

Conjugated Linoleic Acid Reduces Body Fat in Healthy Exercising Humans

E THOM¹, J WADSTEIN² AND O GUDMUNDSEN³

¹PAREXEL Norway AS, PO Box 210, 2001 Lillestrom, Norway; ²Natural Ltd ASA, Oslo, Norway; ³Scandinavian Clinical Research AS, PO Box 135, 2027, Kjeller, Norway

This study was designed to investigate the efficacy and tolerability of daily conjugated linoleic acid (CLA) in healthy exercising humans. This was a randomized, double-blind, placebo-controlled study in 20 healthy humans of normal body weight and body mass index less than 25.0 kg/m², who did standardized physical exercise in a gym for 90 min three times weekly. Participants took either placebo (hydrogel) or CLA 0.6 mg, three times daily, as two capsules during meals,

for 12 weeks. Body fat, measured using near infrared light, was significantly reduced in the CLA group during the study, but not in the placebo group. No effects on body weight were observed. Tolerability was good and similar in the two groups. Compliance, as judged by the number of returned capsules, was more than 80% of the recommended dose for all participants. Thus CLA reduces body fat but not body weight in healthy exercising humans of normal body weight.

KEY WORDS: CONJUGATED LINOLEIC ACID, YOUNG HEALTHY HUMANS, REGULAR STRENUOUS EXERCISE, BODY FAT REDUCTION

Introduction

Congugated linoleic acid (CLA) is an active polyunsaturated fatty acid with unique properties. The effects of CLA on body composition have been studied in rats, mice, pigs, chickens and hamsters. All these studies show a reduction in body fat and a concurrent increase in lean body mass.¹⁻⁸ It has been shown that mice may develop lipodystrophy and fatty livers after CLA intake⁹ but this effect has not been observed in any other animal species or in humans.¹⁰

A number of controlled clinical studies in humans have been published investigating the effects of CLA on body composition.¹⁰⁻¹⁶ No significant changes in body composition were registered in three of these studies.^{11,13,16}

The other studies showed significant changes in body composition through fat reduction.^{10,12,14,15}

The aim of the present study was to investigate the efficacy and tolerability of a daily intake of 1.8 g CLA orally for 12 weeks in healthy exercising humans.

Subjects and methods

VOLUNTEERS

Twenty volunteers (10 females and 10 males), aged between 18 and 30 years, were included in the study. The participants were recruited from a health studio where they did regular physical training consisting of 90 min strenuous exercise, following a standardized programme three times per week. Volunteers were asked not to change

their diet and lifestyle during the study. All participants had a body mass index (BMI) of less than 25.0 kg/m² (Table 1). Before the start of the study, approval was obtained from the regional ethics committee and all participants signed an informed consent form. The study was conducted according to the current version of the Declaration of Helsinki, Good Clinical Practice and local regulations.

STUDY DESIGN

The study was randomized, double blind and placebo controlled with two parallel groups. The volunteers were randomized either to 0.6 g CLA three times daily, orally, or to placebo (hydrogel) by a simple block randomization procedure with gender as a stratification criterion. Two capsules of 0.3 g were taken during breakfast, lunch and dinner. Each volunteer received treatment for 12 weeks. The active capsules contained 0.5 ml oil, of which 60% was CLA (TonalinTM, Natural Ltd ASA), containing approximately equal amounts of the two isomers c9, t11-18:2 and t10, c12-18:2, and the rest was a mixture of linoleic, oleic and stearic oils. Amber hydrogel capsules of identical appearance were used as placebo. Active and placebo capsules were supplied by Natural Ltd ASA, Hovdebygda, Norway. Sample size calculations were not possible before the study started because, at that time, no studies of the effects of CLA in humans had been published. The present study was a pilot study.

ASSESSMENTS

Gender, height, weight and date of birth were recorded at baseline (Table 1). Body weight was registered on a balance beam medical scale to the nearest 0.1 kg. Stature was measured initially on a portable stadiometer to an accuracy of ± 0.5 cm with the volunteer barefoot, feet together and head facing forwards.

