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EFFECT OF USING FOLIC ACID ON DIGESTIBILITY, MILK YIELD AND PRODUCTIVE PERFORMANCE OF LACTATING BUFFALOES .

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ABSTRACT

Ten lactating buffaloes in their 2nd to 6th lactating season with average body weight of 563± 5kg were divided into two equal groups(5 females each). The buffalo groups were subjeded to two treatments during late pregnancy (two monthes prepartum) and postpartum (305 days of lactation) periods. The first group was served as a control group (G1) whereas, the other was tested group(G2), received one intramuscular injection of 4ml saline containing 160mg folic acid weekly dosage. All animals were fed on ration consist of concentrate feed mixture and rice straw according to Shehata requirements (1971).

The obtained results showed that folic acid treatment had no effect on all nutrients digestibility . Similar trend was observed for TDN and DCP values of the experimental rations. Moreover daily intake as DM, TDN and DCP of the treated group (G2) was higher than that in control group (G1). The differences were not significant . The daily milk yield as fat corrected milk (7% FCM) was significantly ($p<0.05$) higher with G2 (7.14) than that of G1 (5.18 Kg) by 45.02%. Milk composition from lactating buffaloes treated with folic acid had significantly ($p<0.05$) higher contents of milk protein and solids not fat (SNF) compared with the control on birth weight and weaning weight of new born calves were relatively higher in group G2 than that in group G1.Also,treated lactating buffaloes by folic acid improved the economic efficiency by 26.35 % compared with control.

Keywords: Lactating buffaloes, folic acid, milk production, milk composition and reproductive traits .

INTRODUCTION

The molecular of folic acid (peteroylmon glutamic acid) is constituted of three different parts 1) apteridine nucleus 2) aparaaminobenzoic moiety , and 3) one glutamic acid molecule, this is the synthetic form of the vitamin. The biologically active forms of the vitamin are called folates (Girard , 1998). Folic acid named vitamin B9 and P.G.A. It is absolutely essential for cell division and growth as well as to protein synthesis and for purine and pyrimidine synthesis, essential consliluents of RNA and DNA (Metz,1970, Loria, *et al.*, 1977 , Bailey, 1990 and Mc Nulty *et al.*, 1993). Synthesis of new tissues such as the foetus, foetalmembrans, mammary gland and milk protein synthesis increases the utilization of folic acid (Gee *et al.*, 1989). Total serum folates of dairy cows decreased by 40% from two months after calving until next calving (Girard *et al.*, 1989). Moreover , milk folates could be of interest for human health given the present interest in the use of folic acid in the prevention of neurological birth defects (Rush,1994 and Whitehead and Rosenblatt ., 1994) , coronary heart diseases and strokes (Giles *et al.*,1995 and Morrison *et al.*, 1996) and cancer (Glynn and Albanes, 1994 and Jennings, 1995). The objective of this work was to study the effect of folic acid

(intramuscular injections) on nutrients digestibility , milk yield , milk composition , some blood serum and reproductive performance of lactating buffaloes at pre partum (two month) and post partum (305 days of lactation) periods.

MATERIALS AND METHODS

This study was carried out at seds Experimental Station of Animal Production belonging to the Animal Production Research Institute, Ministry of Agriculture during (2004-2005) (this station is located in middle Egypt at 150 km south of Cairo).The average annual atmospheric maximum temperature at seds area during the period of this work was 28.6 C_ and the annual mean of relative humidity was 67%.

Feeding trial and management:

Ten lactating buffaloes in their 2nd to 6th seasons of lactation , body weight of buffaloes was 563_ 5kg .The animals were divided randomly into two equal groups (5 females in each).The animals were in the late pregnancy period and continued for 305 day of lactation ,the first group was served as a control group(G1) whereas the other was tested group (G2), received one intramuscular injections of 4 ml saline containing 160 mg of folic acid weekly dosage according to (Girard et al.,1989).All animals were fed on ratic ns consisted of concentrate feed mixture (CFM) and rice straw according to Shehata requirement (1971).

The CFM and rice straw were individually weighed for each animal and offered twice daily at 8 am and 3pm. The concentrate feed mixture consist of 30% undecorticated cotton seeds, 37% yellow corn , 20% wheat bran, 6.5% rice bran, 3% molasses, 2.5% lime stone and 1% common salt. Chemical analysis (%) of feed ingredients (on DM basis) are shown in Table (1)

Table(1):Chemical analysis (%) of feed ingredient (on DM basis)

