Conjugated Linoleic Acid (CLA)

Pubmed (Medline), SPORTDiscus and the Cochrane Library were searched for all human studies published in peer reviewed journals from 2009 (last update) to November 2013. The terms: “Conjugated linoleic acid”, “CLA”, “Conjugated linoleic acid AND exercise” and “CLA AND Exercise” were used as key terms in all databases.

Inclusion criteria

- Human studies published in English
- Healthy subjects who were of a normal weight
- Original investigations assessing the use of Conjugated linoleic acid and exercise
- Incorporated the use of an indistinguishable placebo

Exclusion Criteria

- Studies assessing Conjugated linoleic acid in a combination with another supplement
- Studies assessing Conjugated linoleic acid in the older population (>65 years of age)
- Qualitative studies assessing supplement use in both the general and athletic population

After title and abstract review one original article (Marcaluso et al., 2012), which assessed the use of conjugated linoleic acid compared to placebo, was retrieved for review. Additionally, the most recent systematic review and meta-analysis article assessing the efficacy CLA for the treatment of obesity (Onakpoya et al. 2011) was retrieved. This article reviewed seven randomized, controlled, long-term (>6 months) trials in humans. The review did not “convincingly demonstrate that CLA intake generates any clinically relevant effects on body composition on the long term.” The relevant paper reviewed below (published in the last 5 years) does not change the outcome of the previous review paper and has been compiled with previous evidence to give an overview of current evidence of the efficacy of CLA up until November 2013.

Conjugated linoleic acid (CLA) includes a group of 18-carbon polyunsaturated fatty-acid isomers derived from linoleic acid (Cornish et al. 2009). The primary dietary sources of CLA are from ruminant animals and include meat, dairy produce and eggs (Lambert et al. 2007). In animal models, supplementation with CLA has demonstrated increased lean body mass, reduced fat mass, and improvements in lipid and glucose profiles (Salas-Salvado et al. 2006, Lambert et al. 2007, Cornish et al. 2009). The research in humans is limited and responses to CLA consumption appears to differ between species thus preventing extrapolation of data from animal studies to humans (Lambert et al. 2007).

Short term CLA Supplementation and Resistant Training

Macaluso et al. (2012) studied the effect of conjugated linoleic acid (CLA) supplementation on body composition and testosterone levels in vivo in the blood of 10 physically active male subjects before and after a resistance exercise bout. All participants had more than 2 years of resistance exercise training experience and had been training at least 3 times per week in the last year and were healthy. This study was conducted as a crossover, double-blind, placebo-controlled, clinical trial.
The subjects were randomized to groups receiving either CLA (7 opaque soft gel capsules of total 6g CLA) or placebo (PLA) (7 opaque soft gel capsules total 6 g of sunflower oil) both identical in taste and in appearance for 3 weeks. After 2 weeks of washout, the groups were switched and all subjects received the opposite substance for an additional 3 weeks. Before and after each supplementation period, the subjects underwent body composition analysis using an Inbody 320 bioelectrical impedance analyser, followed by a resistance exercise bout. Blood was drawn before (pre) and after (post) each resistance exercise to determine hormone concentrations (total testosterone, estradiol, and cortisol) and Sex Hormone Binding Globulin (SHGB) levels.

The resistance exercise bout consisted of 8 resistance exercises, each subject doing 3 sets of 8-10 reps at 75% of the subject’s one-repetition maximum and were completed three times per week. One minute of rest between each set and 2 minutes between each exercise were allowed for recovery.

During the 6 weeks (3 weeks x 2 times) of supplementation, the subjects were instructed to consume their regular diet, to maintain their usual training routine, and to maintain normal nocturnal sleep habits. No differences were observed during the study period in macronutrients ingested, training hours per session, and nocturnal sleep hours per night.

Three weeks of CLA supplementation did not cause any significant changes in total body weight or body composition in the subjects, indicating that supplementation for short periods (3-4 weeks) in combination with resistance exercise does not affect body composition.

