A School Nurse Delivered Health Promotion Intervention on Diabetes Indices among overweight children

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Abstract

Globally, the rise in the prevalence of non-communicable illnesses is the most significant public health challenge of the 21st century, with childhood obesity playing a key role. Its well-known evidence that school-based interventions are effective in managing childhood obesity and diabetic profiles. The primary objective of this study was to examine the school nurse delivered health promotion intervention on diabetes indices among overweight children.

Methods: True experimental research design was carried out. A total of eight schools in all consented to take part in the investigation and the distribution of the schools were done randomly using the lottery technique. Children aged between 12 -18 participated in the intervention program and the children in the study group received a school-based intervention for 16 weeks. The anthropometric measurements of weight, height and BMI were assessed as primary outcomes and diabetes indices such as fasting and postprandial blood sugar were assessed as secondary outcomes. Comparison of baseline values band after the intervention was done through paired and unpaired t-tests.

Results: Compared with the control group experimental group showed a decrease in weight (t=3.835 P<0.001) and body mass index (t=1.724 P<0.001). Substantial changes in the fasting blood sugar (t=0.135, p=0.0893) and post prandial blood sugar (t=2.282, p=0.023). Additionally, there was a link between fasting sugar and BMI that was favourable. After a 16-week intervention program, the postprandial blood glucose level in the experimental group showed a significant positive connection (r=0.706 p0.001, r=0.628 p0.001, r=0.567 p0.00).

Conclusion: Despite the fact that a lot of research has focused on the impact of childhood obesity and the significance of the diabetic profile. This study demonstrated that the physical activity-based intervention helped

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the obese children significantly in improving their physical health status and reducing complications on health issues related to diabetes. In order to screen diabetic students and conduct screening procedures, additional policy and protocol need be implemented in school settings.

Keywords: School-based intervention, diabetes indices, obese children.

Introduction

Globally, the rise in the prevalence of non-communicable illnesses is the most significant public health challenge of the 21st century, with childhood obesity playing a key role.[1,2] Childhood obesity was formerly assumed to be an issue only in affluent countries, but it has been steadily increasing in middle and low-income countries over the last two decades.[3,4] Globally, 10% of schoolchildren between the ages of 5 and 17 are obese or overweight[5] and it is predicted that by 2025, there will be 70 million overweight or obese new-borns and young children.[6] The percentage of overweight and obese children has climbed from 5.6 to 9.9 percent, according to an Indian study.[7] Obesity is caused by a mismatch between calorie intake and energy output, but it is actually caused by a mix of variables[8],. Genetics may only account for 5% of the total. Dietary practices such as fast food consumption, higher intake of snakes[9], eating while watching television[10] and reduced intake of milk, fruits, and vegetables[11] carbonated drinks, which leads to unhealthy weight gain among children.[12,13] As a result, the degree of obesity has a negative impact on the metabolic profile of obese children and it is essential to recognize and manage obesity-related complications. The majority of children with diabetes mellitus or impaired glucose tolerance are overweight or obese, which is understandable.[14] However, the World Health Organization (WHO) recently released data showing that 19% of the world's diabetic population resides in India. 126 pupils underwent diabetic screening to determine their risk of getting type 2 diabetes mellitus, and it was found that 8 to 13 percent of them are at risk. Various studies have reported that dietary changes and planned physical exercise can help to maintain a healthy glycaemic profile, which can help to reduce bodyweight. Low carbohydrate diets (30 g daily)[16,17], low glycaemic load diets (1.5 g/kg body mass), and high protein diets (1.5 g/kg body mass)[18,19] supplemented with minerals and vitamins result in a significant reduction in weight loss and better glycaemic management.[20] Several research has looked into the role of exercise in improving body composition in obese children and adolescents.[21] In children and adolescents with obesity and overweight, scheduled aerobic exercise and resistance training are linked to lower fasting insulin and HOMA-IR (homeostatic model assessment—insulin resistance).[22] Davies' recently conducted a study on the benefits of supervised structural endurance exercise four times per week on obese children and reported that there were significant decreases in several measures of adiposity, particularly central adiposity, as well as higher improvements in insulin resistance.[23] It is possible to reduce weight and maintain a healthy diabetic profile by considering the effects of dietary changes and planned physical activity. Therefore, the aim of this study was to investigate the School Nurse delivered health promotion intervention on Diabetes Indices among overweight children.

Materials and Methods

Design and setting

The experimental research was out in the west part of Chennai, Tamil Nadu, India. A total of eight schools in all consented to take part in the investigation and the distribution of the schools were done randomly using the lottery technique after they were chosen based on their feasibility and practicability. There were two sections to the research. The first part involved a cross-sectional survey of school children, while the second phase involved an experimental research. Children in each school who met the inclusion criteria were located and randomly chosen as study samples after the children had been assessed for overweight and obesity.

