African Crop Science Journal, Vol. 24, Issue Supplement s1, pp. 95 - 99 ISSN 1021-9730/2016 $4.00

DOI: http://dx.doi.org/10.4314/acsj.v24i1.10S

QUALITY AND CONSUMER ACCEPTABILITY OF GOAT MILK WITH RESPECT TO GOAT BREED AND LACTATION STAGE

E. WANJEKECHE, Z. MACOSORE, A. KIPTANUI[1] and T. LOBETA
Kenya Agricultural and Livestock Research Organization, Food Crops Research Institute, P. O. Box 450, Kitale, Kenya
[1]University of Eldoret, P. O. Box, Eldoret, Kenya
Corresponding author: elizawanjekeche@gmail.com

ABSTRACT

Lack of information on the quality of goat milk in Kenya and the belief that the milk has an undesirable "goaty" flavour, have been major impediments to its wider utilisation and commercialisation. The objective of the study was to determine nutrient composition of goat milk from different breeds in Kenya, and assess consumer acceptability of goat milk products. An on-station study was carried out at KALRO-Kitale on Kenyan Alpine, Toggenburg and Saanen goat breeds, during their first and second lactation stages. The quality of milk from farmers' goats in Trans Nzoia County was also determined. There were significant differences in yield and quality of milk from different breeds. Milk from the Saanen goats had the highest levels of fat, SNF and density. Protein content did not differ significantly between the three breeds. There was great variation in composition of the milk obtained from farmers' fields, which may be attributed to differences in the breeds, stage of lactation and feeding regimes. Panellists who tasted goat milk and products showed higher preference for goat milk than cow milk products.

Key Words: Dairy goat breed, Kenyan Alpine

RÉSUMÉ

Le manque d'informations sur la qualité de lait de chèvre au Kenya et de la conviction que le lait a un goût "goaty" indésirable, a été des obstacles importants à sa plus large utilisation et commercialisation. L'objectif de l'étude était de déterminer la composition nutritive de lait de chèvre de différentes races au Kenya et évaluer l'acceptabilité de consommateur de produits de lait de chèvre. Une étude sur-station a fait à KALRO-Kitale sur le Kényan Alpestre, Toggenburg et les races de chèvre Saanen, pendant leurs premiers et deuxièmes stades de lactation. La qualité de lait des chèvres de fermiers dans Trans Nzoia le Comté a été aussi déterminée. Il y avait des différences significatives dans la production et la qualité de lait de différentes races. Le lait des chèvres Saanen avait les plus hauts niveaux de gras, SNF et densité. Le contenu de protéine n'a pas différé de façon significative entre les trois races. Il y avait la grande variation dans la composition du lait obtenu des champs de fermiers, qui peuvent être attribués aux différences dans les races, le stade de lactation et de régimes mangeants. Panellists qui a goûté du lait de chèvre et de produits a montré la plus haute préférence pour le lait de chèvre que les produits de lait de vache.

*Mots Clé*s: la race de chèvre laitière, le Kényan Alpestre

INTRODUCTION

The potential for dairy goats in providing nutritional and financial sustenance to the economically weaker sections of the households in east Africa, who cannot afford cows, is well recognised (Okeyo, 2001; Lusweti *et al*., 2011). Goats require little space and feed, and have the ability to thrive under diverse climatic conditions (CTA, 2007). They can be acquired by the poor and can be easily attended to by even women, the old and young members of a household, or those weak victims for instance, those affected by HIV/AIDS virus. Hence, focusing on goats can help to bridge gender disparities in resource ownership.

Lack of information on the quality of goat milk, coupled with the belief that the milk has an undesirable rancid or "goaty" flavour, have been major challenges to wider utilisation and commercialisation of the milk. The "goaty" flavor is a strong, musky flavour having the same characteristics as the odour given off by the buck during the mating season. Goat milk that has been well handled, has a delicious, slightly sweet taste, with sometimes a salty tint. It is indistinguishable in taste and oduor from cow milk ((Okeyo, 1997).

