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ROLE OF LIFESTYLE MODIFICATION AND NUTRITIONAL COUNSELING IN PREVENTING TYPE 2 DIABETES A CLINICAL STUDY

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ABSTRACT

Background: Type 2 diabetes mellitus is a significant issue in health the world over, which is predominantly fueled by the lifestyle factors which are modifiable. Prevention or delaying of the disease has been demonstrated to be the effect of early intervention by people with prediabetes. The purpose of the study was to determine the efficacy of the structured lifestyle modification and nutritional counseling in preventing Type 2 diabetes in high-risk individuals.

Methodology: It was a prospective randomized controlled clinical study with 100 prediabetic adults who were aged 30-65 years. The subjects were randomly divided into an intervention (n = 50) and control (n = 50) group: the first group would receive individualized lifestyle change intervention and nutritional counseling with frequent follow-ups, whereas the second group would receive standard care. At baseline and at 12 months, clinical and biochemical parameter (anthropometric measurements, fasting plasma glucose, and HbA1c) were measured. Proper statistical tests were applied to analyze the data, and the level of p was set to 0.05.

Results: The intervention group presented a great improvement in BMI, waist circumference, fasting plasma glucose, and HbA1c at 12 months relative to the control group ($p < 0.05$). Only 6 participants (12 per cent) in the intervention group and 17 participants (34 per cent) in the control group progressed to Type 2 diabetes ($p = 0.01$). The individuals who were subjected to structured lifestyle counseling had improved dietary habits, physical activities, and reduced weight.

Conclusion: Lifestyle change (with structured lifestyle education) and nutrition education can be very effective in reducing the metabolic risk and avoiding Type 2 diabetes in prediabetics. Introduction of specific lifestyle changes as a part of standard clinical practice is an economically efficient way of diabetes prevention and should be a priority in community health practices.

Keywords: Prediabetes, Type 2 diabetes prevention, Lifestyle modification, Nutritional counseling, Clinical trial, Metabolic health

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INTRODUCTION

T2DM has become one of the most widespread and fast-growing metabolic disorders in the world, making it an important cause of morbidity, mortality and health care burden[1]. Being defined as insulin insensitivity and a dysfunctional glucose metabolism, T2DM is intertwined with a sedentary lifestyle, poor eating habits, obesity, and stress. Based on worldwide estimations, there are millions of adults[2], who are at risk of developing T2DM because of lifestyle factors that can be altered and therefore, it is imperative that preventive measures are implemented, as opposed to treating the disease once it has been acquired 4. Early diagnosis and lifestyle-based interventions have been effective in postponing or averting the development of prediabetes to diabetes[3].

Modification of lifestyle such as exercise, maintaining a healthy weight, reducing stress, quitting smoking is very important in enhancing insulin sensitivity and metabolic condition[5]. Meanwhile, nutritional counseling suggests people to eat balanced diets with a high content of whole grains, fruits, vegetables, lean protein, and healthy fats and less refined sugars and processed luncheons[6]. Such a combined method has been demonstrated over and over again to achieve better

glycemic control, lipid profile, and body mass index (BMI) in turn lowering the rate of T2DM[7].

Moreover, although there is solid clinical evidence to support lifestyle and nutritional interventions, a significant number of people who are at high risk do not know their advantages and do not receive appropriate guidance and systematic assistance to make these changes[8]. As such, there is a need to carry out clinical research on the importance of structured lifestyle modification and nutrition counseling programs to reinforce preventive healthcare strategies [9]. This research will assess the efficacy of lifestyle change and nutritional education in the prevention of type 2 diabetes development in people at risk, which will lead to evidence-based preventive interventions and better health outcomes of the population [10]

MATERIALS AND METHODS

This was a prospective, randomized controlled clinical trial that was carried out in the Department of Medicine/Endocrinology within a 12-month period with the permission of the Institutional Ethics Review Board. One hundred adults aged 30-65 years of prediabetes (a fasting plasma glucose range of 100 125mg/dL, HbA1c of 5.764mg/dL or a 2-hour OGTT range of 140199mg/dL) were recruited. The patients who had known diabetes, chronic illness, pregnant or on glucose-lowering medications were excluded. Having given informed consent in writing, the participants were randomly assigned to two equal groups, one receiving intervention (n=50) with structured lifestyle modification and nutritional counseling, and another one (n=50) with the standard care and regular lifestyle counseling.