Measurements of body composition were carried out using near infrared light utilizing a Futrex 5000 A instrument (Futrex Inc.; Gaithersburg, WA, USA) with the midpoint of the biceps of the commonly used arm as the measuring site.^{17,18} All body composition measurements were done in triplicate and the mean was used in the statistical analysis. Body weight and body fat measurements were again recorded after 4, 8 and 12 weeks. Treatment compliance was checked by counting the number of returned capsules.

STATISTICAL ANALYSIS

Body weights and body fat contents are reported as means with standard deviations. All tests, both between groups and within groups, were carried out two-tailed with a significance level of 5%. SAS (version 6.0) software was used for all the statistical analyses.

Results

VOLUNTEERS

No significant differences were found between the two groups in baseline characteristics;

TABLE 1
Characteristics of the volunteers at baseline

	Placebo	Conjugated linoleic acid
Age (years)	28.0 (3.2)	27.5 (3.0)
Weight (kg)	72.0 (7.9)	71.0 (8.3)
Height (cm)	176.0 (20.0)	175.0 (18.9)
Body mass index (kg/m ²)	23.3 (2.5)	23.2 (2.4)

Values are means (SD) for groups of five men and five women.

namely, gender, age, weight, height and percentage body fat (Table 1). All participants completed the study according to the protocol and were included in the statistical analysis. They all met the compliance definition by taking more than 80% of the recommended dose.

EFFICACY

Body fat was significantly reduced in the CLA group after 4, 8 and 12 weeks but not in the placebo group ($P < 0.01$; Fig. 1). At all times (4, 8 and 12 weeks) the reduction in body fat differed significantly between the groups ($P < 0.01$; Fig. 1). The BMI reduction, however, was not statistically significant in either of the two groups during the treatment period. Neither was there any significant reduction in body weight in either group (Table 2). No gender difference was found in the effects of CLA on fat reduction ($P = 0.75$).

TOLERABILITY

None of the participants withdrew from the study due to adverse events. No serious adverse events were reported. Two participants reported transient gastrointestinal symptoms during the first week, one taking placebo and the other CLA. The symptoms disappeared with continuous treatment and without dose reductions.

Discussion

The results of this pilot study show a significant effect of CLA (1.8 g/day) on body fat in humans. These results are in accordance with other studies,^{10,12,14,15} but the effect obtained in this study is much more pronounced than that previously reported.¹⁰⁻¹⁵ The participants in the majority of these studies have been middle-aged and overweight or obese, except in one case¹⁴ in