Item	DM	OM	CF	CP	EE	NFE	ASH
CFM	92.20	91.39	10.20	5.95	4.41	60.83	8.61
RS	91.88	83.96	32.05	4.33	1.32	46.26	16.04

Water and mineral blocks were freely available for all animals . Animals were weighed at the beginning and monthly intervals to adjust their nutritional requirements according to the change of body weight and milk production. The lactating buffaloes were housed in open sheds and subjected to the regular managerial practices of breeding stock . After calving the dams were kept for one week with their new born calves for colostrums feeding then transferred to the milking unit .The buffaloes were hand milked twice daily at 8 am and 3 pm. Milk yield was recorded and corrected to 7% fat milk according to Raafat and Saleh (1962). Two milk samples were individually collected every two weeks at the same time of milk collection period from each buffaloes then mixed together . About 10 ml HcHo were added to preserve the

milk untile analysis. Chemical analysis of milk (fat, protein , lactose , total solids , solids not fat and ash)were determined using milko scan apparatus.

Digestibility Trial :

During the last three monthes of the experimental period , three animals from each experimental group were used in digestibility trial. Acid insoluble ash (AIA)method as internal marker for determining the nutrients digestibility coefficents according to (Van Keulen and Young ,1977). Faeces samples were collected handily from the rectum at 12.00 am for three successive days from each animal . At the end of the collection period , respresentative samples (10% of fresh faces were taken from each animal faeces and dried at 60c for 48 hrs. After drying samples were grinded and kept for chemical analysis

Chemical analysis of samples:

Samples of CFM , RS and faeces were analyzed for dry matter (DM) ,ash ,crude protein (CP),crude fiber (CF) and ether extract (EE) according to A.O.A.C.(1995). .

blood serum constituents:

Two blood samples were collected from the jugular vein of three buffaloes from each group at the beginning and at the end of feeding trials. The collected blood samples were centrifuged at 4000 r.p.m for 20 min to separate the blood serum, then stored in clean glasses vials at –180C till time of analysis. Total protein , albumin and urea were determined calorimetrically using commercial kits.

Reproductive aspects:

Estrus behavior signs of experimental animals such as standing behavior , mounting others, blowing and vulval mucus discharge were considered for heat detection. Days to uterine involution, onset of first estrus as well as first service interval were recorded for each animal.

Statistical analysis:

The data were analyzed by the general linear models using ANOVA procedures of SAS (1985) .The significant differnces among means were calculated using Duncan multiple test when the mean effect was significant (Duncan ,1955)

RESULTS AND DISCUSSION

Digestion coefficients and feeding values:- Data in Table (2) showed no significant differences between treated group (G2) and control groups (G1) in digestibility coefficients (DM,OM,CP,CF,EE and NFE%) and feeding values (TDN and DCP%). The CF digestibility was lower in all animals in both groups, this is may be due to high level of concentrate feed mixture in ration as explained by competition between cellulolytic and amylolytic groups of bacteria for nutrients or by decrease in ruminal pH that alters the microbial population . The above mentioned results of digestibility and feeding value

were confirmed with Lamb and Eadie (1979), Chiquette *et al.*, (1993) and Girard *et al.*,(1989 and 1994) .They found that dietary supplements of folic acid have no effect on total tract digestibility of DM, NDF , ADF or protein.

Table (2): Digestion coefficients and nutritive values of lactating buffaloes treated by folic acid

Items	Experimental group	
	G1 (control)	G2 (Treated)
Digestibility%:		
DM	59.11	59.75
OM	64.86	64.73
CP	72.62	72.78
CF	31.91	33.22
EE	79.38	77.51
NFE	75.25	72.29
Nutritive values, %:		
TDN	62.64	60.73
DCP	8.83	8.67

Performance of lactating buffaloes :

1-Daily feed intake

Average daily dry matter intake by lactating buffaloes are summarized in Table (3). The daily dry matter intake was increased by treated folic acid . Also,daily feed units intake as TDN and DCP per kg/h/d was slightly increased in G2 (treated by folic acid) .The differences were not significant . Similar results were noticed by Girard *et al.*, (1995), Girard and Matte(1995) , Girard (1998) and Ahmed et al., (2001).They found that feed intake was not modified by supplementary folic acid .Feed efficiency (kg FCM /kg DM, kg FCM /kg TDN and kg FCM /kg DCP) of G2 had the best feed efficiency compared with control (G1).The differences were ($P<0.05$) significant.

2- Milk Yield:

The averages daily milk yield and milk composition of lactating buffaloes are presented in Tables (4,5). Results indicated that daily 7% fat corrected milk yield of buffaloes was significant ($p<0.05$) higher in G2 groups than those in G1 groups (control) . The daily milk yield was improved from 16% in the last lactation season to45.02% in the present work compared with control. Girard (1998) found that folic acid improved utilization and decreased concentration of non protein nitrogen in milk of multiparous cows resulted in higher milk production with constant feed intake. While, Lapierre *et al.*,(2005) observed that neither milk production ,protein yield and leucine kinetics were affected by folic acid and methionine dietary supplementation at 6 and 25 weeks of lactation for dairy cows.

