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COMPARATIVE EFFICACY OF DIET AND EXERCISE PROTOCOLS IN IMPROVING ANTHROPOMETRIC PARAMETERS AMONG PREDIABETIC INDIVIDUALS OF CHH. SAMBHAJINAGAR REGION

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Abstract:

Background: Prediabetes is a significant risk factor for the development of type 2 diabetes mellitus (T2DM). Lifestyle interventions, including dietary modifications and increased physical activity, have been established as the "gold standard" for the prevention of T2DM. This study aims to compare the effects of diet and exercise protocols, alone and in combination, on anthropometric parameters in individuals with prediabetes.

Methods: This was a randomized controlled trial conducted at the Deogiri Diabetes Care Centre in Chh. Sambhajinagar, India. A total of 360 individuals with prediabetes were randomly assigned to three groups: diet protocol (n=120), exercise protocol (n=120), and a combination of diet and exercise (n=120). The intervention period was 12 months, and anthropometric (body mass index, waist-to-hip ratio, and neck circumference) parameters were assessed at baseline and at 3-month intervals.

Results: All three intervention groups showed significant improvements in anthropometric parameters over the 12-month period ($p<0.05$). The combination of diet and exercise protocol demonstrated the most favourable outcomes, with greater reductions in body mass index, waist-to-hip ratio, ($p<0.001$) compared to the diet or exercise groups alone.

Conclusion: Lifestyle interventions, particularly the combination of a structured diet and exercise protocol, are effective in improving anthropometric parameters among individuals with prediabetes. This study provides evidence for the implementation of comprehensive lifestyle modification programs as a strategy for the prevention of type 2 diabetes.

Keywords: Prediabetes, Diet, Exercise, Anthropometric parameters, Type 2 diabetes prevention.

Introduction:

Prediabetes is a condition characterized by impaired fasting glucose (IFG), impaired glucose tolerance (IGT), or elevated glycated haemoglobin (HbA1c) levels, which indicates an increased risk of progression to type 2 diabetes mellitus (T2DM) [1]. The American Diabetes Association (ADA) defines prediabetes as having a fasting plasma glucose (FPG) level between 100 and 125 mg/dL, a 2-hour plasma glucose level during an oral glucose tolerance test (OGTT) between 140 and 199 mg/dL, or an HbA1c level between 5.7% and 6.4% [2].

Numerous large-scale clinical trials, such as the Diabetes Prevention Program (DPP), have established that lifestyle modifications, including dietary changes and increased physical activity, are effective in preventing or delaying the onset of T2DM in individuals with prediabetes [3,4]. Nutritional interventions contribute to weight loss, which appears to be the primary driver for reducing the risk of diabetes [5]. Additionally, regular physical activity, including both aerobic and resistance exercises, has been shown to improve glycaemic control, enhance insulin sensitivity, and attenuate muscle mass loss [6,7].

However, the comparative effectiveness of diet and exercise protocols, alone and in combination, on anthropometric parameters in individuals with prediabetes remains an area of active research. This study aims to investigate the comparative efficacy of diet and exercise protocols, alone and in combination, on improving anthropometric parameters among individuals with prediabetes.

Materials and Methods:

Study Design and Participants: This randomized controlled trial was conducted at the Deogiri Diabetes Care Centre in Chh. Sambhajinagar, India, in collaboration with Dr. Babasaheb Ambedkar Marathwada University, Chh. Sambhajinagar. The study protocol was approved by the institutional ethics committee, and all participants provided written informed consent.

Individuals aged 30 to 60 years with prediabetes, as defined by the ADA criteria (FPG between 100 and 125 mg/dL, 2-hour OGTT between 140 and 199 mg/dL, or HbA1c between 5.7% and 6.4%), were eligible for inclusion. Eligible participants were randomly assigned to one of three intervention groups: diet protocol (n=120), exercise protocol (n=120), or a combination of diet and exercise (n=120). The study duration was 12 months, with assessments performed at baseline and every 3 months.

