Egyptian J. Anim. Prod., 33, Suppl. Issue, Nov. (1996): 149-159

APPLICATION OF LIQUID FEEDING FOR GROWING LOCAL GOAT KIDS

A.Y. El-Badawi[1] and H.M.Gado[2]

1- Department of Animal and Poultry Nutrition and Production, National Research Center, Cairo, Egypt, 2- Department of Animal Production, Faculty of Agriculture, Ain-Shams University, Cairo, Egypt.

SUMMARY

Ten kids trained to eagerly suckle from bottles and five naturally weaned kids were distributed into three similar groups. Animals were three month old of an initial average live body weight of 6.70±0.75 kg. Goat kids were individually fed on solid or solid plus liquid rations for a period of 12 weeks at level of 4% concentrate mixture (16.37% CP) and 2% berseem hay of their body weight.

The concentrate mixture was supplied in three forms, 100% solid in group A, 25% liquid (10%DM) and 75% solid for group B or 50% liquid (20% DM) and 50% solid for group C. The X-ray scanning procedure was applied to monitor the oesophageal groove closure.

Live body composition was determined using the antipyrine space method and body weight gain composition was calculated as the difference between final and initial body composition.

Results showed that, bottle-feeding trained animals maintained the reflex of the oesophageal groove closure active till six month of age and during which the liquid diet by-passed the rumen without health hazards.

No significant differences were found in growth performance among the experimental groups. However, the digestibilities of CF and EE and nitrogen balance ($P<0.05$) increased by liquid feeding. Slight improvement in other nutrient digestibilities and efficiency of energy and protein utilization were also observed by liquid feeding.

It was concluded that liquid feeding via oesophageal groove closure had no marked effect on growth of local goat kids.

Keywords: Goats, growth, liquid feeding, oesphageal groove closure, rumen by-pass

INTRODUCTION

The function of the oesophageal groove reflex have a direct influence on nutrients metabolism in ruminant animals according to the site of digestion. The function of the groove can determine the site in the stomach at which ingested fluids or suspensions arrive namely; the reticulo-rumen or the abomasum (Ørskov, 1982). The oesophageal groove is a muscular fold extending downwards from the cardia to the omasum on

the wall of the reticulum, when closed forms a tube carrying swallowed fluid directly through the omasal orifice into the abomasum. This mechanism could be maintained for a long period of lifetime in most ruminants trained to suck liquid feeds from a teat bottle or bucket (Ørskov, 1982). The practical application of rumen by-passing for high energy feeds or good quality proteins via the oesophageal groove closure might result in decreasing rumen fermentation losses and increasing in N retention and rate of gain for growing ruminant animals (Ørskov *et al.*, 1970).

This study was designed to investigate the response of Baladi goat kids to utilize liquid feeds via the oesophageal groove closure as a practical technique to improve their growth performance.

MATERIALS AND METHODS

Fifteen three month old Baladi male goat kids of an initial average live body weight of 6.70 $\pm$ 0.75 kg were used in a field trial lasted 12 weeks. Ten kids were taken away of their dams after the first week of birth, where they were trained on bottle suckling till three month old. The other five kids were naturally weaned at the same age, and used as a control group (A). The ten bottle-feeding kids were divided into two similar groups (B) and (C). All animals were individually fed during the whole experimental period.

A uniform rations consisted of concentrate mixture (CM) and berseem *(Trifolium alexandrinum)* hay were daily offered at 4% for CM and 2% of hay of animals body weight. The concentrate mixture was fed in three forms being; 100% solid in group (A), 25% liquid suspension (10% DM) and 75% solid for group (B) and 50% liquid suspension (20% DM) and 50% solid for group (C).

The liquid suspension of CM was prepared in two concentrations; 10 and 20% (w/w). Water was added to CM and cooked at 40-50^{o}C for one hour, blended for five minutes to obtain a homogenous suspensions and left to cool to 35^{o}C in average, before being fed to animals. Fresh stock of liquid feed was daily prepared in the morning, and was fed warm at all sucking times. The solid portion of CM and hay were offered once daily at 7.00 a.m. for all groups, while liquid suspensions were offered in four equal portions of 200 ml each with one hour interval. starting at 8.00 a.m. Feed residues - if any- were individually collected before the morning meal. Animals were weekly weighed to adjust their rations according to the body weight development. Drinking water was freely available at all times and no health problems were recorded on animals of different groups during the whole experimental period. At the beginning and at the end of the feeding trial, live body composition was individually determined using the antipyrine space method according to Panaretto and Till (1963). The weight gain composition was calculated as the difference between final and initial live body composition.

