Egyptian J. Nutrition and Feeds (2003) 6 (2): 127-137

EFFECT OF LACTO-SACC AND ACID PAK ADDITIVES ON PRODUCTIVE PERFORMANCE OF FRIESIAN CALVES UNDER EARLY WEANING SYSTEM.

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SUMMARY

Thirty-four newly born calves were assigned to two similar groups, 17 in each (10 males and 7 females). The first group was given non-supplemented diet and whole milk (control) until weaning at 90 kg live body weight (LBW). The second one received whole milk supplemented with 2g Acid-Pak 4 way (AP)/liter and 2kg Lacto-Sacc (LS)/ ton calf starter until 70 kg LBW (early weaning), thereafter they were fed on starter supplemented with LS up to 90 kg LBW.

Results showed that total weight gain (TWG) and average daily gain (ADG) insignificantly increased in treated calves as compared to control during the growth interval from birth to 70 kg LBW (the 1st interval), and from birth up to 90 kg LBW (overall interval) while ADG was significantly higher from 70 to 90 kg LBW (the 2nd interval).

However, growth interval of calves was insignificantly shorter during the 1st and 2nd intervals for treated than control calves (the differences were 3.1 and 4.4 days, respectively), while it was significantly ($P<0.05$) shorter (the differences was 7.5 days) during the overall interval. Digestibility coefficients of CP and CF during the 1st growth interval and of CP, CF and NFE during the 2nd growth interval improved significantly ($P<0.05$) for treated calves, however, that of EE decreased significantly ($P<0.05$) in treated than the control calves. Nitrogen balance was higher in treated than the control, but the differences were significant only during the overall growth interval. Significant ($P<0.05$) increases in concentration of albumin (17%), potassium (3%) and magnesium (8%) and in activity of AST and significant ($P<0.05$) decreases in concentration of globulin (14%) cholesterol (5.6%)and urea (5.3%) and activity of ALT (7.7%) were observed in blood plasma of treated calves compared with their controls. Meanwhile, level of plasma total proteins, calcium, and inorganic phosphorus did not differ significantly between both groups.

Treated calves showed higher starter and berseem hay intakes and lower milk intake than the control calves, but cost per kg gain was decreased to become 33.7% less than the control.

Keywords: *calves, lacto-sacc, acid pak, blood constituents, early weaning.*

INTRODUCTION

Restriction of the consumption of dam's milk in early weaning regimens is one of many management strategies to reduce rearing cost of suckling calves. Restriction of milk consumption and increasing solid feeds supplemented with yeast culture has been reported to accelerate the development of stomach compartments, in turn rumen function. Use of yeast culture (YC) in ruminant

diets to improve performance has been reviewed (Williams, 1989 and Wallace, 1994). Several studies reported that YC supplements may have significant impact on the performance of suckling calves, in terms of increasing live body weight and gain and reducing diarrhea incidence (Ibrahim *et al.*, 1997 and Abdel-Khalek *et al.*, 2000). On the other hand, acidification of milk of suckling calves may provides more desirable PH value in gastric intestinal tract (GIT) of animal (Thickett *et al.*, 1980 and El-Ashry *et al.* 2002) and increases absorption of nutrients and appetite (Skrivanova *et al.*, 1990), which may facilitate the development of the digestive tract at early stage of the suckling period.

The current work was conducted to study the effects of acidification of milk of suckling calves by Acid-Pak (AP) and supplementation of their starter with yeast culture (Lacto-Sacc) as early weaning regimen of suckling Friesian calves at 70 kg live body weight compared with normal regimen. In addition, growth performance of early-weaned calves as affected by dietary supplementation of Lacto-Sacc was studied up to 90 kg live body weight.

MATERIALS AND METHODS

Animals and feeding system:

This study was carried out at Shoha Station, Dakahlia Governorate. A total of 34 newly born Friesian calves was divided into two similar groups according to their birth weights, 17 calves in each. (10 males and 7 females). After birth, calves were left to suckle colostrum from their dams for 1-3 days, thereafter they were artificially fed fresh whole milk supplemented with Acid Pak-4-way (AP) to acidify the milk in the tested group, while calves of the control group were fed unsupplemented milk. Acid Pak-4-way was dissolved at a level of 2g / liter of milk fed during the suckling period.