Interventions:

Diet Protocol: Participants in the diet protocol group received personalized dietary recommendations based on their individual energy requirements and dietary preferences. The diet plan aimed to promote a caloric deficit of 500-750 kcal/day, with a macronutrient composition of 50-60% carbohydrates, 15-20% protein, and 20-30% fat. Participants received regular counselling and support from a registered dietitian throughout the study period.

Exercise Protocol: Participants in the exercise protocol group were prescribed a structured exercise program consisting of both aerobic and resistance training. The aerobic component involved 150 minutes of moderate-intensity physical activity (such as brisk walking) per week, while the resistance training component involved 2-3 sessions per week, focusing on major muscle groups.

Combination Protocol: Participants in the combination protocol group received both the diet and exercise interventions as described above.

Outcome Measures:

The primary outcome measures were changes in anthropometric parameters, including body mass index (BMI), waist-to-hip ratio (WHR), and neck circumference (NC).

Statistical Analysis:

Data analysis was performed using SPSS software (version 25.0). Continuous variables were reported as mean ± standard deviation. Repeated-measures ANOVA was used to assess the changes in anthropometric parameters within and between the intervention groups over the 12-month period. Post-hoc analyses with Bonferroni correction were used for pairwise comparisons. A p-value <0.05 was considered statistically significant.

Results:

A total of 360 individuals with prediabetes were included in the study, with 120 participants in each intervention group. The baseline characteristics of the study participants were comparable across the groups (Table 1,2,3).

Anthropometric Parameters:

Table1: changes in anthropometric parameters (BMI) over the 12-month intervention period for the three groups: diet, exercise, and combination.

BMI (kg/m²)	Baseline	3 Months	6 Months	9 Months	12 Months	p-value
Diet	29.4 ± 2.8	28.9 ± 2.7	28.2 ± 2.6	27.5 ± 2.5	26.7 ± 2.4	<0.001
Exercise	29.7 ± 2.9	29.2 ± 2.8	28.7 ± 2.7	28.2 ± 2.6	27.6 ± 2.5	<0.001
Combination	29.6 ± 2.9	28.7 ± 2.7	27.8 ± 2.6	26.9 ± 2.5	26.4 ± 2.3	<0.001

Data are presented as mean ± standard deviation.