Three digestibility and nitrogen balance trials were conducted on animals of each group at the end of the feeding trial. Four representative animals two from group (A) and two from groups (B and C) were chosen at random to be radiographed after the digestibility trials. Two hundred ml of marker suspension containing 50 g of Gastrografin contrast medium (powder) were bottle fed to each animal. Two radiographs from the left side of the animal in a standing position were taken during sucking the marker suspension.

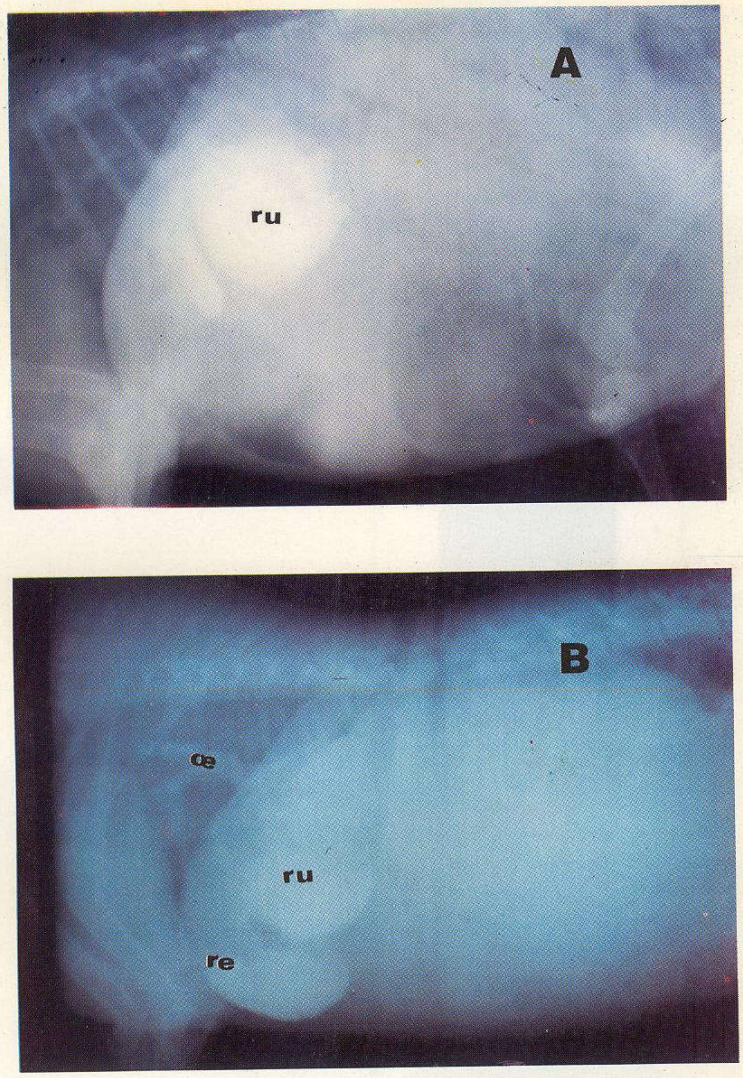

Fig (1): Two radiographs were taken from goat kids not trained on bottle - suckling, (A) at the beginning and (B) at the end of feeding the marker suspension (*Gastrografin medium*). The marker was fed by force using a teat bottle.The swallowed suspension is seen in the rumen (ru)or in the rumen and reticulum.(re). There is no marker to be seen in the abomasum.