At the beginning of the 2nd wk of age beside the whole milk, calves in the tested group were fed fresh berseem hay and starter supplemented with Lacto-Sacc (LS)(2gm/kg) , while calves of the control group were fed unsupplemented starter.

Feed additives:

Acid-Pak WM is an organic acidifier comprised of several sources of organic acids that are buffered to maintain PH reduction along with lactic acid-producing bacteria, digestive enzymes, and electrolytes. It fortifies the whole milk with essential minerals and vitamins, and acidification aids health and digestion (Alltech's Biological Programme). Acid-Pak WM ingredients included, citric and sorbic acids, sodium citrate, potassium chloride, zinc sulfate, ferrous sulfate, magnesium sulfate, dextrose, natural and artificial flavors, dried *Streptococcus faecium* fermentation product, dried *Lactobacillus acidophilus* fermentation product, dried *Aspergillus niger* fermentation extract, dried *Bacillus subtilis* fermentation extract. Beta glucan (encapsulating agent). Guaranteed analysis revealed that it contained not less than 10^5 CFU total lactic acid bacteria/g, 1.5% sodium, and 1.3% potassium.

Lacto-Sacc is a mixed microbial supplement containing dried fermentation products (*Streptococcus faecium* and *Lactobacillus acidophillus*), live yeast culture (*Saccharomyces cerevesiae*, 1026), dried fermentation extracts (*Aspergillus*

orzyae and *Aspergillus niger*) and enzymes (Protease, amylase and cellulose).

Weaning regimen:

Calves of the tested ration were early weaned at 70 kg weight, while calves of the control were normally weaned at 90 kg of live body weight. Calf starter feed and berseem hay were offered once daily at morning in-group feeding. Average daily amount of different feedstuffs are presented in Table (1). Chemical composition of LS and feedstuffs used in calves feeding is presented in Table (2).

Digestibility trials:

Digestion trials were conducted at 70 kg of live body weight (weaning of calves in the tested group) and at 90 kg live body weight (weaning of calves in the control group) by using individual metabolic cages and four calves from each group. Fecal and urine samples were quantitively collected from each calf per day for 5 days to determined digestibility coefficients of nutrients and nitrogen balance of calves at each weight stage.

Experimental procedures:

Individual live body weights (LBW) were weekly recorded, and then total gain and average daily gain (ADG) were calculated. Blood samples were taken from the jagular vein of all calves into heparinized tubes at live body weight of 70 and 90 kg before morning feeding. Blood plasma was separated from the major part of blood samples immediately after collection by centrifugation at 4000 rpm for 15 min. and kept frozen at -20°C for later analyses.

Chemical analysis of feeds, feces and urine was determined according to A.O.A.C. (1984), while milk composition was determined using milko-scan. Concentration of total protein, albumin, cholesterol, urea and creatinin, Ca, K, Mg, Na and inorganic phosphorus as well as activity of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) in blood plasma were determined using commercial kits (Pasteur Lab. Egypt-USA). Concentration of globulin was computed by subtracting albumin from total protein. In addition, economic feed efficiency was performed at each LBW interval.

Statistical analysis:

T-test was carried out according to Snedecor and Cochran (1982) for testing the differences between the two groups at each interval.

RESULTS AND DISCUSSION

Growth performance:

Results in Table (3) show that, average daily gain insignificantly increased in treated calves as compared to control. However, it was significantly ($P<0.05$) higher in treated than the control calves during the 2nd interval. Growth interval of calves was insignificantly shorter during the 1st and 2nd intervals for treated than control calves (the differences were 3.1 and 4.4 days, respectively), while it was significantly ($P<0.05$) shorter (the differences was 7.5 days) during the overall interval.

The higher gain of suckling calves fed dietary LS and/or yeast culture and acidified milk was reported by Ibrahim *et al.* (1997), Abdel-Khalek *et al.* (2000) and El-Ashry *et al.* (2002).

Table (1): Average daily amount of feed stuffs intakes by each calf.

