Human Clinical Study of Exogenous Ketone Supplements

Exogenous Ketones as an Adjunct to Low Calorie Diet on Metabolic Biomarkers, Fat Loss and Health

Double Blind, IRB Clinical Study of Four Different Groups consisting of One Placebo Group and Three Groups using Various Compositions of Real Ketones Exogenous Ketones Supplements on Weight Loss and Other Metabolic Markers

Conducted by The Center For Applied Health Sciences (CAHS)
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Background

Real Ketones has developed various proprietary exogenous ketone supplement formulas based on its patented Quad Ketone backbone technology for the purposes of accelerating weight loss, fat loss, enhancing lean to fat ratios, improving body composition and bolstering key metabolic markers for improving one's health. Real Ketones continues to invest significant funds into advancing the knowledge of the benefits of the daily ingestion of exogenous ketones and discovering the most efficacious formulas for its products.

Study Purpose

The purpose of this placebo-controlled, double-blind, IRB-approved clinical study is to determine the effects of three different Real Ketones exogenous ketone supplements on body weight and body composition and metabolic health during an 8-week diet program. Primary study goals were to determine:

- The effect of supplementation on changes in body composition (lean mass, fat mass), waist and hip girth, and body weight during an eight-week supplementation + diet program.
- The effect of supplementation through changes in serum markers of hepato-renal function (AST, ALT, BUN, creatinine, total bilirubin, alkaline phosphatase) as well as general cardiovascular health (heart rate, blood pressure) during an eight-week supplementation + diet program.
- The effect of supplementation through changes in uric acid, insulin, fasting blood lipids (cholesterol, triglycerides, HDL, LDL) and whole blood cell counts (hemoglobin, hematocrit, RBC, MCV, MCH, MCHC, RDW, differential white cell counts) during an eight-week supplementation + diet program.
- The effect of supplementation through changes in appetite, cravings for sweet foods, mental clarity, mood, and fatigue during an eight-week supplementation + diet program.
- The effect of supplementation through the incidence of adverse events and side-effects.

Study Design

- **Subject Selection -** After giving informed consent and being cleared for participation by passing a screening physical, 104 overweight, but not obese, recreationally active men and women (aged 18-45 years old) were randomly assigned to receive one of the ketone supplements or a placebo. The distribution of the 104 participants was distributed as Group A: n = 27; Group B: n = 24; Group C: n = 27; Group D: n = 26. ***No baseline differences between groups were identified***, indicating a successful randomization. Proper inclusion and exclusion criteria were established to normalize the study to healthy, overweight, but not obese individuals.
- **Testing Period -** All groups would undergo eight weeks of daily supplementation.
- **Diet –** All subjects were placed on a "Zone" type diet. The IRB study protocol diet called for a 500-calorie restriction below their estimated energy requirements. Subjects averaged 308 kcals per day less than their estimated energy requirements (via the Mifflin St. Jeor equation). The research dietitian met with each subject to explain the proper procedures for recording dietary intake and provided examples of the types of foods they could consume. Study results were achieved with ***only a reduction of 308 calories per day.***
- **Exercise –** The IRB study protocol called for an increase in habitual physical activity (30 min of walking exercise, 3 days per week) for study subjects. The results of the Framington Physical Activity measurement information confirmed the subjects ***DID NOT increase their habitual physical activity during the 8 weeks of the study.*** The study results were achieved without an increase in exercise activity.

- **Results Framework –** All subjects were tested for changes in body composition (DEXA) as well as general markers of health (heart rate, blood pressure, and comprehensive clinical chemistry panels of serum and plasma) before and after eight weeks of supplementation. ***The dietary intervention in this study was sufficient on its own to promote weight/fat loss and other metabolic changes.***