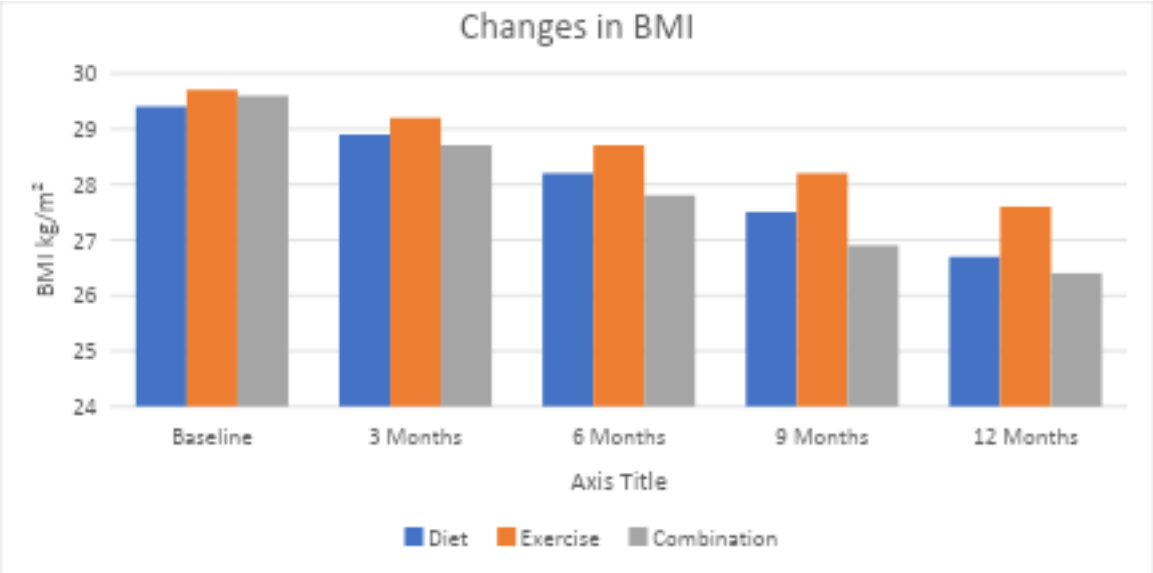

Figure 1: changes in Body Mass Index over the 12-month intervention period for diet, exercise, and combination groups.

Table2: changes in anthropometric parameters (WHR) over the 12-month intervention period for the three groups: diet, exercise, and combination.

WHR	Baseline	3 Months	6 Months	9 Months	12 Months	p-value
Diet	0.92 ± 0.03	0.91 ± 0.03	0.89 ± 0.03	0.88 ± 0.03	0.88 ± 0.03	<0.001
Exercise	0.93 ± 0.04	0.92 ± 0.03	0.91 ± 0.03	0.90 ± 0.03	0.90 ± 0.03	<0.001
Combination	0.93 ± 0.04	0.91 ± 0.03	0.89 ± 0.03	0.88 ± 0.03	0.88 ± 0.03	<0.001

Data are presented as mean ± standard deviation.

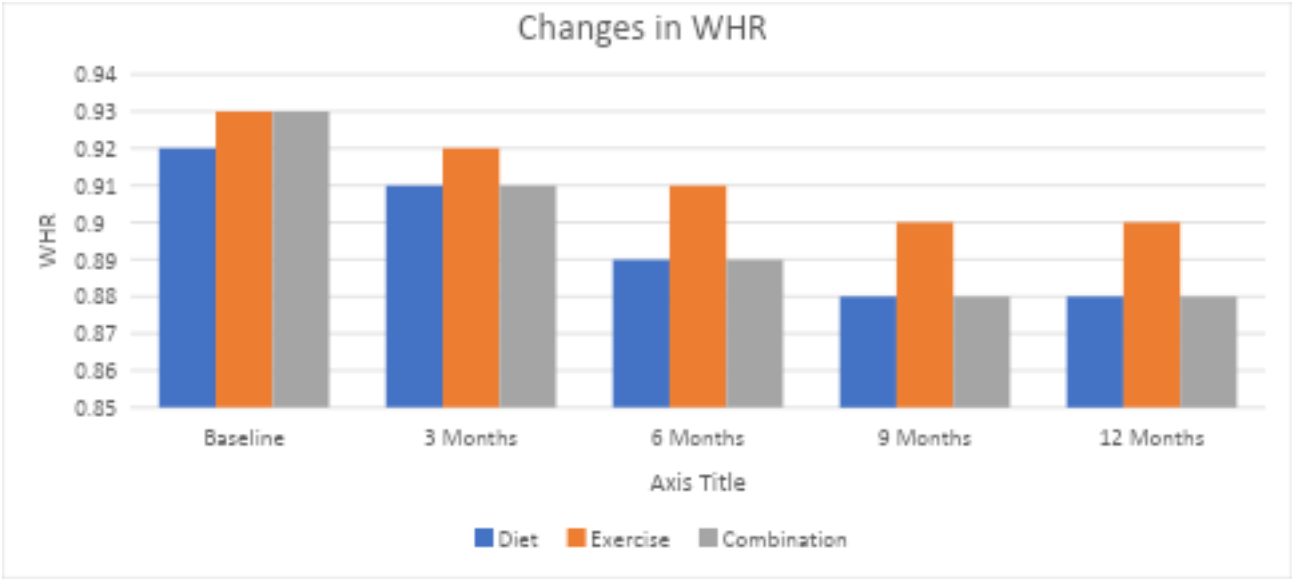

Figure 2: changes in Waist-to-Hip Ratio over the 12-month intervention period for diet, exercise, and combination groups.

