Metabolic effects of conjugated linoleic acid in humans: the Swedish experience

Ulf Risérus, Annika Smedman, Samar Basu, and Bengt Vessby

ABSTRACT
Conjugated linoleic acid (CLA) comprises a group of unsaturated fatty acid isomers with a variety of biological effects. CLA reduces body fat accumulation in animal models and has been ascribed significant effects on lipid and glucose metabolism. It has been suggested that the trans-10,cis-12 isomer is the active isomer with regard to antiobesity and insulin-sensitizing properties. The metabolic effects in humans are not well characterized. We have investigated and published the effects of CLA (given as the commercially available mixture and as the purified trans-10,cis-12 isomer) on anthropometry, lipid and glucose metabolism, and markers of lipid peroxidation. The results from those studies indicate that CLA might slightly decrease body fat in humans, particularly abdominal fat, but there is no effect on body weight or body mass index. There is no simultaneous improvement in lipid or glucose metabolism. Rather, the trans-10,cis-12 CLA isomer unexpectedly caused significant impairment of the peripheral insulin sensitivity as well as of blood glucose and serum lipid concentrations. In addition, CLA markedly elevated lipid peroxidation. Thus, the metabolic effects of CLA in humans seem complex, and further studies, especially of specific isomers and of longer duration, are needed.

KEY WORDS
Conjugated linoleic acid, CLA, abdominal obesity, lipid peroxidation, metabolic syndrome

INTRODUCTION
Countries where there is a high intake of dairy fat in the population are characterized by a high prevalence of coronary artery disease (1). Dairy fat is rich in saturated fatty acids that are known to elevate the serum cholesterol concentrations (2), impair insulin sensitivity (3), and probably increase the risk of thrombus formation (4), thus increasing the risk of coronary artery disease. Somewhat paradoxically, we found that a high proportion of dairy fat in the diet seemed to be associated with a beneficial metabolic profile when studied in 70-year-old men (5). One reason for this finding could be that a high intake of milk fat is part of a healthy lifestyle in elderly men. An alternative possibility is that milk fat might contain some metabolically active (protective) component which could counteract the other, less desirable properties of dairy fat. An interesting compound in this context is conjugated linoleic acid (CLA).

CLA comprises a group of unsaturated fatty acid isomers, present in milk fat and meat from ruminants, with a variety of biological effects when tested in vitro or in experimental animals. CLA reduces body fat accumulation in animal models (6, 7) and has been ascribed significant effects on lipid and glucose metabolism (8, 9). It has been suggested that the trans-10,cis-12 isomer is the active isomer with regard to antiobesity and insulin-sensitizing properties (9, 10). The metabolic effects in humans are, however, not well characterized.

The aim of our studies was to elucidate the metabolic effects of CLA in controlled studies in humans. In these studies we investigated the effects of the commercially available CLA product (a mixture of the 2 isomers cis-9,trans-11 and trans-10,cis-12 CLA in similar proportions) as well as purified preparations of the isolated isomers.

SUBJECTS AND METHODS
All studies were performed as controlled, randomized, double-blind parallel group studies with duration of 4–12 wk. The studies were approved by the ethics committee of the Medical Faculty of Uppsala University, and all data were obtained in accordance with the revised Declaration of Helsinki. CLA capsules were given as supplements containing 2.2–4.2 g/d of the CLA isomers, combined or in isolated form. The participants continued on their habitual diets, as monitored by dietary surveys before and during the studies. The adherence to the prescribed regimens was good, and no significant subjective or objective side effects were registered during the trials.

The effects of CLA were studied in 2 different groups of subjects. Initially, we studied a group of healthy women and men (11). The following studies (12, 13) were performed in abnormally obese men with metabolic syndrome, because we considered this group to be a more suitable and sensitive target group for CLA supplementation. Also, this group is prone to use commercially available supplements.

RESULTS

Effects of conjugated linoleic acid on body weight and body fat
None of the studies showed any effects by CLA on body weight or body mass index (BMI). There were, however, indications of a...
certain reduction of the proportion of body fat (especially abdominal fat) by CLA and \textit{trans}-10,\textit{cis}-12 CLA. Thus, body fat decreased by 3.8\% ($P < 0.001$, paired \textit{t} test) after 3 mo in a CLA-treated group of healthy men and women (11) with a borderline significant difference ($P = 0.05$, unpaired \textit{t} test) from the control group (−1.2\%). Body weight, BMI, and sagittal abdominal diameter (SAD) were unchanged. SAD is suggested to be the best simple anthropometric measurement of visceral fat. After 4 wk of supplementation of abnormally obese men (12) there was a significant decrease in SAD in the CLA group (−2\%; $P = 0.003$, paired \textit{t} test) compared with placebo ($P = 0.04$, unpaired \textit{t} test). A similar tendency was seen in a comparable group of men treated for 3 mo (13) with a reduction of SAD within both the CLA group (−3\%) and the group given the purified 10t,12c-CLA isomer (−3\%). When compared with the control group (−1.5\%), the difference between the groups did not quite reach statistical significance ($P = 0.07$, ANOVA).

The findings in our studies are well in line with findings of others, indicating a certain, but limited, effect of CLA on body fat without any effect on body weight or BMI (14). However, there seems to be no clear relation between body fat reduction and dosage or duration of supplementation.

\section*{Effects of conjugated linoleic acid on lipid and glucose metabolism}

The commercially available CLA mixture seemed to have little, if any, effect on lipid and glucose metabolism in humans. If anything, there was a tendency to a slight impairment of the little, if any, effect on lipid and glucose metabolism in humans.

There was no conflict of interest.

\section*{REFERENCES}

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