3-Milk Composition :

Data in Table (5) indicated that the milk protein and solids not fat were significant ($p<0.05$) higher in (G2) compared with control (G1).This is due to

the metabolic roles of folic acid is absolutely essential for protein synthesis as well as milk protein (Girard, 1998). The improvement rate was 18.93 % for milk protein and 8.81 % for solids not fat compared with control. Girard and Matte (1995) reported that the milk protein increased from 3.2 to 3.5% by intramuscular injection of folic acid during the first 6 wks of lactation for dairy cows . While, Ahmed *et al.*, (2001) found that no clear effect of folic acid on milk contents for zaraibi goats.

Table (3): Feed intake and Feed efficiency of lactating buffaloes treated by folic acid

Items	Experimental group	
	G1 (control)	G2 (Treated)
Av.daily Feed intake (kg/h/d) as fed:		
CFM	8.33	8.83
RS	4.03	4.70
Av.daily Feed intake (kg/h/d) on DM basis:		
CFM	7.68	8.14
RS	3.71	4.32
Total DM intake	11.39	12.46
Daily total nutrients intake (kg/h/d):		
TDN	7.13	7.56
DCP	1.00	1.02
7% FCM yield/kg/h/d	5.18b	7.14a
Feed efficiency, kg FCM / kg :		
DM	0.46b	0.57a
TDN	0.73b	0.94a
DCP	5.18b	7.00a

a and b :Means with different superscripts in the same row are significantly different at ($p<0.05$).

4-Effect of folic acid treated on some blood serum parameters:

Data in Table (6) indicate that the injection folic acid in lactating buffaloes had no effect on total protein and Albumin , while there was ($p<0.05$) a significant effect in Urea-N, obtained values are within the normal ranges reported by (Girard and Matte, 1995 and 1999) who gave folic acid to lactating cows. Whereas, Ahmed *et al.* (2001) noticed that there were no effect on blood profile in lactating Zarabi goats treated with folic acid.

Effect of folic acid on animal performance :

Results in Table (7) showed that weight of calf at birth , weaning weight, daily gain of calf were higher in G2 than control but the differences were not significant. This may be due to the folic acid utilization is increased during synthesis of new tissues such as in the development of the fetus , fetal membranes and mammary gland.(Gee et al., 1988) Also, there was no observed mortality between two groups. The same trend was obtained by Girard and matte (1989 and 1995), Petitclerc *et al.*,(1999) . Moreover , data of table (6) indicated that no significant differences were detected between the two groups for dams body weights at calving . This finding may possibly illustrate that folic acid was to warded to milk production not to meat production during early lactation . The present results agree with those reported by Girard and Matte (1995 and 1998) for dairy cows.

Table (4): average total milk yield, lactaion period and 305-days milk yield by lactating buffaloes treated by folic acid.

groups	No. of dam	Average milk yield at different periods of lactation/Kg.						Total milk yield/Kg.	Lactation period L.P/day	305-day milk yield Kg.
		0-56 days	56-112 days	112-168 days	168-224 days	224-280 days	280-336 days			
G1 control	5								——	
General AV.		333.20a	315.80b	201.20b	184.33b	166.00b	——	994b	200b	——
AV. Daily milk yield/Kg./h./d		5.95a	5.64b	3.60 b	3.29b	2.96b	——	4.98b	——	——
G2 folic acid	5									2362 2265 2275
General AV.		399.40a	417.00a	365.00a	342.00a	299.00a	152.00	1808a	280	2300.66
AV.daily milk yield/Kg./h./d		7.00a	7 45a	6.52a	6.11a	5.33a	2.71	6.50a	——	——
% improvement								45 02	28.57	

Table(5): Effect of folic acid on actually daily milk yield , 7% fat corrected milk yield and milk composition in lactating buffaloes.

Items	Experimental group	
	G1 (control)	G2 (Treated)
Av. Actual milk yield, kg/h/d	4.98	6.50
7% fat corrected milk ,kg/h/d	5.18b	7.14a
Milk composition%:		
Fat	6.51	6.58
Protein	3.54b	4.21a
Lactose	5.32	5.45
Solids not fat	9.54b	10.38a
Total solids	16.05	16.96
Ash	0.68	0.72

a and b: Means with different superscripts in the same row are significantly different at p<0.05).

Table(6) Some blood serum parameters of lactating buffaloes under experimental groups.