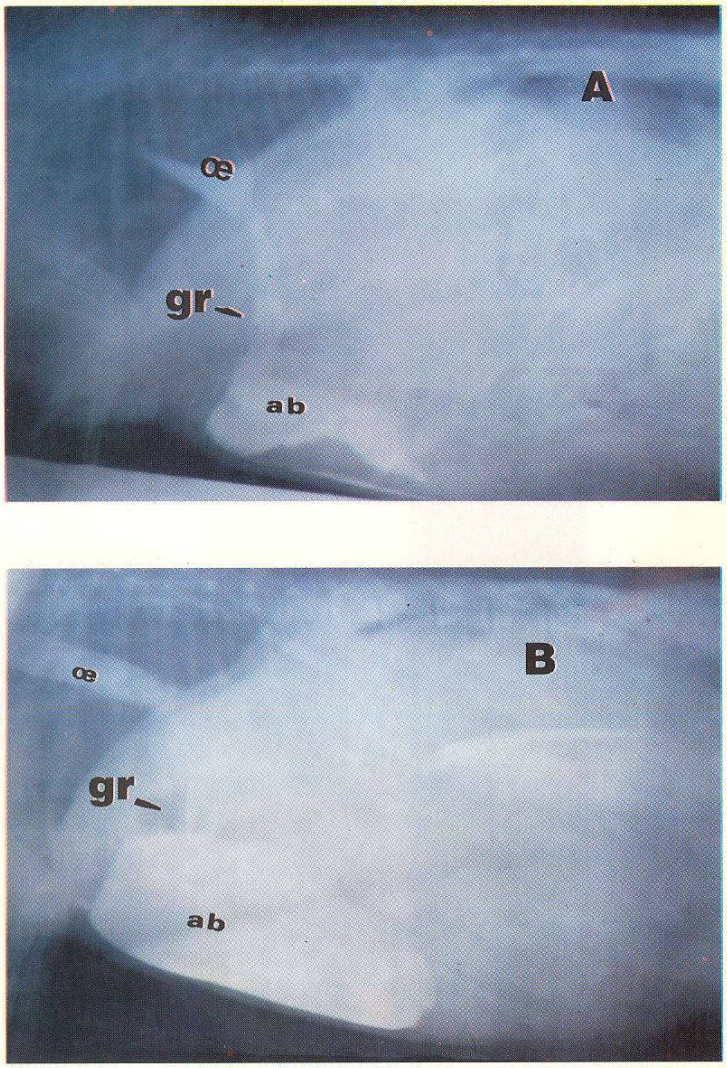

Fig (2) : Two radiographs were taken from goat kids well trained on bottle -suckling ,(A) at the beginning and(B) at the end of feeding the marker suspension (*Gastrografin medium*). The marker was eagrly sucked by kids from the teat bottle .The swallowed suspension is directly entered the abomasum (ab) due to closure of the oesophageal groove (gr) . There is no marker to be seen in the rumen .

composition, but it will be reached earlier or later depending on dietary regimen and always with the limitation of voluntary intake. However, retained energy (NE_g)for groups fed liquid feeding were biologically higher by 30% than that of the control group, but the high variation between animals within groups was also high, which didn't help in showing this kind of difference statistically.

Table 2. Daily intake, nutrients digestibilities, dietary nutritive value and nitrogen balance for kids in experimental groups.

Item	Control group, A	Liquid feeding groups B	C	SE
No. of animals	5	5	5	
Average body weight , kg	7.40	8.41	8.08	0.36
Intake , g/day (DM/basis)				
Total	391.3	446.3	426.3	19.00
CM	259.5	296.0	283.0	12.59
Fed solid	259.5	221.0	141.0	-
Fed liquid	-	75.0	142.0	-
Hay	131.8	150.3	143.3	6.40
TDN	299.1	348.3	327.2	14.59
DCP	49.9	58.2	55.2	20.44
Intake, g/$Kgw^{0.75}$				
DM	88.3	91.3	90.3	1.05
TDN	67.5^{b}	71.3^{a}	69.3^{ab}	0.80*
DCP	11.3^{b}	11.9^{a}	11.7^{a}	0.13
Nutrients digestibilities , %				
DM	80.19	82.66	81.24	1.25
OM	80.82	82.95	81.45	1.18
CP	78.28	79.96	79.40	1.32
EE	64.68^{b}	77.85^{a}	77.64^{a}	5.86*
CF	58.04^{b}	68.36^{a}	68.71^{a}	3.91
NFE	87.60	88.49	86.00	1.05
Nutritive value , %				
TDN	76.43	78.04	76.74	1.11
DCP	12.76	13.03	12.94	0.20
Nitrogen balance , g / day				
Intake	12.44	12.05	13.11	0.36
Faecal	2.70	2.42	2.70	0.18
Urinary	2.20^{a}	1.33^{b}	1.35^{b}	0.10*
Retained	7.54^{b}	8.30^{ab}	9.06^{a}	0.32

* Significant at P< 0.05 ** Significant at P<0.01

a, b, Means with different superscripts in the same row are (P<0.05) different.

