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Effect of ketogenic diet on biochemical and anthropometric parameters

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***Abstract*---** Objective: To find out the effect of a ketogenic Diet (KD) on the biochemical and anthropometric parameters. Methodology: This experimental study was conducted at the physiology laboratory of Khyber Medical University from January 2022 to June 2022. Using non probability convenience sampling, forty-six subjects were recruited for the study following the inclusion and exclusion criteria. Non-probability convenience sampling method was used. Subjects were given KD for twenty-eight days. Blood samples were collected for biochemical parameters along with anthropometric measurements on Day 1 and Day 29 of the study. Paired sample t test was used for pre- and post-trial comparison and ANOVA was used for comparison at day 0, and 29th day. Results: All the physical and chemical parameters like weight, body mass index, MUAC, biceps, Triceps, sub-scapular, waist circumference, hip circumference, fasting blood sugar, ketone level, glucose ketone index, body fat and water mass muscle mass reduced from 1st day to 29th day statically. Two parameters

(height and visceral mass) show an insignificant change in results from day 1st to day 29th. The change in mean value of visceral mass from day 1 (7.68±2.7) today 29 (7.31±2.85) was very low. Conclusion: In conclusion KD leads to significant reduction in the anthropometric measurements including weight, body mass index, after 4 weeks of intervention.

***Keywords*---**Methodology, ANOVA, measurements including weight.

Introduction

Keto diet (KD) diet is almost similar to low carb diet and Atkins diet. (1) In a ketogenic diet, there is less intake of carbs, and they are replaced by in-take of fats. When the amount of carbohydrates becomes limited in the diet, then the body produces energy from fats through ketone production instead of the normal mechanism of glucose production from carbohydrates. (2) Due to the production of ketones this mechanism is called ketosis and this diet is called a ketogenic diet. This diet burns the extra fat present in the body thus reduces weight and decrease the chances of obesity. By avoiding carbs, natural proteins and fats consumption are increased. Thus, a diet which contains less amount of carbs result in weight loss and eventually good overall health. Some people believe that increased intake of fats results in obesity, but it is the exact opposite in the sense that some fats are considered as good fatty acids which do not increase weight. (3) A ketogenic diet is a friend if we want to decrease our weight. Because by neglecting sugar and starch the level of insulin hormone also drops in blood, and as the function of insulin is to store fats so when the levels of insulin will drop it will result in high burning of fats instead of storage during energy need of body. (1) (4) (5)

Numerous research on the KD have been undertaken on overweight/obese patients with varying outcomes. Thus, the evidence assessing the effects of the KD on biochemical and anthropometric parameters is minimal. Anthropometric parameters include: weight, body mass index, MUAC, biceps, triceps, subscapular, waist circumference, and hip circumference. (6) The purpose of this study was to assess the effect of KD on biochemical and anthropometric parameters.

Methodology

This experimental study was conducted at the physiology laboratory of Khyber Medical University from January 2022 to June 2022. Using non probability convenience sampling, forty-six subjects were recruited for the study following the inclusion and exclusion criteria. Non-probability convenience sampling method was used. The age of the participants ranged between 25-45 years with BMIs ranging from 20 to 29.9 kg/m2. Any person with chronic disorders such as diabetes mellitus, high blood pressure, cardiac diseases and obesity etc. were excluded.

This study was carried out in these steps; firstly, a document including food items and beverages included in the ketogenic diet was prepared. Then mastered nutrition facts and size portion of food items, practiced windiet software and kitchen scale to measure nutrition values and to calculate the quantity of macronutrients respectively for preparation of ketogenic recipes. A 24-hour dietary recall questionnaire and daily caloric intake logbook was prepared. All the recipes were evaluated by "Windiet software" to calculate the macronutrient percentage of fats, proteins and carbohydrates in the diet for being 75%, 20% and 5% respectively.

A four-week meal plan was prepared. The recipes made from ketogenic food items contained meat (chicken, beef, fish), dairy products (cheese, butter, cream, ghee, yoghurt), high fat oil, low carb vegetables (green leafy plants, cabbage, tomato, onion, green bell pepper, spinach etc.), nuts and seeds (walnuts, almonds, sunflower seeds, peanuts, basil seeds). Instructions were given for the balanced consumption of nuts, seeds and oil.

Fasting blood sugar (FBS), renal function test (RFT) (such as blood urea nitrogen, serum creatinine), lipid profile (serum cholesterol and triglycerides, HDL & LDL-cholesterol levels), Liver function tests (albumin test, alkaline phosphate, alkaline transaminase and aspartate aminotransferase) was measured using Biotech micro lab 300 by colorimetry and fluorimetry method. HbA1c was measured using Biotech Getein1100 immunofluorescence Quantitative analyzer. Blood samples were collected for biochemical parameters along with anthropometric measurements on Day 1 and Day 29 of the study.

The data was first organized in Microsoft excel 2019. Furthermore, data was analyzed using SPSS version 26. Mean ± SD or Median was used to express further distribution of data. Paired sample t-test was done for the comparison of pre and post data analysis. Independent t test was used to compare continuous data between genders. ANOVA was also used to compare continuous data at 1st day and 29th day.

Results

The mean level of all dietary agents except starch was lower on day 29 than 1st day and all results were very highly statistically significant (P<0.001). Though the mean starch level reduced from 1st day (7.928±8.152) to 29th day (6.443±9.34) but results were statistically insignificant (P=0.419).