Table3: changes in anthropometric parameters (NC) over the 12-month intervention period for the three groups: diet, exercise, and combination.

NC (cm)	Baseline	3 Months	6 Months	9 Months	12 Months	p-value
Diet	38.2 ± 1.8	37.6 ± 1.7	37.0 ± 1.6	36.5 ± 1.6	36.1 ± 1.5	<0.001
Exercise	38.5 ± 1.9	38.0 ± 1.8	37.5 ± 1.7	37.0 ± 1.6	36.7 ± 1.6	<0.001
Combination	38.4 ± 1.9	37.5 ± 1.7	36.8 ± 1.6	36.2 ± 1.5	35.8 ± 1.4	<0.001

Data are presented as mean ± standard deviation.

BMI: Body Mass Index, WHR: Waist-to-Hip Ratio, NC: Neck Circumference. P-values are for the repeated-measures ANOVA within each group.

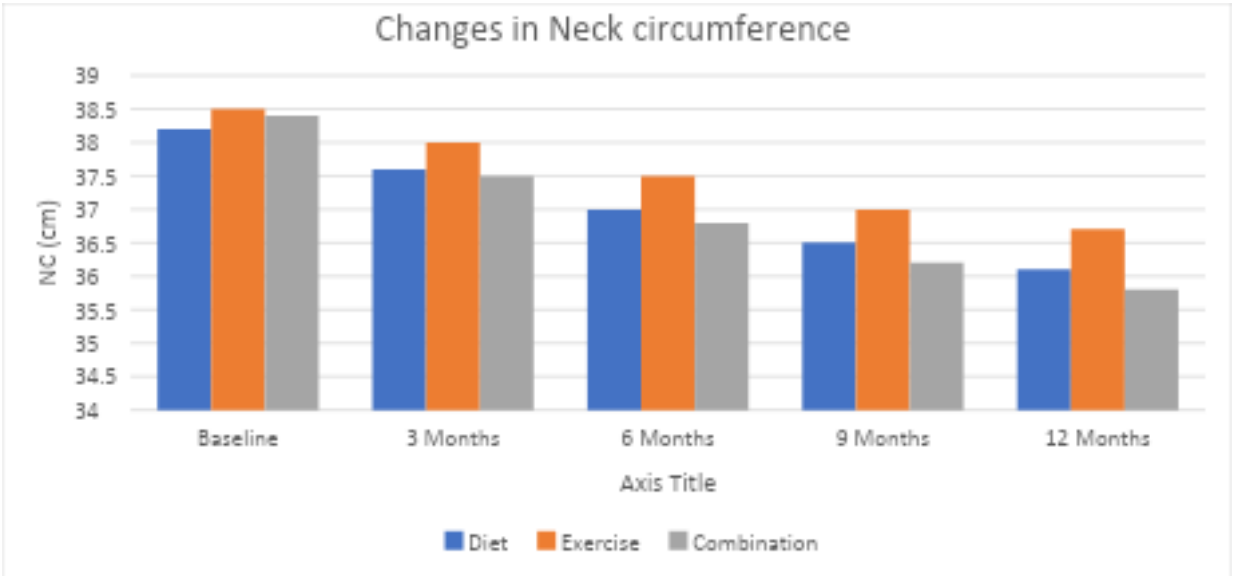

Figure 3: changes in Neck Circumference over the 12-month intervention period for diet, exercise, and combination groups.

