨,٣ ص و ٤,٣مساءا أما البادئ ودريس البرسيم أو البرسيم الطازج كان يتم إعطاؤه اعتباراً من الأسبوع الثانى من الولادة احد الشبع حتى الفطام عند عمر ١٠٥ يوم مع توافر الماء طوال اليوم ويتم حساب المأكول اليومى وأوزان الحيوانات كل أسبوعين كما تم إجراء تجربة هضم فى نهاية فترة التجربة لتقدير المستهلك من المادة الجافة ومجموعة العناصر الغذائية المهضومة. وقد استخدم فى المقارنة بين المعاملات النمو اليومى والكفاءة الغذائية والكفاءة الاقتصادية.

وقد أشارت النتائج إلى أن العجول التى رضعت لبن فول الصويا أظهرت انخفاضاً معنوياً فى المأكول اليومى عن مجموعة المقارنة بالإضافة إلى انه كان هناك تشابهاً فى معدل النمو اليومى بين كل المجاميع التجريبية مع عدم وجود فروق معنوية خلال الفترة التجريبية الكلية (من الميلاد إلى

عمر ٣شهور) مما يوضح أنه ليس هناك أى تأثير عكسى لإحلال لبن فول الصويا محل لبن الجاموس كما ظهر تحسن معنوى فى كفاءة استخدام الغذاء (كا TDN / كيلو نمو) باستخدام لبن فول الصويا كما أشارت النتائج إلى أن تكلفة الغذاء انخفضت فى المجموعة التى أخذت لبن فول صويا.

ومن هذه الدراسة نوصى برضاعة العجول حديثة الولادة بلبن فول الصويا بدون اضافة لبن جاموسى (٣ ملجم) وذلك بعد اضافة جرام من كل من المثايونين و مخلوط فيتامينات واملاح معدنية وكذلك ١% زيت فول الصويا الخام لكل لتر لبن صويا ليساعد على نمو اسرع للحيوانات حديثة الميلاد مع تحسين كفاءة تحويل الغذاء وتكاليف نمو منخفضة .