EFFECT OF FEEDING OF A LOW DOSE OF FAT FROM BITTER MELON SEEDS RICH IN α-ELEOSTEARIC ACID ON CONJUGATED LINOLEIC ACID (CLA) LEVEL IN GOAT MILK

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Introduction

Recently, a group of isomers of linoleic acid named as conjugated linoleic acids (CLA) has attracted considerable attention due to their biological activities with a minimal dose. CLA isomers are reported to exert a number of beneficial health effects including anti-carcinogenic, anti-diabetic, anti-obese and anti-atherogenic actions. CLA present in ruminant products such as milk and meat originate from the activities of ruminant microflora, such as *Butyriovibrio fibrosolvens*. Synthetic CLA is sold as weight management capsules all over the world including in Sri Lanka. As the information on health benefits are disseminated to the general public, the demand for CLA is rising in the local market. The seed fat of bitter melon (*Momordica charantia*) commonly known as *karawila* contains a conjugated trienoic fatty acid named as -eleostearic acid, (*c*9, *t*11, *t*13), which is directly converted to CLA (*c*9, *t*11 isomer) *in vivo* in rats when it is added with their food (Jayasooriya, 2000). The *c*9, *t*11 isomer is reported to contain a potent anti-carcinogenic activity (Ip *et al.*, 2002). In this context, the objective of the present study was to assess, whether or not the CLA content in goat milk could be enhanced by feeding fat extracted from locally available bitter melon seeds.

Materials and Methods

Sixteen lactating goats (n=16) were initially selected for the study from Imbulandanda farm, Matale managed by the Department of Animal Production & Health. The bitter melon seed fat was extracted from seeds purchased from the Department of Agriculture. The animals were blocked according to the parity, milk yield and stage of lactation, and then allotted into two groups (n=8 per group), categorized as TEST and CONTROL groups. Both groups were fed with roughages *adlibitum.* In addition, they were supplemented with 200g of concentrate feeds, which were prepared by adding either coconut fat (CONTROL group) or bitter melon seed fat (TEST group).

The bitter melon seed fat was extracted with hexane. The total proportion of fat added to the concentrate of the TEST group was

2.5% (1.5% coconut fat and 1% of bitter melon fat). The concentrate of the CONTROL group was added with 2.5% coconut fat. Feeding trial was conducted following a one week acclimatization period. Subsequently, milk samples were collected at the end of the third week of the feeding trial. Fat levels of the milk samples collected from goats fed with TEST and CONTROL diets were estimated using an electronic milk tester. The total protein levels of milk samples were analyzed using Biuret test. Fatty acid profile of milk was analyzed by gas chromatography (GC) using GC column: CP-Sil 88 (100m x ID 0.25 mm x OD 0.29 mm x film thickness 0.2fYm). The injector-temperature (T): 220 °C and FID-T: 240 °C. The oven T was ramped as follows; 100 °C to 130 °C at 30 °C/min (hold 10 min), 130 °C to 170 °C, 50 °C/min (hold 20 min) and 170 °C to 200 °C at 100 °C/min (hold 20 min). The specific fatty acid peak in the chromatogram was identified and verified using authentic standards.

The results were analyzed using unpaired t-test (GraphPad Software Inc., CA). Results were expressed as group means SEM (standard error of mean). Differences were considered statistically significant at $P < 0.05$.

Results

The total fat and protein levels were comparable in CONTROL and TEST groups (Table 1). The CLA level was significantly higher ($p<0.05$) in TEST group compared to the CONTROL group (Table 2). Moreover, no significant difference was observed in the levels of linoleic acid (omega-6 series) and -linolenic acid (omega-3 series). The analysis of fatty acid profile revealed that conjugated trienoic fatty acid (-eleostearic acid) is possibly converted into conjugated dienoic acid (CLA) This shows that the conversion reported in monogastric animals also occurs in

Table 1. Total fat and protein levels in milk collected from two experimental groups

Constituent	CONTROL	TEST
Total Fat content (%)	6.34 ± 2.61	6.95± 2.55
Total Protein content (g/l)	29.38 ± 7.70	29.53 ± 5.76

The values are expressed as Mean ± SEM

Table2. CLA, linoleic acid and α-linolenic acid levels in goat milk fat from two experimental groups

	CLA (*c9, t11*) % (w/w) of total fatty acids	Linoleic acid % (w/w) of total fatty acids	α -linolenic acid % (w/w) of total fatty acids
CONTROL (n=6)	0.36 ± 0.04	1.96 ± 0.27	0.45 ± 0.07
TEST (n=7)	0.56 ± 0.06*	1.76 ± 0.24	0.48 ± 0.05

The values are expressed as Mean ± SEM. The value indicated by * is significantly different from the respective value in the same column at $p<0.05$.

ruminants.

Discussion

Previously, it has been revealed that in monogastric animals, the conjugated trienoic fatty acid present in bitter melon seeds is efficiently converted to *c*9, *t*11 isomer of CLA within their body (Jayasooriya, 2000). For the first time we report that the same results are obtainable in ruminants that have a complex stomach and a complex digestive process. Interestingly, this significant increase of CLA level in milk was observed with just 1% dietary level of bitter melon fat, which contains approximately 50% of -eleostearic acids in its fatty acid profile. Thus, these results indicate the potential of applying this novel method for the value addition of milk. It will be a great achievement, if the quality of milk can be improved by enhancing bioactive agents such as CLA in milk using a local material like bitter melon seeds.

Conclusion

Feeding of fat extracted from bitter melon seeds to goats enhanced the CLA content in their milk. Thus, this method can be applied for enhancing the nutritional quality of ruminant milk.

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