Age (week)	Control group (Normal weaning)			Tested group (Early weaning)		
	Milk (l)	Hay (g)	Starter (g)	Milk (l)	Hay (g)	Starter (g)
1-3 days	Colostrum	-	-	Colostrum	-	-
4-7 days	4	-	-	4	-	-
2	4	50	100	4	50	100
3	5	50	150	4	100	250
4	5	100	200	3	150	350
5	5	100	300	3	250	500
6	5	150	400	3	350	700
7	4	200	500	2	450	900
8	4	250	600	2	550	1100
9	4	300	800	1	650	1300
10	4	350	1200	1	750	1500
11	3	400	1400	-	1000	1500
12	2	500	1500	-	1000	1600
13	2	600	1500	-	1250	1700
14	2	700	1500	-	1250	1750
15	1	750	1500	-	1500	1800
Total	366	31500	81550	177	65100	105350

Fresh milk was given to calves twice daily (8.0 a.m. and 15.0 p.m.) and the solids feeds were once daily.

Table (2): Dry matter (DM) and chemical analysis of different feedstuffs.

Feed stuff	DM%	Chemical analysis (%)					TDN (%)	DCP (%)
		CP	CF	EE	NFE	Ash		
Milk	11.51	28.74	-	30.41	34.72	6.13	17.20	3.10
Starter	89.00	21.37	7.44	5.47	58.61	7.11	70.38	14.41
Berseem hay	89.20	13.62	27.63	3.03	42.60	13.12	46.10	6.90
Lacto-Sacc	91.00	47.20	5.50	1.70	37.10	8.50	-	-

Table (3): Growth performance of treated and control calves at different intervals of live body weight.

Item	From birth to 70 kg LBW		From 70 to 90 kg LBW		From birth to 90 kg LBW	
	Control	Tested	Control	Tested	Control	Tested
Initial LBW, kg	34.0±1.2	33.6±1.3	71.4±0.64	70.7±0.35	34.0±1.2	33.6±1.3
Final LBW, kg	71.4±0.64	70.7±0.35	90.6±0.46	89.9±0.7	90.6±0.46	89.9±0.7
Total gain, kg	37.4±1.4	37.1±1.3	19.2±0.53	19.2±0.7	56.6±1.7	56.3±1.5
Growth interval, day	76.8±2.5	73.7±1.7	35.5±2.7	31.1±2.2	112.3±2.4[a]	104.8±2.7[b]
Average daily gain, g	487.0±26.7	503.3±17.5	540.8±35.6[a]	617.4±35.3[b]	504.0±19.7	537.2±16.6

A and b significant differences at P<0.05.

Feed intake and feed efficiency:

During the 1st interval of growth from birth up to 70 kg live body weight data presented in Table (4) show that level of starter and hay intakes increased by about 56 and 99% and level of milk intake decreased by about 39% in treated than in control group. Nearly similar trends were observed for TDN and DCP intakes between the treated and control calves. Feed efficiency as kg gain/kg DM or DCP was significantly ($P<0.05$) lower for control group than tested group. While, feed efficiency as kg gain/kg TDN did not differ significantly.

During the 2nd interval of growth (from 70 to 90 kg live body weight) the present results revealed that level of starter and hay intakes (as DM, TDN and DCP) increased by about 15 and 38%, respectively and milk was saved for treated calves during this interval. However, feed efficiency as kg gain/kg TDN or DCP was significantly ($P<0.05$) better in the treated group than the control, while it was similar for both groups as kg gain/kg DM (table 4).

On the basis of the overall means during the experimental period from birth to 90 kg live body weight, level of starter and hay intakes (as DM, TDN and DCP) increased by about 29 and 56%, respectively, and level of milk intake decreased by about 92 % in treated than in control. Yet, feed efficiency as kg gain/kg, TDN or DCP was significantly ($P<0.05$) better in the treated group than the control, while it was similar for both groups as kg gain/kg DM (table 4).

Nutrient digestibility:

Results of digestion coefficients at 70 and 90 kg LBW (Table 5) revealed that significant ($P<0.05$) increase was observed in digestibility of both CP and CF in treated calves as compared to their control at 70 kg LBW. However that of EE decreased significantly ($P<0.05$) in treated than the control calves. Meanwhile, nitrogen balance did not differ between both groups. At 90 kg LBW, digestibility of CP, CF, and NFE as well as nitrogen balance significantly ($P<0.05$) increased in treated compared to control calves.

The present results are in agreement with Al-Dabeeb and Ahmed (2002) on sheep fed on different diets, the digestibility of CF was improved by YC supplementation and the effect was significant ($p<0.05$) and was more pronounced with the high roughage. Supplementation of YC had no effect on digestibility of NFE and EE. It has been reported that, nitrogen balance was improved with the edition of YC.