Participants

In the second phase, children in each school who met the inclusion requirements were located, randomly selected as study samples, and placed into the control and experimental groups after assessing their weight and body mass index. Based on the

inclusion criteria, a random sampling approach was used to choose the participants, children who are overweight or obese, youths between the ages of 12 and 18, both sexes, no use of medication to prevent weight gain or loss and no history of regular exercise program were included in the study.

School based intervention

A systematic physical activity program and instructions on good eating habits were provided to the experimental group. The study subjects were instructed on the importance of consuming whole foods, complex carbohydrates, a variety of fruits and vegetables, foods with a low glycaemic index, whole proteins, and fats primarily derived from plant sources while avoiding refined sugars, processed carbohydrates, artificial sweeteners, and fat derived from animal products. The research group members participated in a regimented physical activity program that included stretches and exercises to build and develop their muscles. Each participant began vigorous walking, stair climbing, and running for 15 minutes after a 5-minute cool-down period. Performed muscle-building exercises like pull-ups, push-ups, toe stands, stomach crunches, leg curls, and bicep curls for 30 minutes. There were 12 repetitions of each exercise, followed by a 5-minute warm-up and 5-minute cool-down. Obesity and diabetes indicators were also discussed with the study participants over the 16 -week intervention period.

Anthropometric measurements

To evaluate the children basic health profile, anthropometric measurements were taken both before and after the intervention. Height, weight, and BMI. Weight was calculated using an Omron digital scale, and height was calculated using a stadiometer to the nearest 0.1 cm. The body mass index was calculated using weight/height squared (Kg/m^2) (BMI). Obesity was categorized using the WHO growth for children and adolescents aged 5 to 19 years.

Blood sample analysis

The glycaemic profiles of the study subjects, including fasting and postprandial blood sugar, were investigated. To review the results of their glycaemic test, which measured capillary blood glucose levels, the participants were called to their respective schools. The subjects were examined and blood samples were collected using a disposable needle through a digital puncture after they had fasted for 8 to 10 hours. Immediately after the drop was applied to the strip, a glucometer reading was taken. After giving the participants instructions to eat their meals, the identical procedure was repeated two hours later. The data was interpreted with Indian Diabetes Foundation's criteria. Fasting glucose levels normal range from 100 to 126 mg/dL for impaired fasting glucose tolerance and 126 mg/dL for fasting diabetes mellitus. 140 mg/dL of postprandial blood sugar was considered normal, but 200 mg/dL and more were considered to be impaired.

Ethical Considerations

The study protocol was approved by Saveetha University's Institutional Human Ethical Clearance with the reference number 002/05/2016/IEC/SU after the relevant authorities gave administrative authorization. All study participants who met the inclusion criteria were properly informed of the study's methodology. The written consent from the parents and assent from the study participants were secured and ethical principals were followed throughout the study period.

Statistical analysis

Descriptive and inferential statistics were used to analyse the acquired data. The analysis was carried out using SPSS version 21. The effect of school-based intervention on the diabetes indices in the experimental groups was determined using a paired "t" test and coefficient of correlation was used to examine the association between obesity and diabetic indices. Statistical significance was defined as a probability of 0.05 or less.

Results

Table 1: Effects of School based intervention on weight and Body Mass Index

S. No	Profile	Group	Mean ±SE	Significance unpaired t test		Significance paired t test	
				Con-Exp Pre- test	Con-Exp Post - test	Control Pre –Post test	Exp Pre –Post test
1.	Weight	Control group - pre -test	75.4±2.3	t=0.422 P =0.678	t=0.043 P = 0.966	t=1.964 P<0.05	t=3.835 P<0.001
		Control group - post -test	74.8±2.3				
		Experimental group- pre- test	77.4±4.1				
		Experimental group- post-test	74.6±4.1				
2.	BMI	Control group - pre -test	33.8±1.3	t=0.167 P =0.869	t=1.696 P = 0.496	t=1.958 P<0.05	t=1.724 P<0.001
		Control group - post -test	33.6±1.2				
		Experimental group- pre- test	33.5±1.2				
		Experimental group- post-test	32.3±1.2				

Table 1: Explains The effectiveness of the 16-week, school-based intervention has a considerable influence on weight and body mass index. Pre-test t=0.422, P =0.678, and post-test t=1.964, P0.05, both showed no worthy changes for the control group, with a mean weight pre-test of 75.4 and post-test of 74.8. but there have been substantial changes in the experimental pre and after (t=3.835 P0.001). Body mass index shows no detectable changes between the pre-test and post-test for the control group, but a significant improvement between the pre-test and post-test for the experimental group (t=1.724, P0.001).

