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CLAS (Conjugated Linoleic Acids) in Milk for Health

Chetan C. Chougale, , Abasaheb K. Paraden and Pranjali B. Meshram
Ph.D Research Scholar, Department of Animal Husbandry and Dairy Science, Mahatma Phule Krishi Vidyapeeth Rahuri-413722, Ahmednagar (MH)

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Introduction

There has been an increased demand of functional milk products in the past decades. Functional milk products contain some molecules which have biological effect in terms of health benefits to consumers. One such molecule conjugated linoleic acids (CLAs) present in milk has been attributed to reduce carcinogenesis, atherosclerosis, onset of diabetes and body fat mass. CLAS have been shown to alter body composition by increasing body muscle and reducing body fat by increasing the energy expenditure. In type II diabetes which is normally associated with obesity or overweight, there is evidence that CLAS may have the ability to normalize glucose metabolism. Major risk factor for coronary heart disease is abnormal level of fat in the blood, particularly high levels of low-density lipoproteins (LDL) cholesterol (bad cholesterol) In animal model a number of studies show potential benefits of CLAS in reducing serum triglycerides and low-density lipoprotein cholesterol. Importantly for CVD diseases, aortas of rabbits fed with CLA containing diet exhibited less atherosclerotic plaque formation (Lee et al 1994).

CLAS have been found to inhibit formation and growth of cancerous cells. CLAS inhibit chemically induced skin tumour, mammary and colon carcinogenesis when added to semi-synthetic diets (Belury et al, 1996; Ip of a 1991; Liew et al, 1995). Although clinical studies are limited but low risk of breast cancer is found to be associated with high intakes of CLAS. CLAS have been found to be associated with modulation of immune system animal model by decreasing the eicosanoid and histamine in production, cytokine synthesis and inflammation. CLAs are incompletely hydrogenated product by rumen microorganisms in ruminants. Bovine milk and milk products are among the richest dietary sources for humans. Conjugated linoleic acids (CLAs) represent a mixture of positional and geometric isomers of an 18-carbon fatty acid with two double bonds. The double bonds pairs in fatty acids generally have a methylene group between them but in CLAS they have a conjugated arrangement. Theoretically, a number of CLA isomers are possible that differ in the positions

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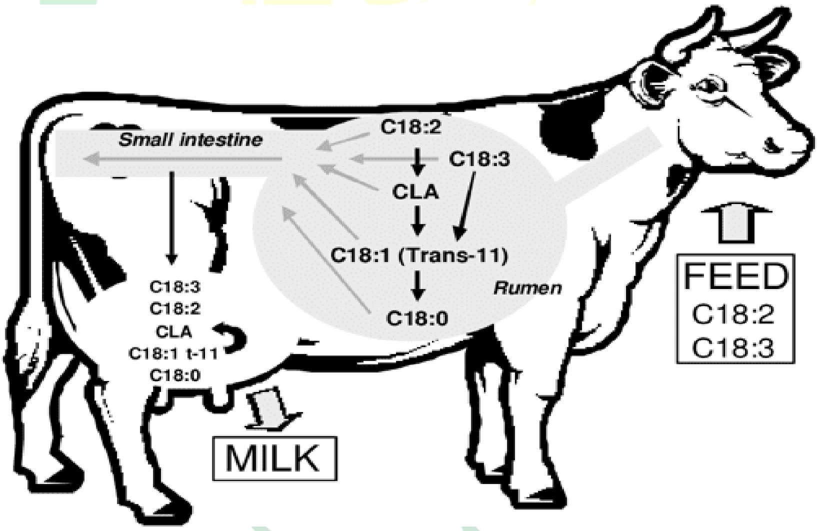
of the double bond pairs (e.g., 7-9, 8-10, 9-11, 10-12). Parodi (1977) was the first to demonstrate the presence of cis-9, trans- 11 CLA in milk fat. This is the major isomer and it represents about 75-90% of the total CLA in milk fat. This is of special importance because the cis-9, trans-11 CLA isomer has been shown to be anticarcinogenic in biomedical studies with animal models. The second most prevalent CLA isomer in milk fat is trans-7, cis-9 and its concentration in milk fat is about 10% of that for cis-9, trans-11. In addition, milk fat contains trans-10, cis-12 CLA. It is about 2% of the cis-9, trans-11 CLA content. The amount of CLA found in whole milk is generally about 4.5 to 5.5 mg/g fat (approximately 0.45 to 0.55%), although variation of as much as 2.5 to 18 mg/g fat has been reported. Breed, age of the dairy cow and stage of lactation may influence the milk CLA content to some degree. The CLA contents of milk and dairy products are little affected by processing, storage or cooking. The concentration of CLA in bovine milk varies quite substantially on the feeding strategy adopted. So diet manipulation to increase the CLA content of milk can be feasible. The various dietary manipulations suggested to increase CLA content of milk are as follows:



Supplementation of Oils Rich In

Linoleic or linolenic acid a number of reports have suggested that supplementation of plant oil rich in unsaturated fatty acids in cow diet will increase the CLA content of milk. Dhiman et al (1997) showed that free oils (rich in linoleic or linolenic acid) in the diets of dairy cows increased the CLA content of milk. Stanton et al (1997) reported that a supplement of full-fat rapeseed (high in oleic acid) caused a greater increase in CLA content of milk than did soyabean oil (high in linoleic acid). They found that rapeseed supplementation resulted in an increase of 650 g CLA/ kg milk over non-supplemented control. Two-fold increase in fat and CLA content were reported in milk from goats when 40 g rapeseed oil/kg diet was fed (Mir et al,in type II diabetes which is normally associated with obesity or overweight, there is evidence that CLAS may have the ability to normalize glucose metabolism.Jahreis et al (1996) reported that feeding dairy cows with increasing amounts of rapeseed oil (control 470 fat, treatment I 200 g oil, treatment II 400 g oil/ cow per d) correlated with elevated trans-fatty acid contents in milk fat from 202 g/100 g, total fatty acid in the control group to 304 and 4 4 g/100 g respectively. Kelly et al (1998) reported that feeding sunflower oil (high in linoleic acid) increased CLA concentrations to 2404 g/kg milk fat compared with values of 133 and 1607 g/kg fat for high-oleic (peanut oil) and high-linolenic acid oils (linseed oil), respectively. These studies suggested that, given an adequate dietary intake of linoleic acid, dietary constituents that provide rumen substrates for the optimal growth of bacteria producing linoleic acid isomerase would maximize CLA output. Feeding linseed oil (linolenic-rich) greatly increased CLA content in milk fat (Dhiman et al, 1997; Chouinard et al, 1998) and was shown to be as efficient sources of linoleic acid (Chilliard et al, 2000). Linolenic acid is not a precursor of CLA in the rumen and it has been suggested (Chilliard et al, 2000) that feeding linseed oil results in a large increase in the production of rumen trans-11-18:1, which can be used by the mammary gland for CLA synthesis. The CLA content of milk and cheese may also be increased by the addition of extracted soybeans and cottonseed to the diets of dairy cows. Dhiman et al (1999a) suggested that to make oil more readily available for digestion, the soybeans and cottonseeds can be processed through an extruder to rupture the seeds. Dhiman et al (1999b) reported that contents of CLA in milk and cheese were doubled from 0034 g/100 g fatty acid to 0069 g/100, fatty acid by the inclusion of full-fat extruded soybeans Full-fat rapeseed supplementation of diets to dairy com has been shown to increase CLA content of milk (Stanton et al, 1997).

Increased Pasture Feeding

Cows on lush spring pasture will have a milk fat contentof CLA that is 2 to 3 folds greater than corn based total mixed rations. However, as pasture matures, this difference decreases. The high content of CLA in milk from cow offered pasture has also been attributed to the linoleic acid content of the forage although the proportion of linoleic acid is low compared with linolenic acid (Garton, 1960). Jahreis et al (1997) reported that milk from cow grazing pasture had higher CLA content compared with cows offered maize silage and high-cereal-based concentrates. Increasing the proportion of grazed grass from pasture in the diet of dairy cows linearly increased the CLA content of milk (Dhiman et al, 1999a). Cows grazing on pasture permanently had five times more CLA compared with cows fed total mixed ration containing conserved forage-grain (50:50, w/w). Precht and Molkentin

Cows on lush spring pasture will have a milk fat content of CLA that is 2 to 3-fold greater than com based total mixed rations. In animal model a number of studies show potential benefits of CLAS in reducing serum triglycerides and low-density lipoprotein cholesterol. Importantly for CVD diseases, aortas of rabbits fed with CLA containing diet exhibited less atherosclerotic plaque formation.(1997) found that milk fat from cows consuming pasture contained a mean of 120 g CLA/kg milk compared with 405 g CLA/kg in milk from cows fed hay, silage and concentrates. Jahreis et al (1997) suggested that the reason that the CLA content in the milk from cows living indoors all year was low compared with pasture fed cows, was that the diet fed to these cows was low in polyunsaturated fatty acids, and therefore a deficiency of substrate for bio hydrogenation by rumen bacteria existed.

Lower Forage: Concentrate Ratio

Lower forage: concentrate ratios in dairy cattle diets have also been shown to increase CLA concentration in milk (Jiang et al, 1996). They were able to double the CLA content from 50 04 to 110 28 g/kg fat by feeding a higher concentrate: roughage ratio to dairy cows, without appreciably increasing the percentage milk fat. Forageto concentrate ratio can affect the biohydrogenation in the rumen environment. Kelly and Bauman (1996) found that the CLA levels in milk were halved when the forage concentrate ratio of the diet was changed from 50:50 to 20:80. Griinari et al (1999) showed that high concentrate diets could alter the products of rumen bio hydrogenation of polyunsaturated fatty acids resulting in an increase in the proportion of trans-10 C18:1 and trans-10, cis 12 CLA isomers.

Supplementation of Synthetic CLA

Dietary supplementation of synthetic CLA also increases CLA in milk fat. This supplement can be given as infusion to by-pass rumen fermentation process. Denatured protein coated fat containing CLA can also be given. It shows that supplements of CLA result in dose-related increase in the concentration of CLA in milk fat.

Conclusion

Increasing the concentration of CLA in dairy food is a possible way to hike CLA intake in the diet of human beings and obtain the potential health benefits of CLAS. There is a tremendous scope for increasing CLA concentration in milk and milk products by diet manipulation.Conjugated linoleic acids (CLAS) have been found to exhibit a numbercardiovascular diseases like hypercholesteremia andof beneficial health effect in obesity, type ii diabetes and many atherosclerosis. Dietary factors cause variation in the content of CLA in milk fat. So, there is a great opportunity to increase the concentration of CLA in dairy products by diet manipulation.