Body Mass Index (BMI):

The diet protocol group showed a significant reduction in BMI over the 12-month intervention period. At baseline, the mean BMI was 29.4 ± 2.8 kg/m². By the end of the 12-month intervention, the BMI had decreased to 26.7 ± 2.4 kg/m², representing a mean reduction of 2.7 ± 1.0 kg/m² ($p<0.001$). The exercise protocol group also demonstrated a significant improvement in BMI over the 12-month period. The mean BMI decreased from 29.7 ± 2.9 kg/m² at baseline to 27.6 ± 2.5 kg/m² at 12 months, with a mean reduction of 2.1 ± 0.9 kg/m² ($p<0.001$). The combination of diet and exercise protocol showed the most favourable outcome, with a mean BMI reduction of 3.2 ± 1.1 kg/m² from 29.6 ± 2.9 kg/m² at baseline to 26.4 ± 2.3 kg/m² at the end of the 12-month intervention ($p<0.001$). The combination protocol group demonstrated significantly greater improvements in BMI compared to the diet and exercise groups alone ($p<0.001$).

Waist-to-Hip Ratio (WHR):

The diet protocol group exhibited a significant decrease in WHR over the 12-month period, from 0.92 ± 0.03 at baseline to 0.88 ± 0.03 at 12 months, a mean reduction of 0.04 ± 0.02 ($p<0.001$). The exercise protocol group also showed a significant improvement in WHR, with a mean reduction of 0.03 ± 0.01 from 0.93 ± 0.04 at baseline to 0.90 ± 0.03 at 12 months ($p<0.001$). The combination of diet and exercise protocol demonstrated the most substantial improvement in WHR, with a mean reduction of 0.05 ± 0.02 from 0.93 ± 0.04 at baseline to 0.88 ± 0.03 at the end of the 12-month intervention ($p<0.001$). The combination protocol group achieved significantly greater reductions in WHR compared to the diet and exercise groups alone ($p<0.001$).

Neck Circumference (NC):

The diet protocol group experienced a significant decrease in neck circumference, from 38.2 ± 1.8 cm at baseline to 36.1 ± 1.5 cm at 12 months, a mean reduction of 1.4 ± 0.5 cm ($p<0.001$). The exercise protocol group also showed a significant reduction in neck circumference, with a mean decrease of 1.2 ± 0.4 cm from 38.5 ± 1.9 cm at baseline to 36.7 ± 1.6 cm at 12 months ($p<0.001$). The combination of diet and exercise protocol demonstrated the most favourable outcome, with a mean reduction of 1.8 ± 0.6 cm in neck circumference, from 38.4 ± 1.9 cm at baseline to 35.8 ± 1.4 cm at the end of the 12-month intervention ($p<0.001$). The combination protocol group achieved significantly greater reductions in neck circumference compared to the diet and exercise groups alone ($p<0.001$).

Overall, the combination of diet and exercise protocol was found to be the most effective in improving all three anthropometric parameters (BMI, WHR, and NC) compared to either intervention alone. The diet and exercise groups also showed significant improvements, but the combination protocol group exhibited the most substantial and favourable outcomes.

Discussion:

The findings of this study demonstrate that lifestyle interventions, including diet and exercise protocols, are effective in improving anthropometric and biochemical parameters among individuals with prediabetes. The combination of a structured diet and exercise program was found to be the most effective approach, resulting in greater reductions in BMI, WHR, neck circumference, fasting and post-prandial blood glucose, HbA1c, and insulin resistance compared to either intervention alone.

The observed improvements in anthropometric parameters, such as BMI and WHR, align with the well-established role of weight loss in reducing the risk of progression to type 2 diabetes [8]. The combination protocol's superior effectiveness in achieving greater weight loss and improvements in body composition may be attributed to the synergistic effects of dietary calorie restriction and increased physical activity.

The strengths of this study include its randomized controlled design, the use of comprehensive assessment of both anthropometric and biochemical parameters, and the inclusion of a combination protocol group to evaluate the potential additive or synergistic effects of diet and exercise interventions. However, the study's limitation is the absence of a long-term follow-up period, which could provide insights into the sustainability of the observed improvements.

Conclusion:

This study provides evidence that lifestyle interventions, particularly the combination of a structured diet and exercise protocol, are effective in improving anthropometric and biochemical parameters among individuals with prediabetes. These findings support the implementation of comprehensive lifestyle modification programs as a strategy for the prevention of type 2 diabetes and its associated complications.

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