The observed improvement in nutrients digestibility of treated from control calves in accordance findings of Williams (1989), who indicated that yeast culture supplemented to diet of dairy cattle enhanced initial rate of ruminal digestion of diet. Basiony , *et al* . (1998) and Allam, *et al.* (2001), found that YC could increase digestibility of CF and CP .

It is worthy noting that the better digestibility coefficients of CF in treated than control calves may be related to the beneficial effect of LS on the microbial fermentation (Williams, 1989) or/and to the reported increase in number of rumen cellulolytic (Dawson *et al.*, 1990) and proteolytic bacteria (Williams, 1988) with dietary addition of yeast culture.

Blood constituent:

Concentration of total protein (TP) tended to be higher in treated calves

Table (4): Daily intakes from feedstuffs (as DM, TDN and DCP) in control and treated group at different LBW intervals

Item	From birth to 70 kg LBW		From 70 to 90 kg LBW		From birth to 90 kg LBW	
	Control	Tested	Control	Tested	Control	Tested
Average daily dry matter intake (kg /h/d)						
Milk	0.469	0.287	0.215	-	0.388	0.202
Starter	0.420	0.656	1.264	1.451	0.691	0.893
Hay	0.159	0.316	0.569	0.785	0.291	0.455
Total	1.048	1.259	2.048	2.236	1.370	1.550
Average daily TDN intake (kg/h/d)						
Milk	0.700	0.430	0.322	-	0.580	0.302
Starter	0.332	0.519	0.999	1.147	0.546	0.706
Hay	0.082	0.164	0.294	0.406	0.150	0.235
Total	1.114	1.113	1.615	1.553	1.276	1.243
Average daily DCP intake (g/h/d):						
Milk	0.126	0.078	0.058	-	0.104	0.054
Starter	0.068	0.106	0.205	0.235	0.112	0.145
Hay	0.012	0.024	0.044	0.061	0.022	0.035
Total	0.206	0.208	0.307	0.296	0.238	0.234
Feed efficiency (weight gain per kg):						
DM	0.460*	0.400	0.290	0.289	0.376*	0.348
TDN	0.442	0.453	0.368	0.416*	0.404	0.434*
DCP	2.390*	2.223	1.936	2.183*	2.163	2.306*

***Significant difference at P<0.05**

Table (5): Digestibility coefficients of nutrients in treated and control group at 70 and 90 kg live body weight.

Period	Group	Digestibility coefficient (%)					Nitrogen balance (g/d)
		DM	CP	EE	CF	NFE	
At 70 kg	Control	80.5	77.7^{b}	82.6^{a}	46.6^{b}	87.9	14.0
	Treated	82.4	81.6^{a}	80.2^{b}	52.8^{a}	87.3	14.2
At 90 kg	Control	69.89	70.34^{b}	73.13	51.45^{b}	70.10^{b}	15.2^{b}
	Treated	71.23	74.98^{a}	74.58	54.31^{a}	73.51^{a}	17.4^{a}

a and b Group means having different superscripts are significantly different at P<0.05.

than the controls, however level of albumin (AL) was significantly ($P<0.05$) higher by about 17% and globulin (GL) was significantly ($P<0.05$) decreased by about 14% in treated than control calves (Table 6). The present results are in agreement with the results of many investigators using acidified milk and/or yeast culture in rearing calves feeds. Skrivanova *et al.* (1990) found that acidification of milk did not affect plasma TP. However, El-Ashry *et al.* (2002) reported that supplementing suckling buffalo calves with live yeast and acidified milk caused an insignificant increase in plasma TP and AL, while resulted in significant increase in GL concentration.

Cholesterol concentration significantly ($P<0.05$) decreased by about 5.6% in plasma of treated calves than the controls (Table 6). Abdel-Khalek *et al.* (2000) reported similar trend of reduction in cholesterol in Friesian calves fed milk supplemented with Lacto-Sacc (LS). O'Kelly (1987) reported that cattle lack homeostatic mechanism for cholesterol regulation in blood and its amount depends on the quantity of long-chain fatty acids absorbed from alimentary tract.

Lacto-Sacc may have led to somewhat alteration in bacterial lipids content by stimulation of bacterial lipids synthesis (Williams, 1989). Furthermore, LS as a yeast culture has anticholesteroleamic effect (Fuller, 1989).

