Effect of a home –made milk replacer on post-weaning performance of Nubian male kids

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ABSTRACT

The use of milk replacers to substitute valuable whole milk for feeding goat kids is not widely practiced in the Sudan. The aim of this study was to investigate the effect of a home -made milk replacer on post- weaning performance (concentrate intake, rumen development and function, live weight gain and carcass characteristics) of Nubian male kids. Ten Nubian male kids of 7 weeks age and 5.65-6.1kgs mean live weight after weaning were used. The kids were selected randomly from two groups. Group A reared on milk replacer (50% home-made milk replacer and 50% goat milk) and group B reared on goat milk and each containing 5 kids. The concentrate intake was measured daily for five weeks and body weight and mortality rate were recorded weekly. In week 3, 4 and 5 blood samples were collected for plasma urea and glucose concentration determination and were analyzed using enzymatic colorimetric methods. After 5 weeks, kids were slaughtered and body components were separated and weighed. Also, empty rumen was weighed and rumen percent from whole body live weight was calculated. The left carcass side was divided into wholesale cuts and weighed. Data were statistically analyzed for the previously mentioned parameters using SPSS program. Results showed that concentrate intake, live weight gain, slaughter weight, rumen weight and wholesale cuts except loin and best-end of neck were not significantly different. The dressing out percentage was significantly ($P<0.05$) higher in group B than A. Plasma urea was significantly ($P<0.05$) higher in treatment B than A, while glucose concentration was higher in treatment B than A, but not significant. The study concluded that goat milk could be replaced by 50% home-made milk replacer without any deleterious effects on performance of Nubian kids.

INTRODUCTION

Livestock production in developing countries needs greater attention because of its role in food production, livelihood support, and environmental change. One of the major limitations of the livestock sectors in developing countries is the scarcity of feed resources resulting in low productivity and poor growth and reproduction of animals (FAO, 2005). Goat contributes to the health and nutrition of several million people in developing countries, especially those on the poverty line. Rearing goats provides a small but important supply of animal protein of high biological value, plus essential minerals and vitamins which are of particular significance for the most vulnerable group namely pregnant and nursing mothers and young children (Devendra and Burns, 1983).

Milk replacers are fed to young animals prior to weaning. The milking period may last only 3-4 weeks or up to 5-6 month (Morand, 1981; Mowlem, 1984). The weaning period, defined by changing from feeding on milk to solids, is a critical phase characterized by a slowing down or stopping of growth or even weight loss. This is referred to as weaning shock. Pual (2000) reported that goat kids weaned at early age, 6 weeks or less were inadequately grown. Weaning at 7 weeks leads to only a slight growth retardation compared with weaning at 3 weeks which leads to severe weaning shock. Normally, weaned ruminants might lose some weight when change liquid feed to solid feed because of undeveloped rumen.

Several metabolic changes also occur in the rumen epithelium accompanied with morphological development, including decreased glucose oxidation, increased VFA oxidation and increased production of ketone bodies from butyrate (Baldwant *et al.*,1992). The mechanisms responsible for rumen development have not been completely characterized, however, solid feed consumption stimulates rumen. Lane and Jesse(1997) found that, calves fed milk alone showed little rumen development, but those fed milk plus solid feed showed a marked increase in rumen volume and weight, as well as exhibiting increased papillary length and density. In an adult ruminant, most glucose obtained from feed is not passed into the small intestine. Rather, it is fermented to short chain fatty acids by rumen microorganisms. Due to the production of the short chain fatty acids, ruminant blood-glucose levels are much lower than nonruminant animals at around 60-80 mg/dl as compared to non-ruminants at around 80-120 mg/dl.

Ruminants are in constant state of gluconeogenesis (Hsu and Crump, 1989). Once fermentation begins, the dependency on glucose metabolism will decrease and the production of propionate, a VFA produced by fermentation, will begin to become essential. Propionate acts as a precursor for glucose synthesis (Lyford and Huber, 1993). Carbohydrates obtained from feedstuffs are fermented in the rumen and converted to VFA which include acetate, butyrate, and propionate. Hayashi *et al.* (2006) noted that the amount of recycled urea can be used as determining factor of rumen development. As the rumen develops, there should be a higher presence of urea and lower amounts of NH_3 present in the rumen. Moreover, the presence of urea in the blood demonstrates the utilization of crude protein the animals received. Thus the urea should increase once the animal is weaned. When high protein diets are fed, this leads to an increase in both urea and nitrogen in the ruminant's urine. Likewise, when low protein rations are fed, there will be a decreased amount of urea in the urine and blood due to the reutilization of urea (Hayashi *et al.*, 2006). Urea concentrations are indicative of protein utilization and the amounts are expected to increase as the calf ages and begins to utilize nitrogen more efficiently. The objective of this study was to explore the effect of milk replacer after weaning on concentrate intake, rumen development and function, live weight gain and carcass characteristics.