Study Methods

- Subjects were instructed to refrain from exercise for 48 hours and to fast for 12-hours prior to screening.
- Subjects were given a two-month supply of differing Quad Ketone exogenous ketones products, with the exception of the placebo group (Group A) that was provided a calorically equivalent substitute to the non-placebo groups (Groups B, C, and D). Subjects were blinded as to what product they received. Researchers were also blinded in all aspects of the study and in comparing the results of the four treatment groups.
- Subjects were familiarized to the experimental procedures used in the study prior to pre-supplementation/baseline testing.
- Physical activity levels and health history were determined using standardized questionnaires.
- Heart rate and blood pressure were measured using an automated sphygmomanometer.
- Standing height were determined using a wall-mounted stadiometer.
- Body weight were measured using a Seca™ Medical Scale.
- DEXA (GE Lunar) were used to measure body composition.
- Waist and hip girth were measured with an anthropometric tape measure.
- Metabolic Cart (Parvo Medics TrueOne 2400) were used to measure metabolic rate.
- Diet records were analyzed using Nutribase IX Nutrition Software, CyberSoft, Inc. (Phoenix, AZ).
- To replicate baseline testing conditions as closely as possible, subjects followed their previously recorded 3-day diet records, refrained from exercise for 48-hr, and fasted for at least 12-hr prior to post testing.
- To enhance study compliance, CAHS contacted subjects on a bi-weekly basis to remind them of their appointments, to reaffirm the importance of adhering to their prescribed diet and supplement program, and to answer any questions that they may have had.

