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Original Article

Effect of a 2-Month Very Low-Calorie Ketogenic Diet (VLCKD) Compared to a Standard Low-Calorie Diet (LCCD) on Deep Superficial Adipose Tissue in Obese Adults: A Randomized, Controlled Trial

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Abstract

Introduction: This study aims to compare the effects of a 2-month very low-calorie ketogenic diet (VLCKD) with a standard low-calorie diet (LCCD) on deep superficial adipose tissue (dSAT) in obese adults. The primary goal was to evaluate changes in dSAT and other anthropometric measurements, while the secondary objectives included assessing weight loss, fat mass (FM), and fat-free mass (FFM). ***Methodology:*** In this randomized controlled trial, 70 obese adults (35 in each group) were assigned to follow either the VLCKD or the LCCD for 2 months. dSAT was measured using ultrasound, and additional parameters, including body weight, waist and hip circumference, body fat percentage, and FFM, were recorded at the beginning and end of the study. ***Results:*** After 2 months, the VLCKD group showed a significantly greater reduction in dSAT (-3.86 mm) compared to the LCCD group (-2.88 mm) ($p < 0.05$). The VLCKD group also experienced a 12% decrease in body fat percentage, while the LCCD group showed a 9% reduction ($p < 0.01$). Both groups maintained similar levels of FFM, with no significant differences. ***Discussion:*** The VLCKD group demonstrated more substantial reductions in dSAT and body fat percentage compared to the LCCD group, suggesting that VLCKD may be more effective in reducing visceral fat. These findings indicate potential metabolic health benefits of VLCKD for obese individuals. Further research with longer follow-up periods is necessary to determine the sustainability and underlying mechanisms of these effects.

Keywords: ***Ketogenic diet, Obesity, Deep and superficial adipose tissue, Body composition, Weight loss.***

Introduction

The very low-calorie ketogenic diet (VLCKD) is an effective weight loss intervention that significantly reduces fat mass (FM) while preserving lean mass (FFM) in obese individuals. Ultrasound measurement of abdominal superficial adipose tissue (SAT), particularly in the deep compartment (dSAT), is indirectly correlated with visceral fat (VAT), providing an estimate of visceral fat levels. This study compares the effects of VLCKD and a standard low-calorie control diet (LCCD) on dSAT and other anthropometric parameters in obese adults. Secondary objectives included evaluating changes in weight loss (WL), fat mass (FM), and fat-free mass (FFM) over two months [1,2].

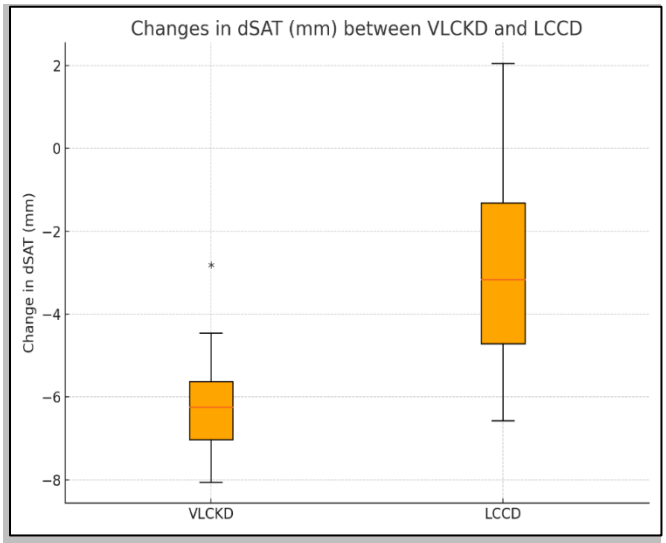
Method

This open, randomized controlled trial with a double-arm design involved 75 obese adults, who were randomly assigned to either the VLCKD group (n=35) or the LCCD group (n=35). Both groups adhered to their respective diets for a period of 2 months. Deep superficial adipose tissue (dSAT) was measured before and after the intervention using a validated ultrasound device. Additional measurements, including body weight, waist and hip circumferences, body fat percentage (via bioelectrical impedance analysis), and fat-free mass (FFM), were recorded at baseline and after the 2-month intervention. All data collection followed established protocols to ensure accurate and reliable results.