MATERIALS AND METHODS

This experiment was conducted in the Goat Research Centre of the Faculty of Agricultural Sciences, University of Gezira at Elneshasheba farm, north of Wad Medani, Gezira State, Sudan.

Animals

Ten healthy Nubian male kids at 7weeks of age post weaning were selected from kids reared on 50% home-made milk replacer and 50% normal goat milk, designated as group (A) and goat milk group (B). The body weight was 5.65 and 6.1 kg for group A and B, respectively. Each group consisted of five kids. The experiment lasted for 5 weeks during 2017.

Housing

The experimental animals were housed individually in a pen of 1.5×1.5x 1.5 m made of a wire net. All pens were located in a hangar of 30×20×3m. Each pen was provided with water and feed troughs.

Animal feed

The concentrate of 20% CP and 10 MjME/Kg DM was formulated using a combination of wheat bran, sorghum grain groundnut cake and normal salt (Table 1). The type of roughage used throughout the period of the study was not constant due to difficulty in availability of one type for the whole period.

The DM intake of roughage and concentrate were given according to their weight (5% of live body weight). The feed was offered twice a day in the morning and evening.

Table 1. Percent concentrate composition.

Ingredient	GNC	Wheat bran	Sorghum grain	Nacl
Percentage	34	20	45	1

Water

The experimental kids were offered water freely. Multi- vitamins were added in each water container.

Live weight gain

Animals were weighed weekly till the end of experiment while they were fastened using a string scale balance. Animals were placed in a holder which was attached to the spring scale.

Investigation of rumen function

Samples collection and analysis

During the last three weeks of the experiment, 18 blood samples were collected weekly from the jugular vein of the kids for analysis of plasma urea and glucose concentration. Blood was collected in 5 ml vacutainer tubes containing anticoagulant. The blood was centrifuged at 3000 rpm for 10 minutes and plasma was collected, and stored at -4ºC until analysis. Plasma glucose concentration was determined according to Henry *et al*. (1964). Plasma urea analysis was carried out according to Chancy and Marbash (1962) and Vasssault and Trinder (1986).

Slaughtering

At the end of the experiment, three animals from each group were selected randomly, fastened overnight and weighed before slaughter according to the Islamic rituals by severing the jugular vein. After the slaughtering the animal, blood was collected in a preweighed plastic container and weighed. Finally, feet and head were removed and the animal was skinned.

Rumen development

The rumen was weighed empty and its weight was taken as proportional to the live weight.

$$\text{Rumen development} = \frac{\text{Rumen weight (empty)}}{\text{Live weigh of animal}} \times 100$$

Carcass characteristics

The carcasses were split into left and right halves by sawing along the vertebral column. Carcasses were weighed seperately with kidneys and renal fat (hot carcass weight, HCW). The gastro-intestinal tract was weighed full and empty to determine the gut fill and empty body weight (EBW). The tail, kidneys and renal fats were separated and weighed for each animal. Furthemore, the dressing percentages were calculated for each animal.

Wholesale cuts

The left side from each animal was divided into five wholesale cuts including neck, single short forequarter, best end of neck, loin and leg and chump.

Statistical analysis

Data were subjected to the analysis of variance procedure using SPSS program.

RESULTS AND DISCUSSION

Body weight gain

Table 2 shows no significant difference in live weight gain between kids which consumed milk replacer and those which consumed goat milk. However, only in week 2 and 3 animals which

consumed milk replacer had significantly higher (P<0.05) body weight gain compared to those which consumed goat milk. The results of this study were higher than those of Hassan *et al.* (2008) for Nubian kids and Tahmasbi *et al.* (2007) for Angora and Cashmere kids. Improved weight gain in this study compared to Nubian kids in the study of Hassan *et al.* (2008) may be referred to the type of feed used.

Table 2. Effect of feeding milk replacer and goat milk, on weekly weight gain (kg) of Nubian kids during post- weaning periods.