In young healthy physically active men, CLA supplementation does not significantly increase testosterone synthesis or body composition after an unmarkedly stressful bout of acute resistance exercise.

**Long Term CLA Supplementation and Resistance Training**

Pinkoski et al. (2006) recruited 36 males and 40 females to participate in a seven week resistance training program. All exercises consisted of 3-4 sets of 4-10 reps at 75-90% of the subject’s one-repetition maximum and were completed three times per week. To ensure maximum muscle gains, the program was altered 3 times throughout the seven week testing phase. All participants consumed 5g of CLA or a placebo daily for the duration of the study.

Total body weight, percent body fat, lean body mass, fat mass, strength (leg and bench), peak torque for knee extensors, muscle thickness, respiratory exchange ratio, resting metabolic rate, urinary-3-methylhistadine, and N-telopeptide were measured at baseline and after seven weeks of training.

At the completion of the seven weeks of resistance training, 17 participants completed another seven weeks of resistance training, crossing over to the opposite supplement group after a two week washout. All outcome measures were reassessed after the washout period and at the completion of the second bout of resistance training.

The main findings of the initial seven weeks resistance training was a significant increase in lean tissue mass and reduction in fat mass. However, the changes in the CLA group were so small that the authors questioned their clinical significance even though statistically significant. After the second round of resistance training there were no significant changes identified for fat mass or
lean muscle mass in the CLA group, suggesting there was no benefit in regards to increasing lean muscle mass and decreasing fat mass in healthy, normal weight individuals.

Adverse effects were reported in both the CLA and placebo groups. Adverse effects reported from the CLA group included gastrointestinal upset, heartburn/reflux and nausea.

**CLA and Running**

Colakoglu et al. (2006) studied the effects of CLA supplementation alone and with aerobic training on endurance performance, body composition, serum lipids, leptin, and glucose levels in 44 healthy, normal weigh, active females. The participants were randomized into four groups: CLA only, CLA with exercise, exercise only or a control. Participants consuming the CLA ingested 3.6g of CLA daily for six weeks.

Subjects completed an incremental treadmill test to determine running velocities for 65% and 80% of the subject’s heart rate reserve which were then applied to the training sessions. Those subjects randomized into an exercise group participated in three running sessions per week of 30 minutes duration. The speeds at which participants ran were adjusted so that the subjects would be running till exhaustion at the end of each 30 minute bout. Therefore, running speeds were continually increased as the participant improved.

Anthropometric assessments of all participants were undertaken including: stature, waist and hip girths, body weight, fat mass and fat free mass. The last three measurements were completed with a Tanita BIA scale, and all measurements taken at baseline and after the six week intervention. Blood samples were also draw at baseline and upon completion of the study to assess glucose, total cholesterol, LDL, HDL, Apo A, Apo B, free fatty acids, leptin and insulin.

Results of the study were:

- Fat ratio, fat mass, and waist and hip girths were all significantly reduced in the experimental groups
- Fat free mass increased in the exercise plus CLA group and the CLA only group when compared to the control
- Body weight decreased in the CLA group when compared to baseline
- Significant reductions in serum glucose were identified in the exercise plus CLA group and the CLA only group
- In the exercise plus CLA group insulin level were reduced
- As expected, endurance performance increased significantly in both exercising groups

The authors therefore concluded that CLA and exercise were effective in improving body composition and the effects were cumulative when used together. It was also concluded that CLA supplementation alone or in conjunction with exercise was effective in reducing serum glucose and insulin levels but ineffective in improving endurance performance.

Though the female participants were reported as active, we are unsure how active they were. Favourable body composition changes would be expected with the introduction with any form of exercise, and with the addition of three exhaustive bouts of running to the participant’s week, it would be expected that fat mass would decrease and fat free mass increase. We are unsure of the participant’s weekly physical activity habits and if dietary habits were altered during the six week
testing period. Further, tighter controlled research is therefore required to validate the results. The use of a more reliable method for assessing body composition is also desirable.