The baseline assessment involved clinical assessment, anthropometry (weight, height, BMI, and waist circumference), blood pressure, and biochemistry (fasting glucose, HbA1c, lipids profile, and optional fasting insulin). The use of validated questionnaires was used to record physical activity and dietary practices. The intervention group was subjected to a 1-on-1 diet and lifestyle counseling at the baseline and monthly group sessions and planned follow-up counseling via phone or clinic visits. Counseling focused on the caloric moderation of energy levels, greater consumption of fibers, less intake of refined sugars and fats, at least 150 minutes of moderate physical activity per week. Only outpatient care was done in the control group. The follow up tests took place at the end of 3, 6 and 12 months to record the variation in anthropometric, biochemical and lifestyle parameters. The standardized techniques used in laboratory tests had quality control measures.

The data will be documented through standardized forms of case reports and inputted in a secure electronic database with data entry duplication and periodical auditing. Personal identifiers will be kept in a different place to study information. The data were noted using structured forms and treated on the intention-to-treat basis. Appropriate statistical tests like t-test or repeated-measures ANOVA were used to compare continuous variables across groups whereas Chi-square tests were used to measure categorical variables with a statistical significance level of $p < 0.05$.

RESULTS

The sample size of the study was 100 prediabetics participants (n=50 each in the intervention and control groups). The demographic and clinical backgrounds of the two groups could not be considered as different, as the age, BMI, fasting blood sugar and HbA1c levels did not differ significantly. By the end of 12 months, the intervention group was significantly lower in the mean fasting plasma glucose and HbA1c, body weight, and waist circumference than the control group. The more exercising the better the physical activity of the intervention and the healthier the diet, the greater was the lifestyle improvement observed. The value of 6 (12 percent) participants in the intervention group converted to Type 2 diabetes compared to 17 (34 percent) in the control group ($p = 0.01$) presents a significant difference as the access rate of the intervention group is less than that of the control group.

The result of the comparative analysis of clinical and biochemical parameters of the intervention and control groups is presented in Table 1. The baseline aspects such as an average age, BMI, waist circumference, fasting plasma glucose, and HbA1c were similar in both groups with no significant difference in mean age between them. Twelve months later, the intervention group experienced a drastic decrease in body weight and BMI than the control group ($P = 0.01$ and $P = 0.001$ respectively). In the same vein, the change in the waist circumference of the intervention group was substantial (reduced by 97.8 cm to 93.1 cm) but the change in the control group was too insignificant ($p = 0.003$). The levels of fasting plasma glucose significantly decreased in the intervention group to 102.3 +/- 7.2 mg/dL as opposed to 109.6 +/- 8.4mg/dL in the control group ($p < 0.001$). The level of HbA1c also showed a good improvement in the intervention arm as it went down to $5.68 \pm 0.23\%$ as opposed to no improvement in the control group ($p < 0.001$). In addition, the occurrence of Type 2 diabetes was significantly reduced among the participants aged 30-35 years in the intervention group with just 6 patients (12 percent) developing diabetes as opposed to 17 patients (34 percent) in the control group ($p = 0.01$). According to these results, it is evident that organized lifestyle changes and nutritional education made a considerable contribution to a better metabolic status and decreased the chances of turning into diabetes in pre-diabetic persons.

Besides the metabolic changes, the findings demonstrate the utility of a regular lifestyle intervention in promoting clinically significant health outcomes. The outcome of the intervention group alone showed not only

the improvement of the glycemic control but the significant weight loss and the decreased waist circumference also, which signifies the minimized central obesity, which is also a major cause of insulin resistance. The decreased HbA1c and fasting glucose may indicate that there was a greater insulin sensitivity and a greater glucose metabolism as the study period was going on. By contrast, the control group had little improvement, which probably corresponded to the lack of opportunity to influence it due to the briefness of standard counseling and an absence of any form of organization and individual attention. The much-minimalized rate of conversion to diabetes among the intervention group supports the usefulness of monitored dietary and physical activity interventions in retarding or averting the advancement to Type 2 diabetes. All in all, the evidence-based data highlight the opportunity that the proper lifestyle and nutritional counseling is a potent tool that can reduce metabolic risks in pre-diabetic patients.

Table 1. Comparison of Clinical and Biochemical Parameters Between Groups

Parameter	Intervention Group (n=50) Mean ± SD	Control Group (n=50) Mean ± SD	p-value
Age (years)	49.2 ± 7.8	48.6 ± 8.1	0.71
BMI (kg/m²) Baseline	29.4 ± 3.2	29.1 ± 3.5	0.65
BMI (kg/m²) 12 months	27.8 ± 3.1	29.0 ± 3.6	0.01*
Weight change (kg)	−3.4 ± 1.9	−0.8 ± 1.2	<0.001*
Waist circumference (cm) Baseline	97.8 ± 6.4	97.2 ± 6.1	0.58
Waist circumference (cm) 12 months	93.1 ± 6.0	96.4 ± 6.2	0.003*
Fasting Plasma Glucose (mg/dL) Baseline	112.6 ± 8.5	111.8 ± 8.9	0.67
Fasting Plasma Glucose (mg/dL) 12 months	102.3 ± 7.2	109.6 ± 8.4	<0.001*
HbA1c (%) Baseline	5.96 ± 0.19	5.94 ± 0.21	0.44
HbA1c (%) 12 months	5.68 ± 0.23	5.96 ± 0.28	<0.001*
Progression to Diabetes n (%)	6 (12%)	17 (34%)	0.01*