Plasma urea of treated calves decreased significantly ($P<0.05$) by about 10% than the controls (Table 6). Ibrahim *et al.* (1997) and Abdel-Khalek *et al.* (2000) found similar results in suckling Friesian calves fed whole milk supplemented with LS. While, concentration of creatinine tended to decline in treated than control calves (Table 6). Similar changes in urea and creatinine levels were observed by El-Ashry *et al.* (2002) on reared buffalo calves fed live yeast and acidified milk.

Activity of AST significantly ($P<0.05$) increased and of ALT significantly ($P<0.05$) decreased in plasma of calves (Table 6), but still within the normal range reported by Metwally *et al.* (1999) on Friesian calves and El- Ashry *et al.* (2002) on rearing buffalo calves. This may reflect the normal physiological status and normal liver function of treated calves (Streov and Makarova, 1989).

Concerning the mineral contents in blood plasma, potassium and magnesium levels increased significantly ($P<0.05$) at treated by about 3 and 8%, respectively, than control calves. While level of calcium, sodium and inorganic phosphorus did not differ significantly (Table, 6).

The present blood parameters of treated calves as compared to the controls may indicate the beneficial effect of the treated feeding regimen on calf metabolism without any adverse effects on kidney and liver function.

Economic efficiency:

Results of economics of feeding calves in both groups (Table 7) revealed that total cost of each kg gain of treated group was 79, 49 and 66% of that in the control one from birth to 70kg, from 70 to 90 kg and from birth to 90 kg LBW, respectively.

On the basis of the present results concerning the growth performance , digestibility coefficients and blood constituents, and from the economic point of view, it could be concluded that

Table (6): Blood constituents in plasma of suckling calves in treated and control groups.

Parameter	Control Group	Treated Group	Signif.
Biochemical content:			
Total protein (g/dl)	6.34±0.16	6.46±0.25	NS
Albumin (g/dl)	3.21±0.19	3.76±0.05	*
Globulin (g/dl)	3.13±0.27	2.70±0.38	*
Cholesterol (mg/dl)	46.52±2.20	43.91±2.10	*
Creatinine (mg/dl)	1.24±0.12	1.20±0.80	NS
Urea (mg/dl)	41.05±3.12	36.87±2.89	*
AST activity (U/l)	146.53±3.15	151.14±3.15	*
ALT activity (U/l)	48.52±3.08	44.80±3.88	*
Mineral content:			
Calcium (mg/dl)	7.55±0.36	7.73±0.42	NS
Potassium (mg/dl)	8.83±1.1	9.09±0.09	*
Magnesium (mg/dl)	2.98±0.19	3.22±0.27	*
Sodium (mg/dl)	237.98±3.2	232.42±1.4	NS
Inorganic phosphorus (mg/dl)	7.60±0.12	7.77±0.10	NS

NS not significant * significant at P<0.05.

□

Table (7): Economics of feed supplements on weight gain of calves at different intervals of live body weight.

Item	From birth to 70 kg LBW		From 70 to 90 kg LBW		From birth to 90 kg LBW	
	Control	Tested	Control	Tested	Control	Tested
Daily feed cost/h/d, L.E.						
Milk	4.070	2.50	1.87	-	3.370	1.756
Starter	0.378	0.590	1.136	1.304	0.621	0.802
Hay	0.081	0.16	0.287	0.396	0.147	0.229
Acid-Pak	-	0.10	-	-	-	0.070
Lacto-Sacc	-	0.02	-	0.05	-	0.022
Total daily feed cost/h/d, L.E.	4.53	3.37	3.29	1.75	4.14	2.88
Cost of kg gain, L.E.	9.21	7.28	5.54	2.71	8.04	5.33
Relative cost of kg gain	100	79.0	100	49.0	100	66.0

Price of starter and berseem hay was 800 and 450 L.E. per ton, respectively.
Price of Acid-Pak and Lacto-Sace was 40 and 30 L.E. per kg., respectively.

using feeding system applied for treated group is effective way to profitable Friesian calf rearing.