Efficiencies of energy and protein utilization for gain as well, did not show any statistical differences between groups (Table 4). The similar energy and protein efficiencies for growth (Kcal DE or gDCP/g gain) in liquid feeding qroups, might support that kids after weaning have limited capacities to utilize by-passed energy or protein feeds for growth purpose. In other words , it seems possible to state that

dietary energy in the form of VFA's are more utilizable than glucose for growing ruminants.

It is clear that, the application of liquid feeding to directly pass high amounts of starchy feeds to abomasum via the oesophageal groove dose not reflected on any significant improvement of energy or protein utilization efficiencies by growing local

Table 3. Mean intial and final live body composition and net energy gain for kids in experimental groups.

Item	Control group, A	Liquid feeding groups B	C	SE
Initial wt., kg	6.30	6.84	6.95	0.33
water	4.27	4.60	4.69	0.22
fat	0.52	0.61	0.61	0.03
protein	1.18	1.27	1.29	0.06
ash	0.34	0.36	0.36	0.02
Final wt., kg	8.94	9.90	10.04	0.49
water	5.84	6.31	6.45	0.30
fat	1.04	1.35	1.30	0.10
protein	1.61	1.74	1.78	0.08
ash	0.46	0.50	0.51	0.04
Wt. gain , kg	2.64	3.06	3.09	0.38
water	1.57	1.72	1.76	0.22
fat	0.51	0.74	0.69	0.08
protein	0.43	0.47	0.49	0.06
ash	0.12	0.14	0.15	0.02
NE g , Mcal	7.317	9.689	9.326	1.02

Body fat = 9.5 kcal/g, Body protein = 5.7 kcal/g (Kleiber , 1961)

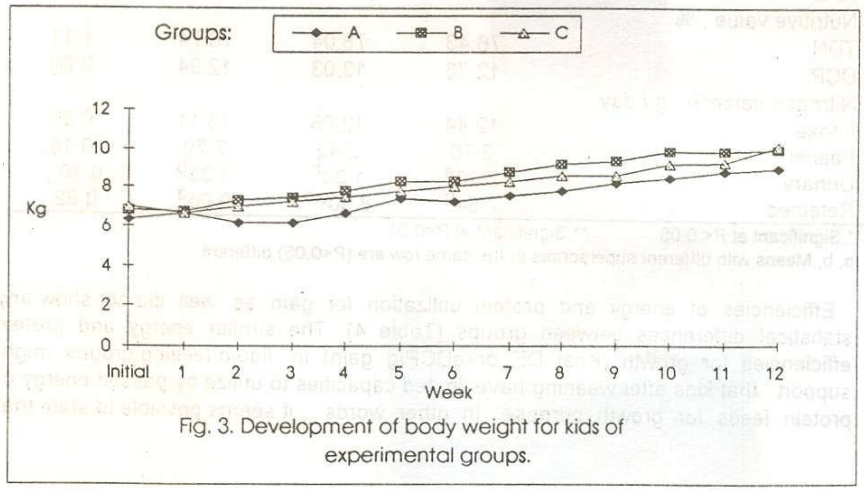

Fig. 3. Development of body weight for kids of experimental groups.

goats. This result might partially be related to the fact that, ruminant animals have limited capacities to secret adequate amounts of pancreatic amylase and intestinal maltase to efficiently digest the starch products (Soliman, 1977). On the other hand, the relatively high volume of sucked feeds (about 10% of body weight/h/day) might also contribute to affect feed utilization, due to the fast passage rate and short retention time of ingested feeds in the whole GI tract. These short-comings of the present feeding system should be considered in the future studies, dealing with applied liquid feeding for ruminant animals. Great attention should also be given to the feeding requirements of local animals. In this concern, some published results indicate that, the feeding requirements of local goats for growth were higher than those recorded in the NRC (1981).