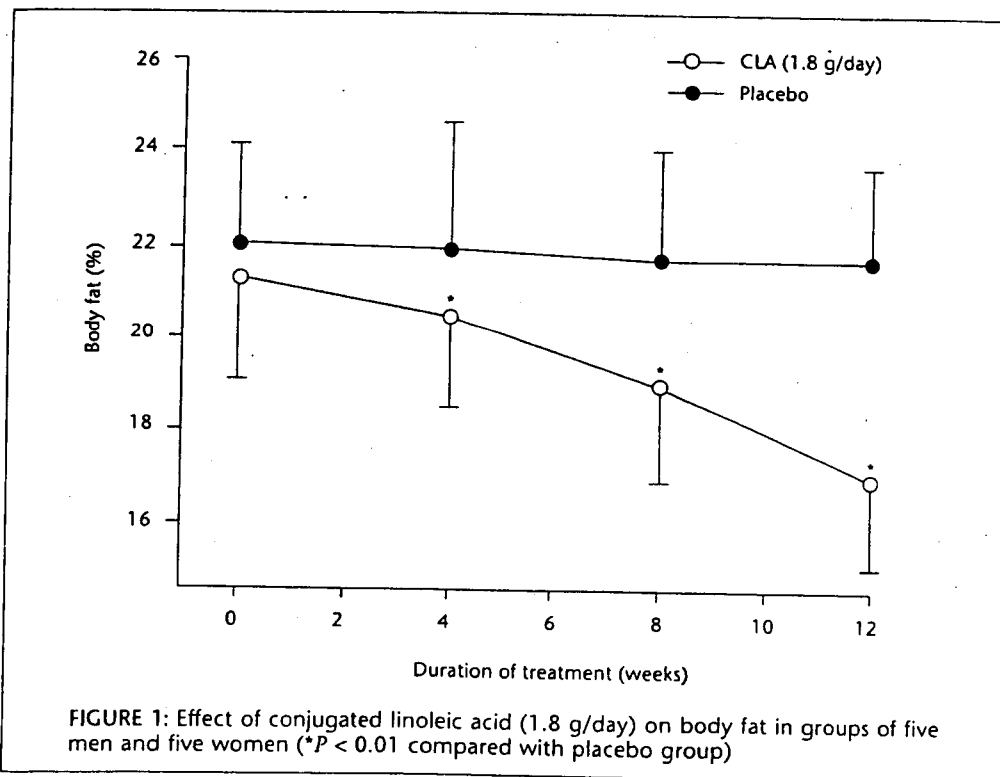


TABLE 2
Body weights of volunteers given 1.8 g conjugated linoleic acid daily compared with placebo controls

	Week	Placebo	Conjugated linoleic acid
Body weight (kg)	Baseline	72.0 (7.9)	71.8 (8.3)
	4	71.9 (8.5)	70.2 (8.0)
	8	72.0 (8.5)	70.0 (8.3)
	12	72.2 (7.6)	69.9 (8.0)

Values are means (SD) for groups of five men and five women.

which novice male body builders were studied. We have studied young, healthy humans doing a standardized physical exercise programme for 4.5 h per week and with a BMI of less than 25.0 kg/m² at the start of the study. The CLA preparations and the doses used in the different studies vary considerably. In the present study a daily dose of 1.8 g CLA was taken. This dose is approximately half of the most effective dose found by Blankson *et al.*¹² but the significant body fat reductions recorded are larger than those found by Blankson *et al.*¹² at the same daily dose. The difference in body weight and body fat mass between the study populations may partly explain these findings. The strenuous exercise performed by the participants in the present study may also have a positive influence on the effect of CLA.

In this study body composition was measured using the near infrared technique, which has been shown to be a simple and reliable method compared with other indirect methods such as bioimpedance, caliper and underwater weighing.^{17,18} Blankson *et al.*¹² used dual-energy X-ray absorptiometry to measure body fat mass and lean body mass. The choice of method in the present study did not allow

measurements of lean body mass, although, taking into consideration the fat reduction and the stable body weights in the study, an increase in lean body mass after CLA intake seems likely.

In summary, the present results support a body fat reducing effect of CLA and suggest that further studies should be done.

Acknowledgements

This study was supported by a grant from Natural Ltd ASA, Hovdebygda, Norway. We appreciate the help and support of Christian Arnesen at Kom i Form gym, Oslo, in making all the practical arrangements allowing us to carry out the study.

Conflict of interest

Erling Thom and Ola Gudmundsen are independent consultants who carried out the present study. Jan Wadstein, a medical advisor for Natural Ltd ASA, was involved in planning the study and interpreting the data, but was not directly involved in doing the study or in the statistical analysis. The present study does not constitute endorsement of the product by the authors.