Table 2: Effects of School based intervention on Diabetes indices

S. No	Profile	Group	Mean ±SE	Statistical significance
1.	Fating blood sugar	Control group - pre -test	90.6±1.1	Figure 1
		Control group - post -test	86.6±1.0	
		Experimental group- pre- test	92.2±1.1	
		Experimental group- post-test	86.8±1.0	
2.	Postprandial blood sugar	Control group - pre -test	126.2±1.0	Figure 2
		Control group - post -test	124.2±1.0	
		Experimental group- pre- test	126.2±1.0	
		Experimental group- post-test	120.8±1.1	

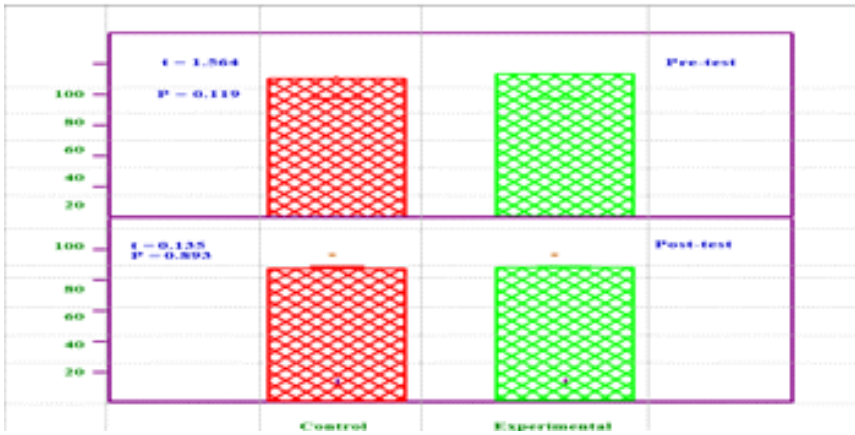

Figure 1: The Fasting blood glucose(FBS) of obese children in control and experimental groups.

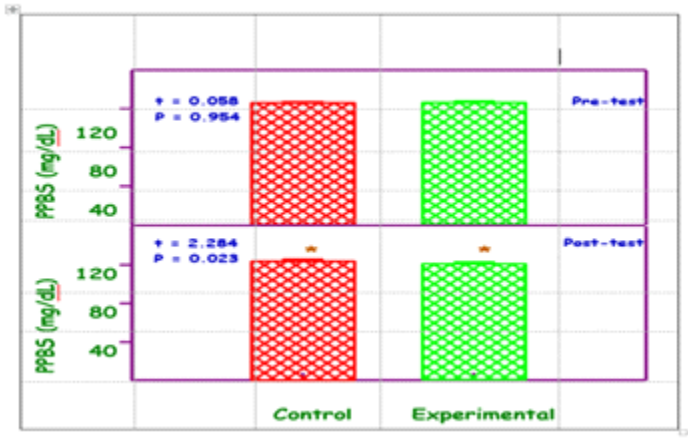

Figure 2: The Post prandial blood glucose(PPBS) of obese children in control and experimental groups.

Table 2, figure 1, 2 illustrate the mean difference in fasting and postprandial blood sugar levels between the control and experimental groups before and after the 16-week school-based intervention. There was no discernible change in the pre-test between the groups' control group fasting blood sugar levels. There were no discernible changes between the control and experimental groups according to unpaired 't' tests on baseline fasting blood glucose data (t=1.564, p=0.119). Differences between the control and experimental groups were found in the post-test (paired t-test) (t=0.135, p=0.0893). Regarding the post-prandial blood sugar, the pre-test (t=0.058, p=0.954) showed no significant differences between the control and experimental groups, however the post-test (paired t-test) showed differences between the two groups (t=2.282, p=0.023). As a result, the study's findings indicated that the intervention at the school level has a big impact on the diabetic markers.