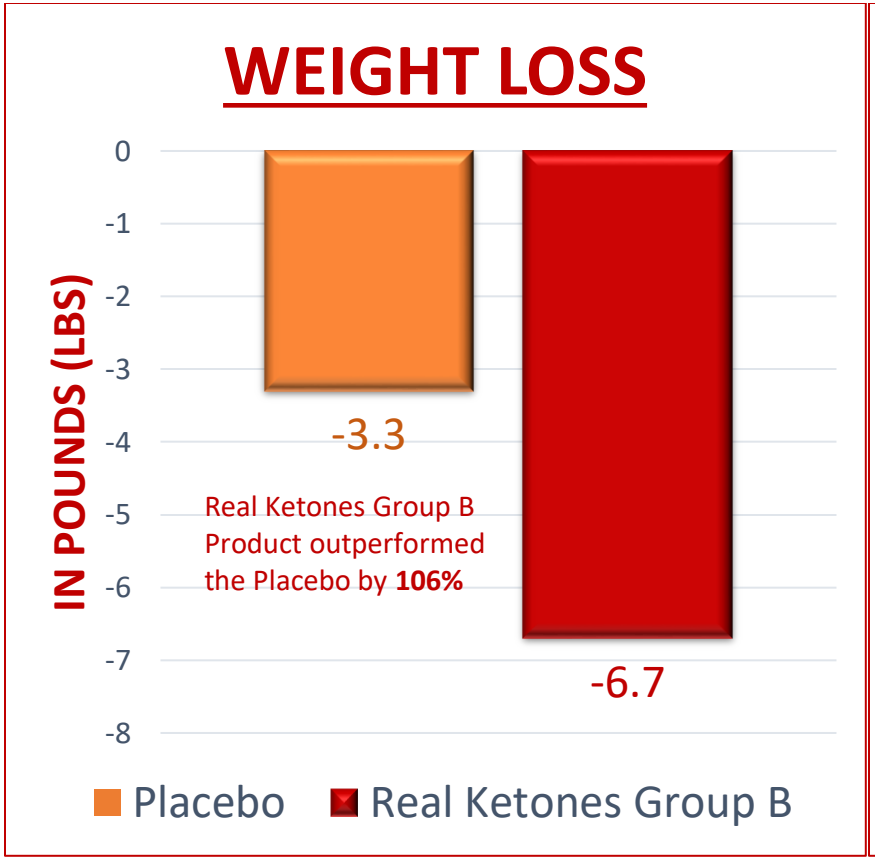
Key Study Findings

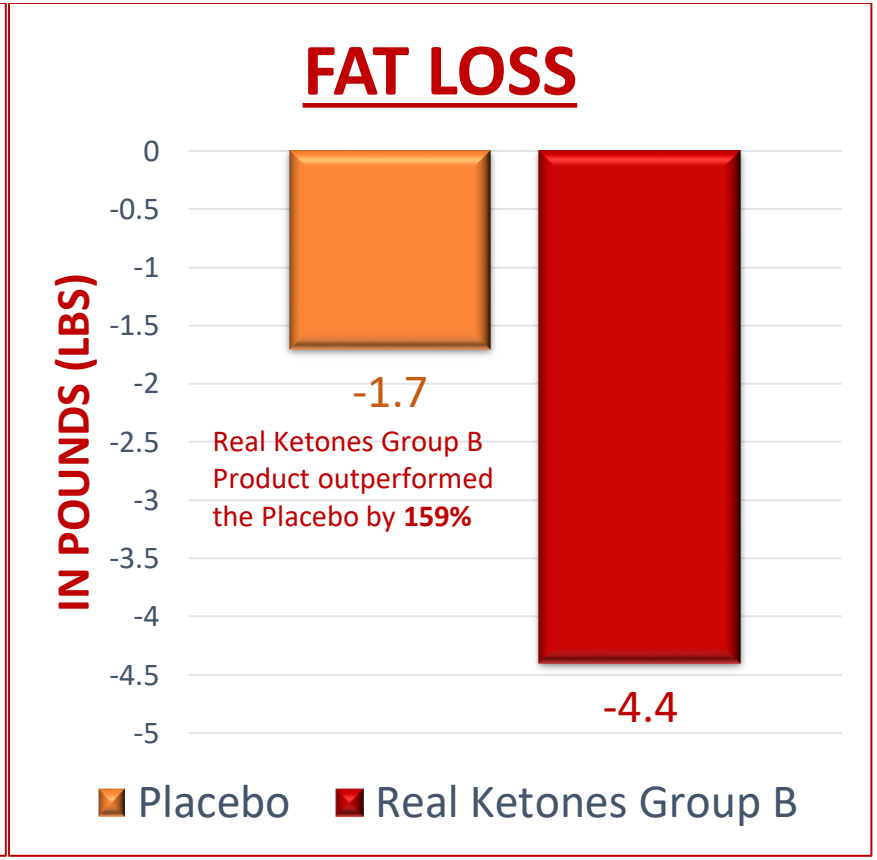
Researchers were able to determine which Real Ketones Quad Ketone product(s) garnered the greatest benefits with regard to both body composition and other metabolic markers results.

Body Composition Results

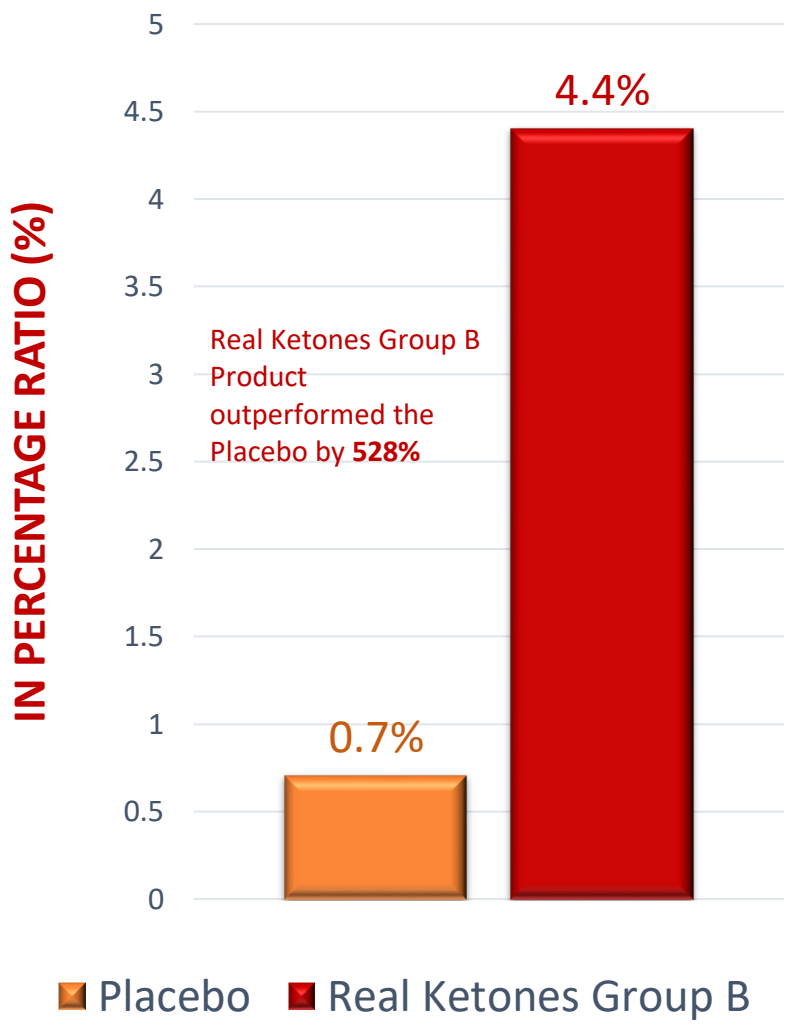
All three of the Quad Ketone Groups surpassed the results of the placebo in loss in Body Mass (Weight Loss), reduction of BMI, loss of Fat Mass, increase in the ratio of lean body mass to fat mass, and reduction in Hip Circumference. However, of the three different Quad Ketone supplements tested, Group B surpassed the results of both Group C, and Group D, in body composition results, specifically in its ability to significantly accelerate weight loss, fat loss, lean mass to fat mass ratio and reduction in hip circumference over the placebo group. This demonstrates Group B to be an extraordinary weight loss formulation.