In Kenya, most of the research to improve dairy goat milk production has focused on issues related to breeding and general animal husbandry (Ruvuna *et al*., 1988), but issues of milk composition and quality, and breed differences, have not been investigated. Moreover, these attributes affect consumer acceptability, hence market potential. Studies done elsewhere show that goat milk has superior nutritional quality to cow milk (Jenness, 1980). Nutritional superiority of goat milk can therefore, be used as a basis for promoting the marketing and consumption of goat milk products. The objective of the study was to_determine nutrient composition of goat milk from different breeds in Kenya and assess consumer acceptability of goat milk products

MATERIALS AND METHODS

The study was conducted at the Kenya Agricultural and Livestock Research Organisation (KALRO) Centre in Kitale, Trans Nzoia county. The research centre lies in the Upper Midland (UM4) agro-ecological zone, and receives annual rainfall of 1000-2100 m.a.s.l in Kenya. The area is generally cool, with temperatures ranging from 25-26 ^{o}C. The study used three dairy goat breeds; namely, the Kenya Alpine, Toggenburg and Saanen in Kenya. For each breed, three does were selected. The goats were kept under zero grazing, and fed on napier grass (7 kg dry weight) and sweet potato vines (2 kg of dry weight basis). Dairy meal (1 kg) was also given to the goats; while mineral supplements and water were provided *ad-libitum*. Recommended management practices including good housing, separation of does from the bucks and clean milk handling, were carried out.

Milking was done twice a day at 7.00 a.m and at 3.p.m, but only the morning milk was analysed for quality, starting from the fourth day after kidding. Milk samples were collected daily throughout the first and second lactation periods. Milk samples were also collected from 15 farm fields in Trans Nzoia County and analysed for quality.

Analysis of the milk was done using the milk Analyser. The parameters measured were fat, protein, solids-not-fat (SNF), density and added water. The data collected were subjected to Analysis of Variance (ANOVA) using SPSS statistical software.

Consumer acceptability of fresh milk, yoghurt, and tea made using goat milk was determined by 15 taste panellists from the research centre. The panellists indicated their degree of liking for colour, taste, odour of the products using a five point Hedonic scale as follows; 1- like extremely, 2-like slightly, 3-Dislike slightly, 4- Dislike extremely.

RESULTS AND DISCUSSION

Milk yield. Data for milk yield per day for the three breeds over the first and second lactation periods are presented in Table 1. The Kenya Alpine had the highest milk yield during both lactation periods; while the Saanen had the lowest yield. Studies done elsewhere show that the Saanen breed has higher milk yield than the Alpine or Toggenburg (Peacock C, 2008). It is possible that the cool climatic conditions of the study site contributed to low yields, since the

Saanen breed prefers warm environments. The milk yield for all breeds generally increased during the second lactation period, although it was much lower than the potential yield of 4 litres per goat per day for pedigree goats (TOF, 2010). There is, therefore, need for efforts to improve the quantity of dairy goat breeds in Kenya for this subsector to contribute significantly to the welfare of small-holder farmers.

Milk quality. Table 2 shows the quality of milk from the Kenya Alpine, Toggenburg and Saanen goats during the first lactation periods. The contents of protein, fat and solids not fat were similar to those reported in other regions (Jenness, 1980). The data show differences in fat content of the milk between breeds, with the Saanen having the highest average fat content.

TABLE 1. Milk yield of dairy goats (litres per day) in Kenya

Goat breed	1st Lactation period	2nd Lactation period
Kenya Alpine	1.02	1.85
Toggenburg	0.75	1.5
Saanen	0.65	1.0
Mean	0.81	1.45

It should be remembered, however, that the quality and quantity of feeds, genetics, season and stage of lactation, influence the richness of goat milk fat. In California, goat records indicated that the dairy goats produced milk with a 3.9% milk fat. It is important to identify feeds that will maximise the quality of milk. The milk from the Saanen goats had the highest levels of fat (6.30%), protein (4.14%), SNF (10.47%) and density (34.37 gcm^{-3}). The Toggenburg had the lowest levels of all nutrients.