Table 4. Efficiency of energy and protein utilization for gain of kids in experimental groups

Item	Control group	Liquid feeding groups		SE
	A	B	C	
Average daily gain, g	31.43	36.43	36.69	4.56
Energy:				
TDN, g/day	299.10	348.30	327.20	37.33
Total DE , Mcal/day	1.319	1.536	1.443	0.07
DE maintenance	0.553	0.611	0.591	0.02
DE gain	0.766	0.925	0.852	0.05
NEg , Kcal/day	87.10	115.30	111.00	12.64
K value (Kcal DEg/g wt. gain)	26.18	26.06	25.33	3.17
Protein:				
DCPI, g/day	49.93	58.10	55.18	2.40
DCPmaintenance	12.46	13.77	13.30	0.45
DCP gain	37.47	44.39	41.88	1.99
K value (g DCP gain/g wt. gain)	1.19	1.22	1.14	4.58

g TDN = 4.409 Kcal DE, TDN for maintenance = 28.4 g/Kgw$^{0.75}$
and DCP for maintenance = 2.82g/Kg w $^{0.75}$ (NRC, 1981)

In the present study, growing kids needed 25.33-26.18 Kcal DE and 1.14-1.22 g DCP/g gain. These values are higher than 8.9 Kcal DE and 0.195 g DCP/gain suggested for growing goats by the NRC (1981). El-Bedawy *et al.* (1993) on adult Zaraibi male goats and El-Badawi *et al.* (1996) on growing Baladi goat kids suggested 10.7 and 15.2 Kcal DE and 0.68 and 0.66 g DCP/g gain for Zaraibi and Baladi goats, respectively. The low growth efficiency and the high individuality of local goats might give another reason for the misleading results in this study.

It could be concluded that, feeding 25% or 50% of the barley based CM (16.37% CP) in a liquid form via the oesophageal groove closure did not achieve any remarkable advantage on the growth performance of Baladi goat kids.

Acknowledgment

The authors would like to thank Prof. Dr. M.S. Saleh, Head of Dept. of Surgery, Anesthesiology and Radiology, Fac. of Vet. Medicine, Cairo University, Dr. S.T. El-

Zomor, Lecturer at the same Dept., and Prot. Dr. A.E. Fekry, Biological Applications Dept., Nuclear Research Center, for their kind help and sincere efforts.

REFERENCES

A.O.A.C., 1984. Official Methods of Analysis 13th Edt., Association of Official Analytical Chemists, Washington, DC, USA.

Church, D.C., 1979. "Digestive Physiology and Nutrition of Ruminants:" O & B Books, Inc., Corvallis, Oregon, USA.

El-Badawi, A.Y.; T.M. El-Bedawy and H.M. Gado, 1996. Energy and protein requirements for growth of Baladi goat kids. In "47th Annual Meeting of the EAAP", 25-29 Aug., Lillehammer, Norway.

El-Bedawy, T.M., A.Y. El-Badawi, S.M. Ahmed and E.A. Gihad, 1993. Effect of dietary protein level on nutrient utilization, rumen fermentation and composition of body change of Rahmani sheep and Zaraibi goats. Egyptian J. Anim. Prod., 30: 251.

Lawlor, M.J. and S.P. Hopkins, 1971. The functioning of the oesophageal groove reflex and comparison of the performance of lambs fed individually and in groups. Br. J. Nutr., 26: 439.

Lu, C.D. and M.J. Potchoia, 1990. Feed intake and weight gain of growing goats fed diets of various energy and protein levels. J. Anim. Sci., 68:1751.

Ørskov, E.R.; C. Fraster and E.L. Corse, 1970. The effect of protein utilisation of feeding different protein supplements via the rumen or via the abomasum in young growing sheep. Br. J. Nutr. 24:803.

Ørskov, E.R. 1982. "Protein Nutrition in Ruminants". New York, Academic Press , pp. 10.

Owen, B.J. 1981. "Sheep Product" pp. 220, ELBS Pub., Blackwell Press, UK.

Panaretto, B.A. and A.R. Till, 1963. Body composition in vivo. II The composition of mature goats and its relationship to the antipyrine spaces. Aust. J. Agric. Res., 14: 926.

SAS, 1982. User's Guide statistics SAS Inst., Gary, NC .

SanzSampelayo, M.R., I.Ruiz, F. Gil and J. Boza, 1990. Body composition of goat kids during sucking voluntary feed intake. Br. J. of Nutr. 64:611.

Soliman, H.S., 1977. Replacement of milk protein, carbohydrate and fat in lamb milk substitutes. Ph.D. Thesis University of Aberdeen.

Van Soest, J.P., 1982. "Nutritional Ecology of the Ruminant". O.&B Books, Inc., Corvallis, Oregon, USA.

Walker, D.M., 1986. Body composition of animals during sucking and at the immediate post-weaning period. Proceeding of the Nutrition Society, 45:81.