Results

At baseline, there were no significant differences in dSAT or body composition between the two groups. After 2 months, the VLCKD group showed a significantly greater reduction in dSAT (-3.86 mm) compared to the LCCD group (-2.88 mm) ($p < 0.05$). The VLCKD group experienced a mean relative weight loss of 7.79%, while the LCCD group had a slightly higher relative weight loss of 8.22% ($p < 0.05$). However, the reduction in body fat percentage was more pronounced in the VLCKD group, with an average decrease of 12%, compared to a 9% reduction in the LCCD group ($p < 0.01$). Fat-free

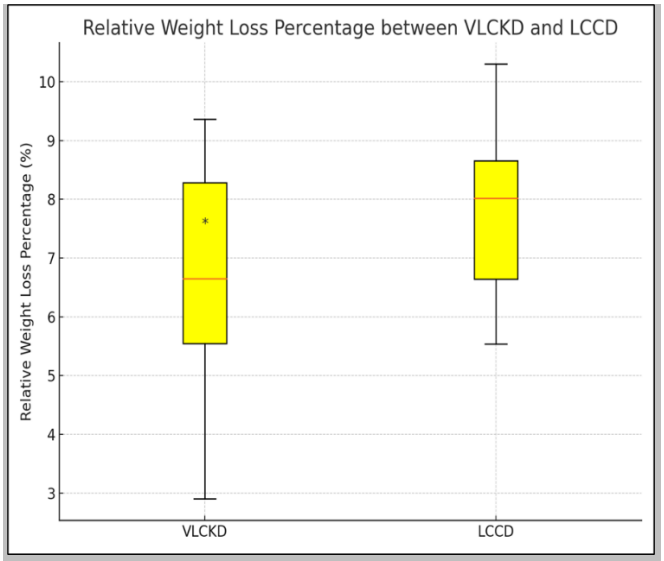
mass (FFM) was preserved in both groups, with no significant differences observed between them [5,6].



Source: Author's own data.

Figure 1: Reduction in Deep Superficial Adipose Tissue (dSAT) between VLCKD and LCCD groups. The VLCKD group showed a greater reduction in dSAT compared to the LCCD group.

Plot showing the reduction in dSAT for both groups, VLCKD and LCCD, at baseline and after 2 months.



Source: Author's own data.

Figure 2: Relative Weight Loss between VLCKD and LCCD groups.

The LCCD group showed a slightly higher relative weight loss than the VLCKD group, although not significantly.

Bar chart comparing the weight loss percentage for both groups.

Source: Author's own data.

Figure 3: Body Fat Percentage Reduction between VLCKD and LCCD groups. The VLCKD group had a greater reduction in body fat percentage than the LCCD group.

Line graph or bar chart showing the decrease in body fat percentage for both groups.

Discussion and Conclusions

The results suggest that the VLCKD group experienced a greater reduction in dSAT and body fat percentage compared to the LCCD group. Since dSAT is correlated with VAT, these results imply a potential reduction in visceral fat with VLCKD. The reduction in dSAT is particularly important, as visceral fat is associated with insulin resistance, metabolic syndrome, and cardiovascular diseases. Studies have shown that dSAT is a reliable surrogate for VAT, making it a crucial measure for assessing changes in visceral fat, which is a primary target in obesity management and metabolic health improvement [7,8].

Limitations

A major limitation of this study is the relatively short duration of the intervention (2 months). A longer follow-up period would be needed to assess the long-term effects of VLCKD on visceral fat and metabolic health. Without longer-term data, it remains unclear whether the observed changes in body composition are sustainable or if they have a lasting impact on overall metabolic health [9].

Conclusions

VLCKD was more effective than LCCD in reducing dSAT, body fat percentage, and improving body composition in obese adults over a 2-month period. Since dSAT correlates with VAT, these findings suggest that VLCKD may be an ideal dietary intervention for individuals aiming to reduce visceral fat and improve metabolic health. However, further studies are needed to assess the long-term effects of VLCKD on metabolic health and to identify the physiological mechanisms behind the reduction of visceral fat [10].

Declarations

Ethical approval

Not applicable.

Funding Statement

None

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

Availability of data and materials

Available on corresponding author upon responsible request.

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