**CLA and Habitual Exercise**

Lambert et al. (2007) assessed the effect of ingesting 3.9g/day of CLA or a high-oleic acid sunflower oil (HOSF) in normal weigh, healthy males (n = 25) and females (n = 37) for 12 weeks. This study differs from the previous two in that there was no exercise intervention. All participants as an inclusion criterion exercised regularly (3 or more times per week for at least the previous six months), though we are unsure of the exercise activities they undertook on a weekly basis.

The subjects were randomized into two groups: CLA or HOSF and were assessed at baseline and at the completion of the 12 weeks for the following: visual analogue scale assessing hunger, fullness, satiety and prospective intake, prior to and for three hours following the ingestion of a standardized breakfast snack. Body composition was assessed by skinfold measurements, dual X-ray absorptiometry (DEXA) and computerized tomography (CT) and blood was withdrawn to assess glucose and lipid profiles, again at baseline and at the completion of the study. Finally, fasting resting metabolic rate, respiratory exchange ratio and respiratory exchange ratio during exercise were measured.

Participants met with a registered dietitian every two weeks to report any adverse effects, changes in training, eating or lifestyle and to assess pill compliance. The reported adverse effects in both the CLA and HOSF group included headaches, bloating, diarrhoea, flatulence, skin irritation and cold and flu like symptoms. The occurrence of these symptoms was not statistically significant between groups.

The findings from this study indicated that 3.9g CLA ingested daily for 12 weeks resulted in significantly favourable changes to plasma insulin and nonesterified fatty acid concentration in response to an oral glucose load. This suggests improved insulin sensitivity. No differences were identified in body composition with CLA supplementation.

The studies reviewed above which assessed the impact of CLA for reducing fat mass in normal weight individuals have found mixed results. Significant decreases in body fat in overweight or obese individuals have been identified, (Gaullier et al. 2004; Gaullier et al. 2005; Gaullier et al. 2007) but whether this alteration in body composition is transferable to healthy, normal weight individuals is yet to be conclusively determined. From these studies we can conclude:

1. CLA supplementation may alter body composition in humans by decreasing fat mass
2. CLA supplementation appears to decrease fasting blood glucose levels in healthy, normal weight humans
3. CLA may favourably affect plasma insulin and nonesterified fatty acid concentration in healthy, normal weight humans
4. CLA does not improve endurance performance
5. CLA does not increase muscle mass
6. There is insufficient evidence for the consumption of CLA as a method for decreasing fat mass in healthy, normal weight humans.
### Summary of CLA literature 2009-2013

<table>
<thead>
<tr>
<th>Reference</th>
<th>Subjects</th>
<th>Dose</th>
<th>Exercise Protocol</th>
<th>Change in Body composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pinkoski et al. 2006</td>
<td>36 males and 40 females who had experience with resistance training</td>
<td>5g CLA per day for 7 weeks</td>
<td>Whole body resistance training * 3-4 sets of 4-10 reps at 75-90% of the subject’s 1RM</td>
<td>Yes</td>
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<tr>
<td>Colakoglu et al. 2006</td>
<td>44 healthy, normal weigh, active females</td>
<td>3.6g CLA ingested daily for six weeks</td>
<td>Running * 3 x 30 minutes running sessions till exhaustion for 6 weeks</td>
<td>Yes</td>
</tr>
<tr>
<td>Lambert et al. 2007</td>
<td>25 males and 37 females who were healthy and of normal weigh</td>
<td>3.9g of CLA or a high-oleic acid sunflower oil per day for 12 weeks</td>
<td>Habitual exercise</td>
<td>No</td>
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<tr>
<td>Marcaluso et al. 2012</td>
<td>10 healthy, active males with 2-years’ experience of resistance exercise</td>
<td>6g CLA or 6g Sunflower oil for 3 weeks</td>
<td>Resistant exercise</td>
<td>No</td>
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