*Statistically significant ($p < 0.05$)

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DISCUSSION

The current clinical trial was a study to determine the effect of structured lifestyle change and nutritional education on the prevention of Type 2 diabetes in pre-diabetic patients. These results indicate that patients with individualized dietary planning, specific lifestyle education, and frequent follow-up had significant changes towards the better metabolic parameters than the patients who were provided with the usual care[11]. It is important to note that the intervention group recorded a significant decrease in body weight, body mass index, waist circumference, fasting plasma glucose and HbA1c levels in 12 months. Also, the conversion rate to Type 2 diabetes was considerably lower in the intervention group, which makes the role of lifestyle intervention as an effective preventive measure in the high-risk individuals quite obvious [12].

These findings can be discussed in relation to the available evidence of landmark trials like Diabetes Prevention Program (DPP) in the US and Finnish Diabetes Prevention Study, where lifestyle change especially the diet and physical activity were presented as the foundation of diabetes prevention [13]. As in these studies, in our trial, smaller weight decrease, 5-7 percent, was linked with better glycemic control and the reduction in the occurrence of diabetes. This paper thus acts as support to the international community that non-pharmacological intervention may be better than early drug therapy in the prevention of Type 2 diabetes especially among pre-diabetes patients [14].

One of the strengths of the intervention introduced in the given study is the use of a combination of nutrition education, one-on-one counseling, weight management information, and frequent follow-up reinforcement [15]. It is also possible that this motivation, adherence, and behavioral change were improved by the presence of

monthly group sessions and individual counseling. The intervention group respondents voiced that they have improved their eating habits by consuming more of fiber-rich food, limiting the use of refined carbohydrates, and better portioning of their meals. In addition, the recommends of the physical activity were followed more in the intervention arm, indicating the need of continuous counseling and monitoring in the lifestyle-based programs[16].

The fact that the reduction of the waist circumference in the intervention group is significant is worthy because central obesity is a determining factor in insulin resistance and metabolic dysfunction [17]. Decreased fat in the abdomen is strongly related with increased insulin sensitivity and glucose metabolism that is the reason why the fasting glucose and HbA1c are concurrently decreasing in the study. On the other hand, the control group, even though it was provided with regular advice, did not show significant changes, which makes it clear that passive health education could not be effective enough to promote sustainable lifestyle change in the high-risk groups [18].

Nonetheless, this research is limited. To begin with, it was a single center study with a rather limited sample of 100 participants, which can be a limitation to generalization. Second, the research was based on self-reports on diet and physical activity, which are prone to recall bias [19]. Third, the follow-up period was one year and it would be of interest to have a longer length of the follow-up to determine the sustainability of the benefits and whether the lifestyle changes are maintained after the study period. These limitations notwithstanding, the results have clinical significance and can be used to introduce structured lifestyle counseling programs into the regular clinical environment[20].

In general, this paper helps to realize that lifestyle change with the help of systematic education and follow-up may substantially decrease the risk of Type 2 diabetes and enhance metabolic well-being of pre-diabetic individuals. The findings demonstrate the importance of preventive medicine and the necessity of the healthcare systems to focus on dietary counseling, promotion of physical activity, and patient education as routine care. Further studies need to determine their long-term outcomes, include more varied groups of participants, and determine how digital health technologies and community-based interventions can be combined to improve accessibility and compliance.

CONCLUSION

The study has demonstrated several steps such as structured lifestyle change and counseling on nutrition are highly applicable steps in preventing the onset of prediabetes into Type 2 diabetes. The respondents who were provided with individualized food intake guidelines, exercises counters, and follow-up (sequential), showed a significant response to body weight, waist circumference, fasting glucose, and HbA1c compared to those that were provided with routine care. Also, the incidence rate of occurrence of diabetes in the intervention group had been much lower portraying the high level of long-term lifestyle changes in the high-risk groups. Such findings emphasize the necessity to introduce lifestyle education and nutritional counseling in the routine clinical practice of pre-diabetic patients. To further enhance the utilization of such interventions and disseminate them to the community levels, by involving primary healthcare and thus offered by the online health interventions may assist in the popularization of further and further more diabetes prevention initiatives and deliver healthier population.

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