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31 RESEARCH GRANT REPORT

Effects of Ketogenic Dietary Intervention on Anthropometrics, Body Composition, Metabolic Parameters, and Psychological Factors in Young Obese Population.

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Keywords: ketogenic diet, body composition, metabolic parameters, psychological factors, young obese

Introduction

Obese have a significantly higher Body Mass Index (BMI), which can be associated with poor nutritional intake and sedentary lifestyles. The ketogenic diet is a form of a dietary intervention that is often implemented for metabolic syndrome individuals such as obese populations. Ketogenic diet is described as high in dietary fat, adequate protein, and constricted numbers of carbohydrates to achieve heightened production of ketone bodies. Reasoning for ketogenic dietary intake for decreased carbohydrates are direct impacts on glycemia levels, which permits increased rate of fat mass loss.

Purpose

The purpose of this study was to investigate the effects of a ketogenic diet on anthropometrics, body composition, metabolic parameters, and psychological factors in young obese population.

Methods

Seven obese participants (n=7, height 174.8 ±10.9 cm, weight 105 ± 20.7 kg, BMI 34.6 ± 4.8 kg·m^{-2}) completed an 8-week intervention with a 70:20:10 ratio of fats to proteins to carbohydrates. Participants were provided three meals per day for 8 weeks. Three testing sessions were provided during the intervention. The first session allowed for familiarization of testing protocols and providing consent forms to participants. The second and third sessions were used to determine pre- and post-tests measurements. Weight (kg) and height (cm) were measured using a stadiometer beam scale (Health O Meter 420KL, Columbia, MD), and BMI was calculated. Flexible tape was used to measure both waist and hip circumferences, which were used to determine hip to waist circumference ratios.

Skin fold calipers were used to measure body fat percentage through the Jackson-Pollock 3-site method. Total ketone levels were recorded by urinary ketone test strips in every day for 8 weeks. A metabolic analyzer (Cardio Coach CO_2 Model 9002- CO_2) was used to measure resting metabolic rate (RMR) to determine caloric intake amounts and the respiratory exchange ratio for each participant. Participants were instructed to be in a fasted state for 8 hours before the urinary ketone and resting metabolic rate tests. The modified Bruce protocol treadmill test was used to measure relative maximal oxygen consumption (VO_{2max}) due to the physical constraints placed by participants being classified as obese. Psychological factors were measured by the Medical Outcomes Study Questionnaire Short Form 36 Health Survey. Statistical analyses were performed with IBM Statistical Package for Social Science (SPSS 27.0, SPSS Inc., Chicago, USA). All data was reported as mean and standard deviation (SD). Dependent paired t-Test was used to determine ketogenic diet intervention effects. Frequencies were used to measure results from psychological factors. Statistical significance was set a priori $p \leq 0.05$.

Results

Participants within the study noted significant reductions in anthropometric variables during 8 weeks: body mass (Pre:105.8 ± 20.5 kg Post:98.9 ± 18.8 kg, p= 0.000), BMI (Pre: 34.6 ± 4.8 kg·m^{-2}, Post:32.2 ± 4.2 kg·m^{-2}, p= 0.001), waist circumference (Pre:101.5 ± 13.9 cm, Post: 96.3 ± 13.3 cm, p= 0.000), and hip circumference (Pre:112.6 ± 11.5 cm, Post: 107.3 ± 10.8 cm, p= 0.000). Significant reductions were shown in body composition variables: body fat (Pre: 25.6 ± 0.8%, Post: 21.1 ± 1.4%, p=0.000), and lean body mass (Post: 78.9 ± 14.9 kg, Post: 78.2 ± 14.5 kg, p=.0035). Significant reductions were shown in metabolic parameters: systolic blood pressure (Post: 126.6 ± 10.0 mmHg, Post: 120 ± 6.6 mmHg, p=0.029), diastolic blood pressure (Pre: 81.7 ± 4.9 mmHg, Post: 76.3 ± 1.8 mmHg, p= 0.020), and VO_{2max} (Pre: 47.6 ± 8.9 mL·kg^{-1}·min^{-1}, Post: 51.8 ± 9.2 mL·kg^{-1}·min^{-1}, p=0.001. There were no significant changes in ketone bodies (p=0.090), resting metabolic rate (p=0.150), and resting heart rate (p=0.177). Overall, the psychological questionnaire measured quality of life factors such as feelings of energy, satiety, and emotional health. Questionnaire was recorded by weekly, pre- and post-intervention as well. Question 1 within the psychological questionnaire results shown a reduction in the negative aspect in poor health score, with a significant increase shown towards good health. Question 3g results shown that here was a significant increase in frequencies of improvement towards having no limitations regarding walking a one-mile distance. Question 9g had significant increase in individuals selecting improved overall energy levels in comparison to baseline.