Table 3 shows the milk quality from the three breeds during the second lactation period. A similar trend to the first lactation period was observed in the fat and protein contents. Milk from the Saanen was again superior to that from the Kenya Alpine and Toggenburg with respect to all the nutrients, and the density and solids not fat. Variations in the composition of goat milk from goats of same breed and between different breeds, and with lactation stage have been reported (Jenness,1980; Ruvuna *et al*.,1988).

Consumer acceptability. Table 4 shows the panelists' scores for colour, taste, odour and overall acceptability of fresh goat milk, yoghurt and tea; compared to similar products made using cow milk. The results of the taste tests showed

TABLE 2. Quality of goat milk during the 1stlactation period in Kenya

Parameter	Breed	Lactation stage (months after kidding)					Mean ± SD
		0*	2	4	6	8	
Fat (%)	Kenya Alpine	5.06	5.93	6.03	6.33	6.82	6.03±0.62
	Toggenburg	3.52	5.81	5.80	5.90	6.44	5.50± 0.68
	Saanen	4.30	4.74	5.38	6.91	7.79	6.30± 1.08
Protein (%)	K.Alpine	4.30	3.84	3.77	3.65	3.89	3.89±0.15
	Toggenburg	3.90	3.70	3.61	3.57	3.68	3.69±0.80
	Saanen	4.17	4.17	4.18	4.17	4.02	4.14±0.04
Solids not fat (%)	K.Alpine	9.53	9.60	9.74	9.86	9.90	9.74± 0.11
	Toggenburg	9.49	9.33	9.28	9.03	8.98	9.22± 0.15
	Saanen	11.00	10.80	10.50	10.20	10.10	10.47± 0.30
Milk density (gcm^{-3})	K.Alpine	35.60	33.50	30.70	32.40	32.50	32.73± 1.20
	Toggenburg	34.00	30.90	30.50	32.30	32.20	31.73± 1.10
	Saanen	35.90	33.90	33.30	34.40	34.70	34.37±0.63

*- Milk sampled 4 days after kidding

TABLE 3. Quality of goat milk from three breeds during the 2nd Lactation period in Kenya

Parameter	Breed	Lactation stage (months after kidding)					Mean ± SD
		0*	2	4	6	8	
Fat (%)	Kenya Alpine	5.94	5.78	5.56	5.93	5.70	5.78±0.29
	Toggenburg	5.34	6.59	7.32	4.71	5.40	5.87±0.80
	Saanen	5.38	5.36	6.03	6.86	6.30	6.00±0.44
Protein (%)	Kenya Alpine	4.06	4.14	4.31	4.00	3.70	4.04±0.16
	Toggenburg	4.07	3.89	4.14	3.57	3.73	3.88±0.17
	Saanen	4.18	4.02	4.17	4.01	3.90	4.06±0.09
Solids not fat (%)	Kenya Alpine	9.79	10.20	10.20	9.36	9.10	9.73±0.41
	Toggenburg	9.13	9.13	9.40	8.90	9.10	9.13±0.13
	Saanen	10.10	9.75	9.08	9.95	9.67	9.71±0.23
Milk density (gcm^{-3})	Kenya Alpine	32.80	32.30	32.40	32.00	30.40	31.98±0.53
	Toggenburg	32.50	32.30	32.20	30.40	30.70	31.62±0.77
	Saanen	34.40	33.00	32.90	32.00	32.00	32.86±0.68

*- Milk sampled 4 days after kidding

TABLE 4. Consumer acceptability (panelists scores*) of goat milk products in the north rift region in Kenya

Property	Fresh milk		Tea		Yoghurt	
	Goat	Cow	Goat	Cow	Goat	Cow
Colour	3.75	3.00	4.00	3.20	3.50	3.75
Taste	3.75	3.00	4.00	3.00	3.20	3.75
Odour	3.75	3.75	4.00	4.00	3.50	4.00
Overall acceptabililty	3.75	3.75	4.00	3.75	3.20	4.00

*Scale – 1 = Dislike very much, 2 = Dislike slightly, 3 = Like slightly, 4 = Like very much

no significant differences in acceptability between goat milk and cow milk products, although the level of acceptability of goat milk products was slightly higher than cow milk products. Boor *et al*. (1984) reported the same findings in western Kenya, and indicated that the oduor of the milk may be unacceptable if during milking, the bucks and does are not separated or the milking utensils have a smell.

