On Fat-Free Mass Change in Resistance-Trained Adults Effects of the Ketogenic Diet on Body Composition and Physical Performance

Researchers evaluated the physiological effects of ketogenic diets (alone or in combination with exercise) on human body composition and physical performance.

The authors synthesized evidence from 50 clinical trials involving competitive athletes, recreationally active individuals, untrained adults, and adults with overweight or obesity. They also conducted a focused meta-analysis of changes in measured lean mass in resistance-trained adults.

Ketogenic diets reduced body weight and fat mass in most trials while generally preserving maximal strength and power. Submaximal endurance was often maintained following keto-adaptation.

Initial pooled estimates suggested less favorable changes in measured fat-free mass (FFM). An exploratory sensitivity analysis indicated that glycogen and water depletion may partly explain these differences. Actual muscle tissue loss remains possible.



Study

Researchers from eCampus University, Magna Graecia University of Catanzaro, Sapienza University of Rome, and San Raffaele Roma University in Italy examined ketogenic diets in adults without major underlying health conditions to better understand their effects on body composition and exercise performance. The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines and was prospectively registered.

Potentially eligible studies were identified from PubMed/MEDLINE, Scopus, and the Cochrane Central Register of Controlled Trials (CENTRAL) databases from database inception through May 19, 2026, supplemented by citation tracking.

After screening titles, abstracts, and full-text articles, the researchers identified 50 eligible trials (33 randomized controlled trials [RCTs] and 17 non-randomized studies) for inclusion in the review.

Studies were grouped into four participant categories: Competitive athletes, recreationally trained adults, healthy untrained adults, and adults with overweight or obesity (body mass index [BMI] ≥ 25 kg/m^2).

Risk of bias was assessed using the Cochrane Risk of Bias 2 (RoB 2) and Risk Of Bias In Non-randomized Studies of Interventions (ROBINS-I) tools, while evidence certainty was appraised via Grading of Recommendations Assessment, Development and Evaluation (GRADE).

Differences in study design prevented the researchers from pooling data from all 50 trials. Following a narrative synthesis, they conducted a post hoc, focused random-effects meta-analysis of measured lean mass changes across six trials involving 121 resistance-trained adults.

Results

Across all four population groups, reductions in body weight and fat mass were more pronounced when participants on ketogenic diets had a greater caloric deficit than those on comparator diets. The review did not establish a clear advantage for ketogenic diets when energy and protein intakes were matched.

Participants' maximal strength and power were generally preserved, and submaximal endurance was often maintained after several weeks of dietary adaptation.

By comparison, high-intensity and repeated-sprint performance was often unchanged or impaired during glycogen-depleted protocols or after short periods of dietary adaptation.

The focused meta-analysis found that in resistance-trained adults, measured lean mass changes favored non-ketogenic diets by an average of 1.37 kg, but the certainty of evidence was low.

Fat-free mass includes muscle, bones, organs, connective tissue, and body water, so reductions do not necessarily indicate skeletal muscle loss. The pooled estimate combined related but distinct measures of lean tissue obtained using dual-energy X-ray absorptiometry (DXA) and bioelectrical impedance analysis (BIA). Neither technique directly quantified contractile muscle tissue.

Restricting the lean mass analysis to three randomized, energy-matched trials using DXA (65 participants) produced a similar estimated difference, but the result was no longer statistically significant.

When the researchers used measurements taken after participants in one trial resumed eating carbohydrates for a week, the pooled lean mass difference decreased from 1.37 kg to 0.62 kg and was no longer statistically significant. The change may reflect glycogen and associated water replenishment, a mechanism that requires confirmation.

Participants following ketogenic diets lost an average of 2.38 kg more body weight but achieved smaller gains in one-repetition maximum (1-RM) back squat strength. Differences in fat mass and bench press strength were not statistically significant.

In adults with overweight or obesity, pairing ketogenic diets with resistance or interval training and adequate protein (at least 1.6 grams per kilogram of body weight daily) appeared to limit reductions in measured lean mass.

Small samples, differences in dietary and exercise protocols, a shortage of long-term trials, and variations in body-composition assessment methods limited the review. None of the trials received an overall low risk-of-bias rating. Inconsistent reporting of adverse events and adherence limited the ability to draw firm conclusions about safety. Limited data also prevented the identification of sex-specific responses to ketogenic diets.

Conclusion

The review suggests that ketogenic diets paired with resistance training and sufficient protein can promote fat loss while generally maintaining maximal strength and often preserving submaximal endurance after adaptation. Gains in back squat strength and changes in measured lean mass favored non-ketogenic diets, but whether carbohydrate restriction limits actual muscle growth remains unclear.

Athletes should weigh the carbohydrate demands of high-intensity competition before adopting ketogenic protocols and account for glycogen-water shifts when interpreting body-composition scans.

Long-term randomized trials that standardize pre-scan hydration and carbohydrate refeeding and directly assess skeletal muscle mass and function are needed to clarify skeletal muscle adaptations during nutritional ketosis.

Source:

https://www.news-medical.net/news/20261117/Is-that-muscle-loss-on-keto-actually-water-loss.aspx