	Average weekly weight gain (kg)				
Week	Kids fed milk replacer	Kids fed milk milk	Kids fed goat	S.E	Sig.
1	0.600	1	0.41	0.925	
2	0.200	0	0.20	0.029	
3	1.100	0.550	0.22	0.039	
4	0.500	0.350	0.19	0.865	
5	0.550	0.750	0.36	0.498	
(Total gain)	2.95	2.65	0.62	0.172	

Concentrate intake

Table 3 shows no significant differences between both groups in concentrated intake. Although there was no significant difference in concentrate intake between the two groups, but the concentrate intake of kids reared on milk replacer was more than that of kids reared on goat milk. This observation may be supported by that rumen weight was slightly higher in milk replacer group than the goat milk group which may be due to rumen improvement.

Table 3. Effect of feeding milk replacer and goat milk on mean concentrate intake (kg) of Nubian kids during post-weaning (kg).

Type of group	**Mean concentrate intake (kg)**	**S.E**	**Sig.**
Kids fed milk replacer	**7.61±1.1**	**0.19**	**0.774**
Kids fed goat milk	**6.11±0.95**		

Rumen function

Glucose concentration

Table 4 shows no significant difference in glucose concentration in kid's blood between the two groups. It was well known that glucose concentration in newborn ruminant is substantially higher than that in adult (Hsu and Crump, 1989). However, glucose concentration gradually drops after kids

were introduced to solid feed (Tahmasbi *et al.*, 2007). In this study, glucose concentration in blood was 41.9 and 53.7mg/dl in kids reared on milk replacer and goat milk, respectively. This finding was similar to that reported by Aufy *et al.* (2009) who found that glucose concentrations in blood were 42.2 and 42.6mg/dl. However, the concentration of blood glucose in this study was lower than that recorded by Sahlu *et al.*(1992) who found that glucose concentration in blood was 80-84mg/dl when acidified milk replacer and solid feed (20% CP and 3.1 Mcal of metabolizable energy/kg of DM) were used. On the other hand, the result in this study was lower than that of Saanen at four months which was reported by Bulent (2012). This difference may be attributed to the breed differences, where Nubian kids were used in this study and Saanen in the study of Bulent (2012).

Table 4. Effect of milk replacer and goat milk on glucose concentration (mg/dL) in Nubian kids blood.

	Glucose concentration			
Days	Kids fed milk replacer	Kids fed goat milk	S.E	Sig.
21	44.4	66.7	13.2	0.217
28	37.0	48.1	5.2	0.187
34	44.2	46.3	12.6	0.062
Over all mean	41.9	53.7	6.4	0.532

Plasma urea

Table 5 shows significantly (P< 0.05) higher levels of plasma urea in blood of kids which consumed goat milk compared to those which consumed milk replacer. However, only in week 1, animals which consumed goat milk had significantly higher (P <0.05) plasma urea compared to those which consumed milk replacer. Urea concentration increases once the animal is weaned (Hayashi *et al.*, 2006). In this study, urea cnncentration was 21.4±1.5 and 30.0mg/dl in kids reared on milk replacer and goat milk, respectivly.This finding was lower than that stated by Bulent (2012) of Sananen at four month. On the other hand, the result in this study was higher than that of Tahmasbi (2007) who reported plasma urea concentrations of 14.7-14.9 and 12.8-10.2mg/dl for Angora and Cashmere goat kids, respectively. The higher concentration of plasma urea in goat milk group may indicate that rumen was not well ready to benefit from recycling of urea.

Days	Plasma urea			
	Kids fed milk	S.E	Sig.	Kids fed goat milk replacer
21	18.6	37.3	4.0	0.01
28	20.8	27.0	2.9	0.101
34	24.9	25.9	7.0	0.889
Overall mean	21.4	30.0	3.2	0.016

Slaughter weight and carcass characteristics

Table 6 shows no significant difference in slaughter weight and dressing percentage between the two groups. However, the results of this study for both groups of animals was higher than that reported by Shahjalal (2000) and Bodruzzaman *et al.* (2015). Higher dressing percentage has been reported in kids which consumed goat milk compared to those which consumed milk replacer. This might be due to the greater gut fill associated with earlier rumen development in milk replacer than the goat milk group. Similar results were found by Perez *et al.* (2001).

Table 6. Effect of milk replacer and goat milk on slaughter weight (kg) and dressing percentage.