• Received for publication 13 June 2001 • Accepted 25 June 2001

©2001 Cambridge Medical Publications

References

- 1 Azain MJ, Hausman DB, Sisk MB, Flatt WP, Jewell DE: Dietary conjugated linoleic acid reduces rat adipose tissue cell size rather than cell number. *J Nutr* 2000; 130: 1548 - 1554.
- 2 Dugan MER, Aalhus JL, Schaefer AL, Kramer JKG: The effect of conjugated linoleic acid on fat to lean repartitioning and feed conversion in pigs. *Can J Anim Sci* 1997; 77: 723 - 725.
- 3 Gavino VC, Gavino G, Leblanc MJ, Tuchweber B: An isomeric mixture of conjugated linoleic acid, but not pure c9, t11 octadecadienoic acid affects body weight gain and plasma lipids in hamsters. *J Nutr* 2000; 130: 27 - 29.
- 4 Ostrowska E, Mularitharan M, Cross RF, Baumann DE, Dunshea FR: Dietary conjugated linoleic acids increase lean tissue and decrease fat deposition in growing pigs. *J Nutr* 1999; 129: 2037 - 2042.
- 5 Pariza M, Park Y, Cook M, Albright K, Liu W: Conjugated linoleic acid (CLA) reduces body fat (abstract). *Exp Biol* 1996; 96: A3227.
- 6 Park Y, Albright KJ, Liu W, Storkson JM, Cook ME, Pariza MW: Effect of conjugated linoleic acid on body composition in mice. *Lipids* 1997; 32: 853 - 858.
- 7 Park Y, Albright KJ, Storkson JM, Liu W, Cook ME, Pariza MW: Changes in body composition in mice during feeding and withdrawal of conjugated linoleic acid. *Lipids* 1999; 34: 243 - 248.
- 8 West DB, Delany JP, Camet PM, Blohm F, Truett AA, Scimeca J: Effects of conjugated linoleic acid on body fat and energy metabolism in the mouse. *Am J Physiol* 1998; 275: R667 - R672.
- 9 Tsuboyama-Kasaoka N, Takahashi M, Tanemura K, Kim H-J, Tange I, Okuyama H, et al: Conjugated linoleic acid supplementation reduces adipose tissue apoptosis and develops lipodystrophy in mice. *Diabetes* 2000; 49: 1534S - 1542S.
- 10 Berven G, Bye A, Hals O, Blankson H, Fagertun H, Thom E, et al: Safety of conjugated linoleic acid (CLA) in overweight or obese human volunteers. *Eur J Lipid Sci Technol* 2000; 102: 455 - 462.
- 11 Atkinson RL: Conjugated linoleic acid for altering body composition and treating obesity. In: *Advances in Conjugated Linoleic Acid Research, Vol. 1* (Yurawecz MP, Mossoba MM, Kramer JKG, eds). Champaign, Illinois: AOCS Press, 1999; pp328 - 350.
- 12 Blankson H, Stakkestad J, Fagertun H, Wadstein J, Thom E, Gudmundsen O: Conjugated linoleic acid (CLA) reduces body fat mass in overweight or obese humans. *J Nutr* 2000; 130: 2943 - 2948.
- 13 Ferreira M, Kreider R, Wilson M, Almada A: Effects of conjugated linoleic acid (CLA) supplementation during resistance training on body composition and strength (abstract). *J Strength Cond Res* 1997; 11: 280.
- 14 Lowery LM, Appicelli PA, Lemon PWR: Conjugated linoleic acid enhances muscle size and strength gains in novice bodybuilders. *Med Sci Sports Exerc* 1998; 30: S182.
- 15 Vessby B, Smedman A: Conjugated linoleic acid (CLA) reduces the body fat content in humans. *Chem Phys Lipids* 1999; 101: AT2/01.
- 16 Zambell KL, Keim NL, van Loan M, Gale B, Benito P, Kelley DS, et al: Conjugated linoleic acid supplementation in humans: effect on body composition and energy expenditure. *Lipids* 2000; 35: 777 - 782.
- 17 Cassady SL, Duffy ML, Meler KM, Venleicher JM, Zimmerman JB: Reliability of near infrared body composition analysis. *Cardiopulm Phys Ther* 1996; 7: 8 - 12.
- 18 Conway J, Norris KH, Bodwell CE: A new approach for estimation of body composition; infrared interactance. *Am J Clin Nutr* 1984; 40: 1123 - 1130.

Address for correspondence

Dr E Thom

PAREXEL Norway AS, PO Box 210, 2001 Lillestrøm, Norway.

E-mail: erling.thom@parexel.com

10
C
We
coc
hoi
ant
dio
thy
neq
mu
in
me
hG
Ir
Th
(Al
gro
dis
im
in
dei
syn
dis
dis
wh
AP