Literature shows that goat milk, handled under clean conditions, will not have any undesirable odour. Most farmers in Kenya milk the goats in their housing structures, where both the does and bucks are kept together for ease of mating (SDCP-IFAD, 2011). This affects the quality of goat milk. Hence, the general consumer perception that goat milk has a rancid flavour.

CONCLUSION

Milk quality does not differ significantly among goat breeds in the north rift area in Kenya, although the Saanen breed has the highest contents of protein, solids not fat and density during both lactation stages. The Toggenburg has the lowest levels of all nutrients. For all the breeds, the protein, fat, solids not fat and density reduce with lactation stage and lactation period.

More data, however, need to be captured for more lactation cycles to confirm the trend in the quality parameters. The colour, taste and smell of goat milk products are highly acceptable to consumers. Acceptability of goat milk should, therefore, not be a constraint to increased consumption as long as clean milk handling is emphasized.

ACKNOWLEDGEMENT

Thanks to the Eastern Africa Agricultural Productivity Project (EAAPP) for financing this work, the Kenya Agricultural and Livestock Research Organization (KALRO) for supporting the research work and the Association for Strengthening Agricultural Research in Eastern and Central Africa for facilitating the publication of this paper.

REFERENCES

Boor, K.J., Brown, D.L. and Fitzhug, H.A. 1984. Consumer acceptance of goat milk products in western Kenya. Technical report, Small Ruminant Collaborative Research Program (SR-CRSP). Nairobi, Kenya.

CTA, 2007. Rearing Dairy Goats.CTA Practical Guide Series No.1.ISSN 1873-8206.

Jenness, R.1980. Composition and characteristics of goat milk: Review 1968 - 1979. *J. Dairy Science* 63: 1605 -1630

Lusweti, F.N., MacOsore, Z.O. and Khisa, N.W. 2011. Banana-dairy small scale farming system for the North Rift region of Kenya. *Journal of Life Sciences* 5 (6):466-471.

Okeyo, A.M.1997. Challenges in goat improvement in developing rural economies of Eastern Africa with special reference to Kenya. In: Houton, A.V. (Ed.). Proceedings of Goat Development in Eastern Africa, Workshop, 8th-l1th December, l997. Izaac Walton Inn, Embu, Kenya. pp. 55-66.

Okeyo, A.M., Thendiu, J.N. and Ahuya, C.O. 2001. The place and role of the goat in livelihood improvement and poverty reduction in Kenya: Potential and some indicative achievements. Annual Project Planning Workshop, Livestock Productivity Project, Farm Africa-Dairy goat and animal Healthcare Project, Meru, Kenya, 7th-9th September 2001. Meru Central Hotel, Meru, Kenya.

Peacock, C. 2008. Dairy goat development in East Africa: A replicable model for smallholders? *Small Ruminant Research* 77: 225-238.

Ruvuna, F., Cartwright, T.C., Blackburn, H., Okeyo, M. and Chema, S.1988. Lactation performance of goats and growth rates of kid under different milking and rearing methods in Kenya. *Animal Production* 46: 237-242.

SDCP-IFAD, 2011. Small Dairy Commercialization Programme- International Fund for Agricultural Development, 2010/2011 Annual Report, Trans-Nzoia, Kenya.

TOF. 2010. The Organic Farmer. Inbreeding educes quality of Dairy goats. Issue No.63, August 2010. http://www.infonet-biovision.org/Publications/TOF.