تطبيق أسلوب التغذية السائلة على الماعز البلدى النامية

علاء الدين يحيى البدوى[1] ، هانى محمود جادو[2]

١ قسم تغذيـة وانتـاج الحيـوان والدواجـن – المركـز القومـى للبحـوث – القـاهرة – مصـر. ٢ قسم الانتـاج الحيوانى – كلية الزراعة – جامعة عين شمس – القاهرة – مصر .

إستهدفت الدراسة تعظيم الاستفادة مـن الاعـلاف المركـزة المغـذاة للجـداء الناميـة بإسـتخدام اسـلوب التغذية السائلة عبر الميزاب المرينى . استخدم عدد خمسة عشر ذكرا من الماعز البلدى منها خمسة جداء حديثة الفطام وعشرة جداء فصلت عن امهاتها بعد الاسبوع الاول من المبلاد واعتادت التغذية بـالبزازة . بلغت أعمار الحيوانات فى بداية التجربة ثلاثة أشهر وكان متوسط أوزانها ٧٠ر٦ كجـم ± ٧٥ر٠ وقـد قسمت الى ثلاثة مجاميع متساوية واستمرت التجربة حتى عمر ستة أشـهر . غذيـت الحيوانـات علـى عليقـة مكونة من مخلوط علف مركز (٣٧ر١٦٪ بروتين خـام) مكـون مـن الشـعير وكسـب فـول الصـويا ومخلـوط أملاح معدنية وفيتامينات بالاضافة الى دريس البرسيم كمادة علـف خشـنة . وكـانت كميـة العلـف المركـز المغذاة يوميا تعادل ٤٪ من وزن الجسم أما الدريس فكان بنسبة ٢٪ من وزن الجسم. كان العلف المركـز يغذى جافا بنسبة ١٠٠٪ لحيوانات مجموعـة المقارنـة ، وسـائلا بنسـبة ٢٥٪ وجافـا بنسـبة ٧٥٪ لحيوانـات المجموعة التجريبية الاولى ، وسائلا بنسبة ٥٠٪ وجافا بنسبة ٥٠٪ لحيوانات المجموعة التجريبية الثانيـة ، وكانت التغذية تتم فرديا فى جميع المجموعات . تم تقدير مكونات جسم الحيوانات الحيـة فـى بدايـة ونهايـة التجربة بإستخدام نظرية حيز الانتيـيرين ، كمـا تـم تصوير انغـلاق الميـزاب المرئيـى للحيوانـات المغـذاة بالمركزات السائلة بإشعة اكس .

أوضحت النتائج مايلى :

– أن استخدام أسلوب التغذية السـائلة (بـالبزازة) يكـون مصحوبـا بـانغلاق الميـزاب المرينـى ومـرور العليقة السائلة الى المعدة الحقيقية مباشرة بالنسبة للحيوانات المعتادة على الرضاعـة الصناعيـة ، ولـم تكـن هناك أى مشاكل صحية مصاحبة للتغذية السائلة فى المجموعتين التجريبيتين .

– ارتفعت القيم الهضمية معنويا (٠ر٠٥) لكل من الالياف الخام والدهن لحيوانات المجموعـات المغـذاة على العلائق السائلة ، كما انخفض معنويا (٠ر٠١) فاقد الازوت البولـى وارتفـع معنويـا (٠ر٠٥) الازوت المحتجز يوميا للحيوانات المغذاة على المركزات السائلة مقارنة بحيوانات مجموعة المقارنة .

– لم تكن الفروق معنوية بالنسبة لتطور وزن الجسم أومعدلات الزيادة اليوميـة فـى الـوزن او تركيـب الجسم فى نهاية التجربة أو قيم الكفاءة التحويليـة لكـل مـن الطاقـة المهضومـة والبـروتين المهضـوم بيـن حيوانات المجموعات التجريبيـة الثـلاث ، وان كـانت المقـاييس المذكـورة قـد تحسـنت نسـبيا للحيوانـات المغذاة على المركزات السائلة .

بناء على النتائج التى أمكن التوصل اليها يمكن تقرير أن استخدام اسلوب التغذيـة السـائلة لتمريـر مـن ٢٥٪ الى ٥٠٪ من العليقة المركزة المغذاة لصغار الماعز البلدى حتى عمر ستة أشهر لم يكن ذو جـدوى معنوية من حيث تحسين الاستفادة من العليقة المركزة .