Items	Experimental group	
	G1 (control)	G2 (Treated)
Total protein g/dl:		
Initial trial	8.84	8.71
Final trial	8.74	8.97
Albumin g/dl:		
Initial trial	3.36	3.46
Final trial	3.45	3.34
Urea mg/100ml:		
Initial trial (at the stant)	27.56	28.39
Final trial (at the end)	25.20b	43.71a

a and b: :Means with different superscripts in the same row are significantly different at (p<0.05).

Table(7):Effect of folic acid injection on animal performance .

	Experimental group	
Items	G1 (control)	G2 (Treated)
No. of dam	5	5
No. of calves	5	5
Av.Weight of dam at calving /kg	552	561
Av.Weight of calf at birth /kg	36.00	40.00
Weaning period of calf (days)	105	105
Av.Weaning weight of calf /kg	93.00	98.00
Daily gain of calf/kg	0.543	0.553
Mortality %	------	-------

Effect of folic acid on some reproductive traits:

Table(8) display averages of some reproductive aspects exhibited by the treated groups . Limited changes were observed for days to uterine involution , onset of first estrus and first service . However , the number of days open and the calving interval were greater in group (G2) than that in

group (G1). .Estimatas of uterine involution and first estrus intervals were comparble with those reported by Abdel – Khalek et al., (2005) , while estimate of the interval for first service was greater than that recorded by some authorsa being 41.3- 47.8 days. Some authors recorded of days open in buffaloes as 135.5 days (Mostageer et al., 1981) and 128.5 days (EL – Rigalaty, 1995) . The prolonges days open with folic acid treatment in the present study may be attributed to the greater milk productivity attaimed by the treated group until the mid term of lactation period. In this content EL-Rigalaty (1995) revealed contraversory effect of milk productivity of buffaloes on reproductive traits and DO in particular. .

Table (8) : Effect of folic acid injection on reproductive traits.

Items	Experimental group		
	G1 (control)	G2 (Treated	Improveme %
Uterine involution (U.I)day	36.2	31.4	-13.26 *
First estrus(day)	48.6	46	-5.35
First service (day)	63	66	+4.55
Days open (D.O) day	122.8	154	+20.13
Calving interval(C.I) day	439	470	+6.64

- **--- : means improvement**
- **+ : means un improvement**

Economical efficiency:

Data in Table(9) revealed that daily feed cost was the highest for treated group , while the control group showed the lowest daily feed cost. The treated group was increased daily feed cost by about 9 % which compared with the control . As a result of increasing avearge daily milk yield in treated group, average daily return of milk yield was higher for group G2 than control. The data indicated that the injection folic acid was better economically than control by 26.35%.

Table(9): Economic efficiency of lactating buffaloes treated by folic acid

Items	Experimental group	
	G1 (control)	G2 (treated)
Daily feed intake/kg :		
CFM	8 33	8.83
RS	4.03	4.70
Folic acid (mg)	-------	160
Economic efficiency:		
Daily milk yield	5.18	7.14
Daily Feed cost (L.E)	9.32	10.18
Price of the daily milk yield (L.E)	15.54	21.42
Feed cost /kg milk yield (L.E)	1.80	1.42
Economic efficiency	1.67	2.11

Price of feed stuffs = concentrate feed mixtures 1100(L.E) per ton, Rise straw 100(L.E) per ton . Folic acid 2000(L.E) per kg, Price of milk 3.00(L.E) per kg

CONCLUSION

It could be concluded that injection 160 mg folic acid had appositive role on improving milk yield by 45.02 % as well as milk protein , and improving productive and reproductive performance.

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تأثيرالمعامله بحمض الفوليك على إنتاج اللبن والـصفا ت الإنتاجيـة و التناسـلية للجاموس الحلاب

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قسمت ١٠اناث من الجاموس ا لحلاب في الشهرين الأخيرين من ا لحمل ا لى مجموعتين غذيت المجموعة الأولى على العلف ا لمركز و قش الأرز وا لمجموعة الثانية على نفس ا لعليقة مع حقنها ب٤ مل محلول ملحي به ١٦٠ مل جرام من حمض الفوليك وكان الحقن اسبوعيا قبل الولادة بشهرين وبعد الولادة الى نهاية موسم الحليب (٣٠٥ يوم)٠ أوضحت النتائج أن الحقن أدى إلى زيادة معنوية في انتاج ا للبن بلغت ٤٥,٠٢عن الكنترول ايضا هنالك ذيادة معنوية فى بروتين اللبن والمركبات اللادهنية وتحسنت بعض المقايس الأنتاجية والتناسلية ٠ استنتجت الدراسة ان حقنة واحدة اسبوعيا بها ١٦٠ ملجرام من حمض الفوليك ا دت الى زيادة الماكول وزيادة انتاج اللبن وتحسين الصفات الأنتاجية والكفاة الاقتصادية للجاموس المصرى الحلاب٠