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تأثير إضافة الاكتوساك و الأسيد باك تحت نظام الفطام المبكر على الأداء الإنتاجي لعجول الفريزيان

السعيد السيد راغب

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استخدم فى هذة الدراسة ٣٤ عجل فريزيان حديث الولادة بمتوسط وزن حى ٣٤ كجم (مجموعة المقارنة) و ٣٣,٦ كجم (المجموعة التجريبية). فى المجموعة الأولى تم تغذية العجول على عليقة بادىء و دريس برسيم بالإضافة إلى اللبن حتى تصل الحيوانات إلى ٩٠ كجم وزن حى، بينما غذيت عجول المجموعة التجريبية على نفس العلائق ولكن أضيف إلى اللبن مادة تحميض (أسيد باك) بمعدل ٢ جم لكل لتر لبن والى عليقة البادىء ٢كجم لاكتوساك/طن وذلك حتى ٧٠ كجم وزن حى بعد ذلك تم فطام العجول على اللبن وغذيت على العليق المعاملة فقط حتى ٩٠ كجم وزن حى.

خلال الفترة التجريبية تم أخذ عينات دم من كل العجول عند وزن ٧٠ و ٩٠ كجم كذلك تم تسجيل وزن الجسم والغذاء المأكول وحساب الزيادة الكلية واليومية فى الوزن وكذلك الكفاءة الغذائية والكفاءة الاقتصادية فى نهاية التجربة لكل مجموعة.

وأدت اضافة اللاكتوساك و الأسيد باك الى النتائج التالية:

١. الزيادة في النمو ومعدل النمو اليومي كانت غير معنوية للعجول المعاملة مقارنة بمجموعة المقارنة خلال فترات النمو الأولي من الميلاد إلي ٧٠ كجم وزن حي، وأيضا خلال الفترة الكلية من الميلاد حتى ٩٠كجم وزن حى، بينما كان معدل النمو اليومى أعلى معنويا فى العجول المعاملة عن المقارنة خلال ا الفترة الثانية من ٧٠ــ٩٠ كجم

٢. كان متوسط عمر العجول خلال الفترة الأولي والثانية لمجموعة المعاملة مقارنة بمجموعة المقارنة وان كانت غير معنوية إلا أن المجموعة التجريبية تقل بـ ٣,١ و ٤,٤ أيام للفترة الأولي والثانية في حين أن متوسط عمر مجموعة التجربة خلال الفترة الكلية كانت معنوية حيث أنخفض متوسط عمر العجول لمجموعة التجربة بمقدار ٧,٥ يوم عن مجموعة المقارنة .

٣. أوضحت النتائج أيضا أن معاملات الهضم لكل من البروتين الخام والألياف الخام خلال فترة النمو الأولي وكذا البروتين الخام والألياف الخام والمستخلص الخالي من الازوت خلال الفترة الثانية قد تحسنت معنويا نتيجة إضافة الخمائر (لاكتوساك و اسيدباك) مقارنة بعلائق مجموعة المقارنة. بينما انخفضت معامل هضم مستخلص الاثير فى مجموعة المعاملة عن المقارنة خلال الفترة ألأولى معنويا وكان ايضا مستوي ميزان الازوت عالي معنويا بالنسبة لمجموعة المعاملة خلال الفترة الثانية (٩٠ كم وزن حي).

٤. أظهرت النتائج أيضا أن مجموعة المعاملة أدت إلي زيادة معنوية فى مستوي الالبيومين (١٧%) ، البوتاسيوم (٣%) ، والمغنيسيوم (٨%) و أرتفاع معنوى فى نشاط AST و أنخفاض معنوي في مستوى الجلوبيولين (١٤%) . وتركيز الكولسترول (٥,٦%)وتركيز اليوريا (٥,٣%) ونشاط ALT (٧,٧%) وهو ما ظهر في بلازما الدم لعجول المجموعة المعاملة مقارنة بمجموعة المقارنة، كما أن مستوي البروتين الكلي- الكاليسوم ــ الفسفور في بلازما الدم كان غير معنوي بين كلا المجاميع .

٥. أوضحت النتائج أيضا أن مجموعة عجول التجربة المعاملة غذيت بنسبة عالية من علف البادئ والدريس وتم تخفيض كميات لبن الرضاعة المقدمة لتلك العجول عن مجاميع المقارنة وقد انخفض السعر لكل كجم وزن حي ليصبح اقل من ٣٣,٧% عن مجموعة المقارنة .

وتوصى الدراسة بإمكانية إضافة مزرعة الخميرة مع تحميض اللبن للعجول الرضيعة تحت نظام الفطام المبكر حيث أعطت أفضل النتائج من حيث زيادة معاملات الهضم و أعلى كفاءة غذائية واقتصادية