Discussion and Conclusion

The 8 weeks of ketogenic diet intervention affected positively in anthropometrics, body composition, metabolic and psychological factors. The main finding was the reduction of total fat mass through bioenergetic pathways. During nutritional ketosis, the main source of energy production comes from the use of fat, high in density, as a primary fuel source versus normal reliance of carbohydrate consumption and conversion into glucose. In obese populations, changes in physical activity associated within a diet intervention may have a significant impact on body mass reductions. The primary impact of the ketogenic diet combined with the synergistic effect of increased physical activity can result in fluctuations to anthropometrics, body composition, metabolic parameters, and psychological factors. Total fat mass reductions allow for a reduction in overall weight and circumferences measures. Significant lean body mass reduction can be associated with the

adaptation process of consuming a ketogenic diet, along with no exercise training protocols combined with the dietary intervention. In metabolic parameters, significant changes were shown due to decreases in body mass that made to improve exercise capacity. No significant changes were shown in absolute resting metabolic rate, resting heart rate, and ketone bodies, which is typical of research with no training interventions. Relative resting metabolic rate ($L \cdot kg^{-1} \cdot min^{-1}$) was not shown significant changes due to the retention of total caloric expenditure with the decrease in body mass.

Significant changes noted in physical variables have a direct relationship on the influence of psychological factors. Psychological questionnaire values were represented by Likert scale indicating frequencies, allowing for a comparison of baseline, individual weeks, and post-intervention. Lowered scores were noted following implementing intervention, related to the decrease in overall energy and mental association with physical health. Following initial intervention adaptations, scores steadily increased until reaching initial values. Psychological questionnaires values improved in comparison to baseline values following completion of dietary intervention.

In conclusion, the 8 weeks of ketogenic diet intervention may contribute or change bioenergetics pathways and it results in significant adaptations on anthropometrics, body composition, metabolic parameters, and psychological factors in young obese population.

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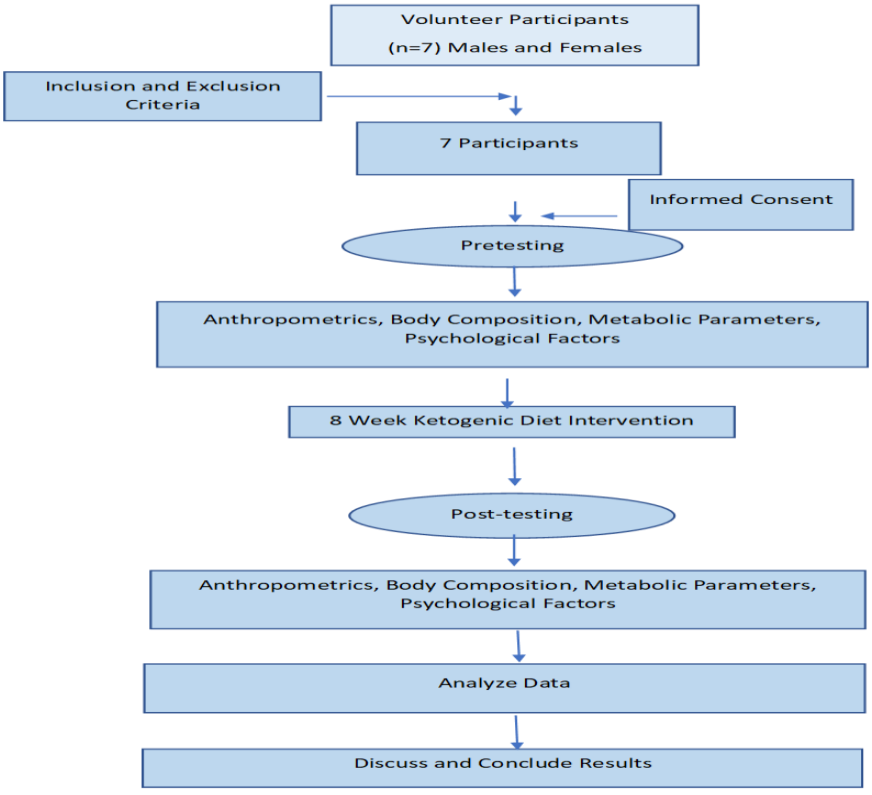

Figure 1. Study Design.

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