Gender based comparison of all the physical and chemical parameters like weight, body mass index, MUAC, biceps, Triceps, sub-scapular, waist circumference, hip circumference, fasting blood sugar, ketone level, glucose ketone index, body fat and water mass muscle mass reduced from 1st day to 29th day statically. Two parameters (height and visceral mass) show a insignificant change in results from day 1st to day 29th. The change in mean value of visceral mass from day 1 (7.68±2.7) to day 29 (7.31±2.85) was very low. **Table 1**

The weight was higher in males (82.0±7.7 Kg) than females (69.4±8.9 Kg) statistically (P<0.001). In the same way water mass, basic metabolic rate, muscle

mass, protein, and bone mass were higher in males than females statistically significant (P<0.005). Only body fat was more in females (37.39±4.34%) than males (27.80±4.24%). **Table 1**

Table 1: Comparison of baseline parameter among genders

Variable	Day 1st		Day 29		Day 1st	Day 29
	1st Female	Male	Female	Male	P-Value*	P-Value*
	Mean± SD	Mean ± SD	Mean± SD	Mean ± SD		
MUAC (cm)	29.30±3.43	30.07±2.02	27.3±3.06	28.9±1.7	.429	.067
Bicep's circumference (cm)	21.9±5.9	21.7±6.7	18.1±4.7	16.4±6.5	.889	.328
Triceps circumference (cm)	26.3±4.3	21.8±5.0	23.9±3.91	19.06±5.7	.003	.002
Subscapular circumference (cm)	28.9±4.5	26.3±7.7	24.6±4.5	21.9±7.4	.155	.140
Waist circumference (cm)	89.02±9.82	94.23±8.60	80.6±9.54	87.6±7.8	.088	.019
Hip circumference (cm)	107.35±9.67	105.73±6.86	100.8±9.3	100.5±5.7	.566	.930
Fasting blood sugar (mg/dl)	92.0±8.1240	91.3±8.78	86.6±8.9	83.9±10.1	.437	.366
Ketone level (mmol/L)	0.15±0.24	0.10±0.05	1.2±1.03	1.6±1.28	.802	.352
Glucose ketone index	43.01±16.48	40.61±17.23	8.2±7.4	9.8±14.3	.433	.616
Body fat (%age)	37.39±4.34	27.80±4.24	35.83±4.5	23.7±3.8	<0.001	<0.001
Water mass (Kg)	44.3±2.9	49.6±2.7	45.49±2.98	52.12±2.75	<0.001	<0.001
Basic metabolic rate	1326.3±85.7	1672.2±144.7	1291.9±76.73	1641.6±90.9	<0.001	<0.001
Muscle mass (Kg)	40.5±3.9	55.9±5.4	39.5±3.23	55.5±3.3	<0.001	<0.001
Protein	14.3±1.3	18.4±1.9	14.5±1.4	19.9±1.3	<0.001	<0.001
Bone mass (Kg)	2.5±0.2	3.0±0.2	2.4±.198	2.9±0.17	<0.001	<0.001

*mid-upper arm circumference
*paired t test

Discussion

This study was aimed to find out the effect of a 4-week ketogenic diet on biochemical and anthropometric parameters. In the anthropometric assessment there was a reduction in weight, body mass index, MUAC, biceps, triceps, subscapular, waist circumference, and hip circumference after use of KD. Bioelectrical Impedance Analysis (BIA) is an approach for the assessment of body composition. Using the BIA technique, we calculated BMI, body fat, protein, water content, muscle and bone mass, visceral fat percentage and basic metabolic rate of the body through the MI Body Composition Scale using MI Fit Application.

In the anthropometric assessment there was a reduction in weight, body mass index, after use of KD. A systematic review was showed that the use of KD for more than 3 weeks duration can lead to a modest reduction in weight, BMI and fat percentage while maintaining fat-free mass. (7) These results are consistent with the current study.

It appears that a non-calorie-restricted KD can be used for optimizing BM and body composition. (8) Literature suggests that KD might be an alternative dietary approach to decrease fat mass and visceral adipose tissue without decreasing lean body mass. (9,10) Individuals using ketogenic diet experience fast weight loss in the initial 4 weeks or less. It is interesting to know, with KD lean body muscle is not affected. (11)

Urbain et al. (12) conducted a study of 6 weeks duration on the effect of KD on physical fitness, body composition and biochemical parameters in healthy adults. Their study results are consistent with our study. Their study shows that KD has a role in reduction of anthropometric measurements. Although, there is a substantial body of evidence on the effectiveness of low-carbohydrate diets for weight loss, the precise biological mechanisms underlying the effect of KDs on weight are not completely understood. (13)

Our study also reports a gender-based difference comparison of baseline parameter. All the anthropometric and biochemical parameters are compared between males and females and their readings are taken at day a1 and day 29 of the study. The comparative analysis along with the significant variables is given in **Table. 1.** There exists a gender based difference in the anthropometric parameters. (14). The results of our study corroborates with a study that reports a gender linked difference in terms of excess body weight loss. Men seem to benefit more from KD in comparison to women. (15)

Conclusion

In conclusion KD leads to significant reduction in the anthropometric measurements including weight, body mass index, after 28 days of dietary intervention.

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