With regard to the overall superior body composition benefits of Group B achieved the greatest results than the Placebo group as graphically shown below:

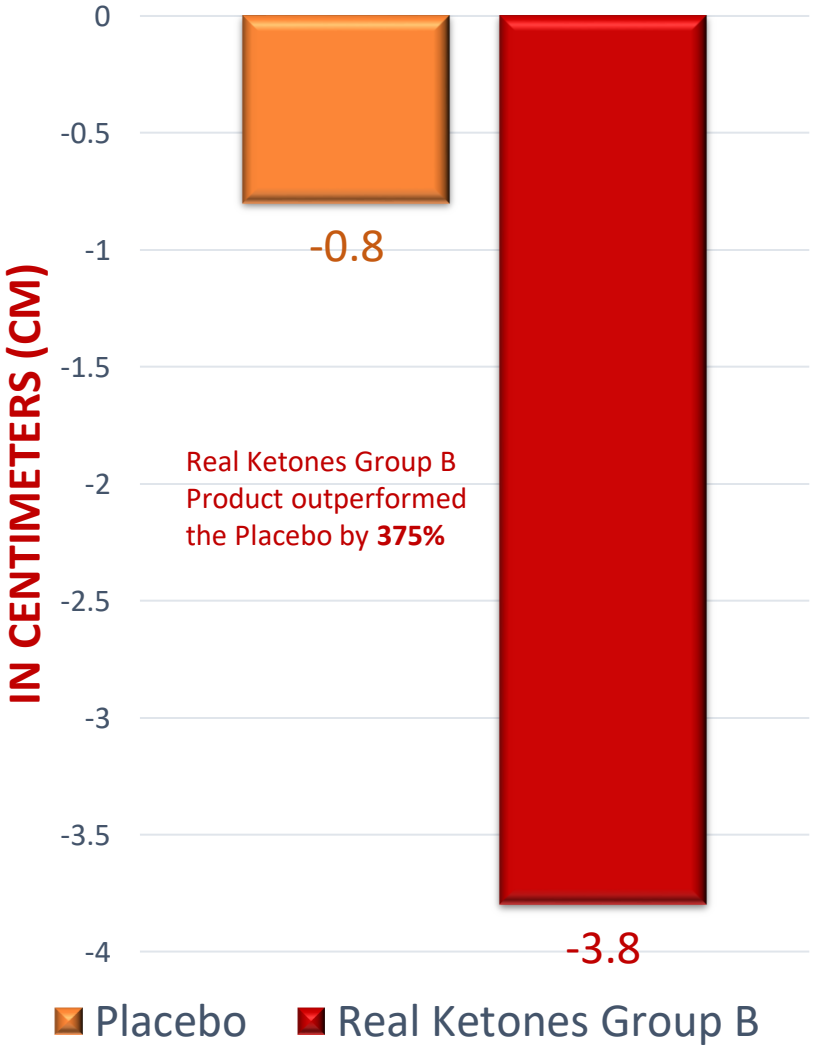

WEIGHT LOSS
IN POUNDS (LBS)
0
-1
-2
-3
-4
-5
-6
-7
-8
-3.3
-6.7
Real Ketones Group B Product outperformed the Placebo by 106%
Placebo
Real Ketones Group B


FAT LOSS
IN POUNDS (LBS)
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
-1.7
-4.4
Real Ketones Group B Product outperformed the Placebo by 159%
Placebo
Real Ketones Group B