Parameter	Kids fed milk replacer	Kids fed goat milk	S.E	Sig.
Slaughter weight (kg)	**8.2±1.2**	**8.7±1.7**	**0.94**	**0.611**
Dressing percentage (%)	**43.3±0.85**	**48.1±2.6**	**1.5**	**0.272**

Empty rumen weight

Table 7 shows no significant difference in rumen weight between the two groups. Empty rumen weight at 12th week was used as a measure of rumen development. A slight increase in rumen weight was noticed in kids which consumed milk replacer. However, the effect of milk replacer on rumen development is not yet known as reported by (Bodruzzaman *et al.*, 2015). Increased rumen weight in kids reared on milk replacer might be attributed to the intake of fibrous particles available in milk replacer.

Table 7. Effect of milk replacer and goat milk on empty rumen weight %.

Animal group	Empty rumen weight of %	S.E±	Sig.
Kids fed milk replacer	**4.0±0.56**	**0.37**	**0.531**
Kids fed goat milk	**3.8±0.34**		

Wholesale cuts weight

Table 8 shows no significant difference in neck, single, short forequarter and leg and chump between both groups. However, best end of neck and loin were significantly (P≤0.05) higher in kids fed goat milk compared to those fed milk replacer.

Table 8. Effect of milk replacer and goat milk on wholesale cuts weight (g) of Nubian kids.

Wholesale cuts	Kids fed milk replacer	Kids fed goat milk	S.E	Sig.
Neck	150.8	172.3	13.7	0.193
Single short forequarter	666.6	746.5	79.3	0.371
Best end of neck	160.9	221.6	13.7	0.012
Loin	130.6	191.2	19.3	0.035
Leg and chump	179.0	179.2	28.1	0.422

CONCLUSION

The performance of Nubian male kids fed milk replacer or goat milk to weaning was not significantly different. Thus, kids may be reared using 50% home-made milk replacer without any deleterious effects on the performance of Nubian kids.

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أثر بديل اللبن المصنع منزلياً على أداء جديان ذكور الماعز بعد الفطام

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الخلاصة

استخدام بدائل اللبن كبديل للبن الطبيعي في تغذية جديان الماعز لا يمارس على نطاق واسع في السودان. الهدف من هذه الدراسة هو معرفة أثر بديل اللبن المصنع منزلياً على أداء جديان الماعز بعد الفطام (المتناول من المركز، وتطور الكرش ووظيفتها وزيادة الوزن الحي وخصائص الذبيحة) .استخدمت 10 من جديان الماعز النوبي (ذكور) في عمر سبعة أسابيع كمتوسط ووزن 5.65 و 6.1 كجم. غذيت الجديان على بدائل لبن مصنع منزلياً (50% بديل لبن و 50% لبن ماعز). وهي المجموعة (أ) والمجموعة (ب) غذيت على لبن الماعز كل مجموعة تحتوي على خمسة جديان بعد الفطام. قيس استهلاك العلف المركز يومياً لمدة خمسة أسابيع والوزن الحي ومعدل النقوق أسبوعياً. في الاسبوع 3 و 4 و5 تم أخذ عينات دم لتحديد نسبه اليوريا و الجلكوز باستخدام طريقة قياس الطيف المرئي. ذبحت الجديان بعد الخمسة اسابيع بعد الفطام وفصلت مكونات الكرش ووزنت الكرش الفارغة وحسبت نسبة الكرش على أساس الوزن الحي. تم تقسيم الجانب الأيسر لقطعيات ووزنت. تم تحليل البيانات إحصائياً للمعاملات المذكورة سابقاً باستخدام برنامج SPSS. أوضحت النتائج انه لا توجد فروقات منويه بين المعاملات في كل من المستهلك من المركز والوزن المكتسب وزن الذبيحة والقطعيات ووزن الكرش. بينما كانت هنالك فروقات معنوية ($P\leq0.05$) في نسبه التصافي كانت أعلى في المجموعة ب. هنالك أيضاً فروقات معنوية ($P\leq0.05$) في نسبه اليوريا في الدم حيث كانت أعلى في المعاملة ب . على الرغم من عدم وجود فروقات معنوية في تركيز الجلكوز في الدم بين المعاملات أ و ب الا إنه كان أعلى نسبياً في المعاملة ب. خلاصه الدراسة يمكن استخدام بديل اللبن 50% دون اي تأثير ضار على أداء جديان الماعز النوبي.