LEAN TO FAT RATIO



HIP CIRCUMFERENCE



Metabolic Marker Results

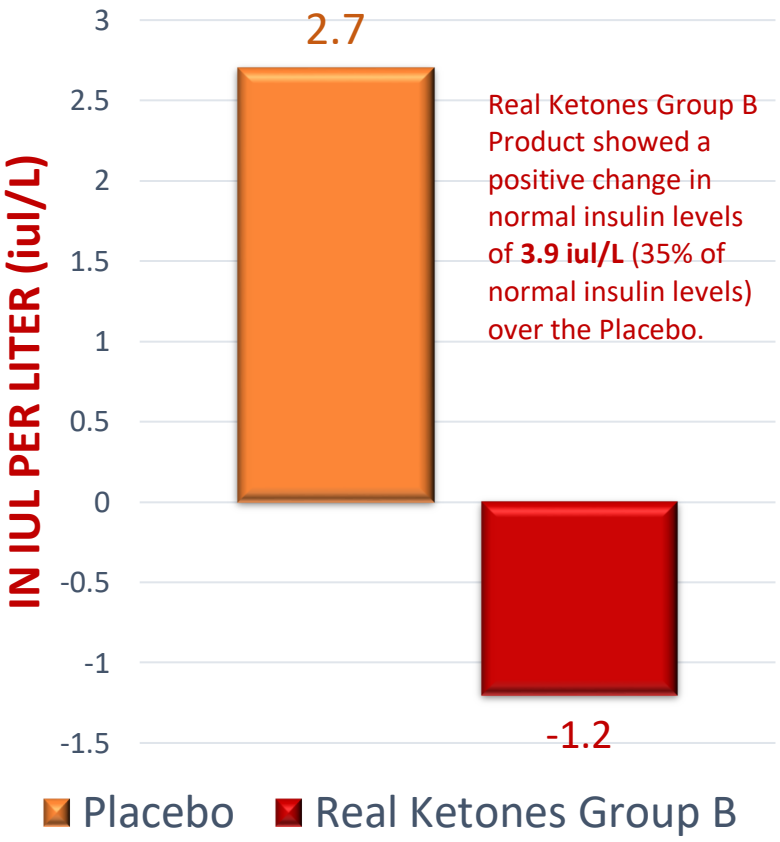
All three of the Quad Ketone supplementation Groups surpassed the results of the placebo in reducing plasma insulin levels. However, of the three different Quad Ketone supplements tested, Group B surpassed the results of both Group C and Group D in reducing plasma insulin levels. This has the appearance of trending towards helping someone control their blood glucose levels and in supporting a reduction in insulin insensitivity.

Two Groups, Group B and Group C showed a reduction in normal Total Cholesterol levels. However, of all the Groups, Group B surpassed the results of all groups reducing Total Cholesterol levels by as much as 5.0% of a subjects normal Total Cholesterol level. The medical community believes that a lower Total Cholesterol level is healthier than a higher Total Cholesterol level.

All Groups showed a reduction in normal LDL Cholesterol levels. However, of all the Groups, Group B surpassed the results of the placebo and both Group C and Group D in reducing normal LDL Cholesterol levels by as much as 6.9% of a subject's normal LDL Cholesterol level. LDL Cholesterol is referred to by the medical community in the literature as the "bad cholesterol."

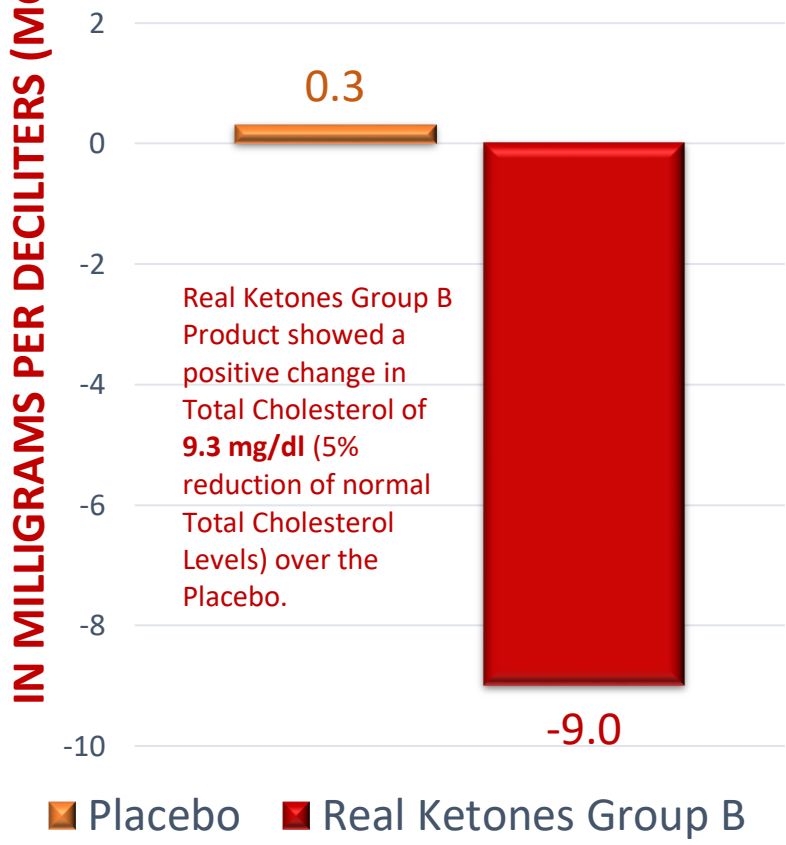
With regard to overall key metabolic markers, the benefits of Group B tested in this study showed significantly better results than the Placebo group as graphically shown below:

INSULIN LEVEL CHANGE

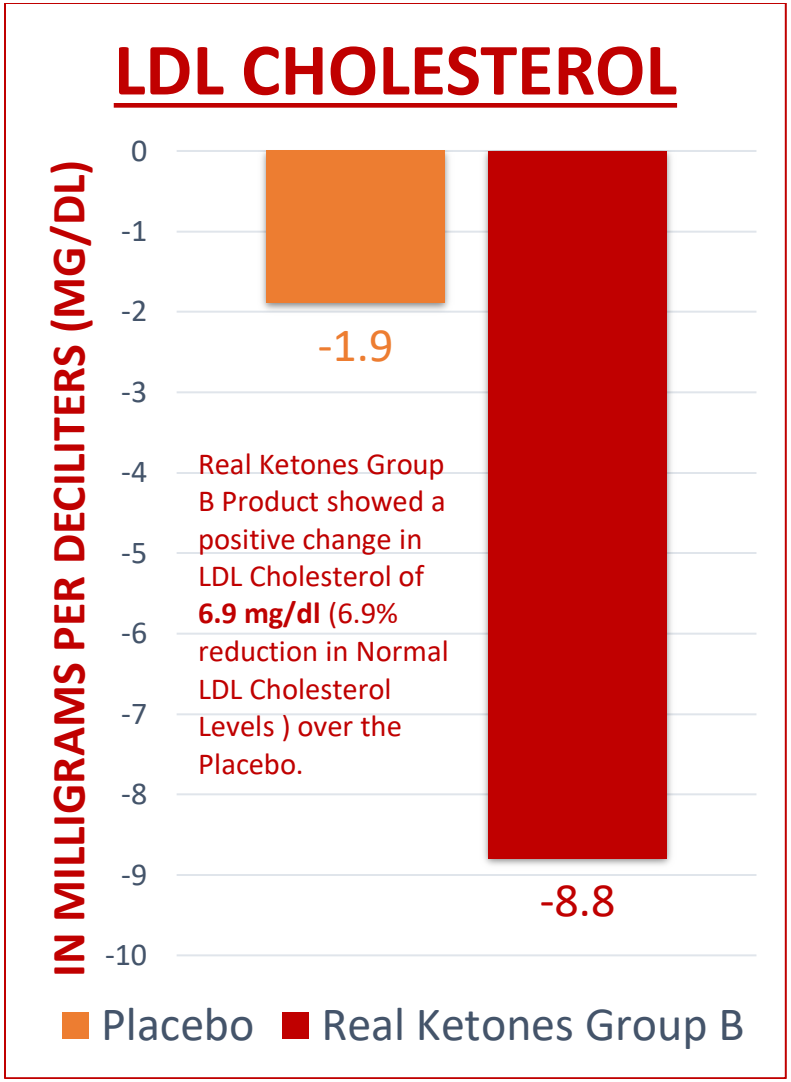


Real Ketones Group B Product showed a positive change in normal insulin levels of **3.9 iul/L** (35% of normal insulin levels) over the Placebo.

TOTAL CHOLESTEROL CHANGE



Real Ketones Group B Product showed a positive change in Total Cholesterol of **9.3 mg/dl** (5% reduction of normal Total Cholesterol Levels) over the Placebo.


LDL CHOLESTEROL
IN MILLIGRAMS PER DECILITERS (MG/DL)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-1.9
-8.8
Real Ketones Group B Product showed a positive change in LDL Cholesterol of **6.9 mg/dl** (6.9% reduction in Normal LDL Cholesterol Levels) over the Placebo.
Placebo
Real Ketones Group B