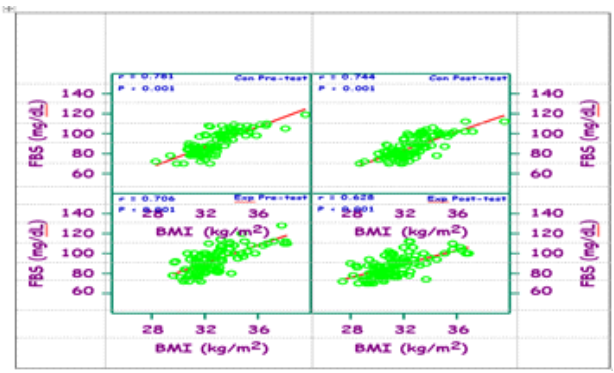

Figure 3: Correlation between the body mass index and fasting blood sugar

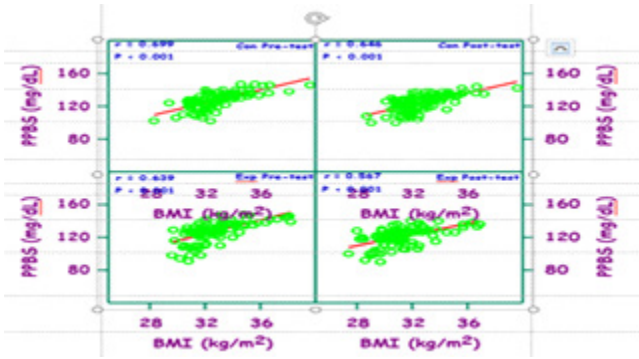

Figure 4: Correlation between the body mass index and postprandial blood sugar

Figure 3,4: Karl Pearson's correlation co-efficient was used to analyse the relationship between body mass index and diabetes indices between the control and experimental group There was a positive correlation between the BMI and the fasting and postprandial blood sugar. The pre- and post-test fasting blood glucose levels in the experimental group exhibited a positive significant connection (r=0.706 p0.001, r=0.628 p0.001). Similarly, the postprandial blood glucose level demonstrated a strong positive correlation in the experimental group (r=0.639p 0.001), r=0.567p 0.001). When the body mass index increase, blood sugar also raises with it, and when the body mass index decrease the blood sugar also falls with it. As a result, it can be inferred that there was a substantial relationship between BMI and diabetic indices.

Discussion

The objective of the study was to determine the effect of school based intervention on diabetic

indices among overweight and obese children. Random sampling technique was used to separate the children into study group and control group and extensive analysis was done to the both group. The study group received a 16-week school-based intervention, and results showed that there was a relative decrease in weight and body mass index in the study group. These results were in line with J. S.Thakur et. al. (2016). Impact of 20-week lifestyle intervention package on anthropometric biochemical and behavioural characteristics of schoolchildren in North India study, which found that after adjusting for age, sex, and clustering within classes, children in the intervention group had a weight loss of 0.08 (from 0.15 to 0.00, p = 0.048) z-score units compared to controls. BMI, however, has not significantly decreased.[23] Numerous long-term and short-term school-based programs have demonstrated a significant decrease in weight, skinfold thickness, BMI, and other anthropometric characteristics.

According to the findings of the current study reported that, there were significant differences between the control and experimental groups' fasting and postprandial blood sugar levels. The pertest did not differ noticeably across the groups, but the pre- and post-fasting blood sugar levels in the experimental group were significantly lower. Similar to the post-prandial blood sugar, there were no discernible differences between the experimental and control groups in the pre-test, but there were in the post-test. The study's conclusions thus showed that the intervention at the school level has a significant impact on the diabetic indicators. The positive impact of the school-based intervention is what caused the significant changes in the research group. This may be due to dietary changes that include consuming complex carbohydrates, lots of fruit and vegetables, low-glycaemic index foods, whole proteins, and fats that are primarily derived from plant sources while avoiding refined sugars, processed carbohydrates, artificial sweeteners, and fat derived from animal products. It may also be related to a physical activity program that included stretches and exercises to help them develop their muscles. With the help of muscle-building exercises like pull-ups, push-ups, toe stands, stomach crunches, leg curls, and bicep curls, each participant in the current study started engaging in vigorous physical activity like walking, stair climbing, and running, which significantly contributed to keeping the diabetic parameters within the normal range. The findings were consistent with those of the Aran research. Donnelly conducted a randomized controlled trial to examine the effects of an aerobic exercise program on insulin resistance in overweight children and found that the study significantly improved changes in body composition and fasting insulin levels[24]. In a similar vein, Reed et al. claimed that intense exercise boosts basal calorie expenditure and controls blood glucose absorption[25].

The link between body mass index and diabetes indices among obese children was found in the current study. Blood sugar levels rise in line with changes in body mass index, and fall in conjunction with changes in body mass index. This suggests that there was a significant correlation between BMI and diabetes indicators. According to the study's findings, which are in line with those of Brown et al study there is a substantial correlation between the parameters for diabetes, cardiovascular disease, and obesity.[26] In a similar vein, Rodriguez observed that high levels of hypertension are related to the prevalence of diabetes and central obesity, while prevalence values are highly correlated with a high consumption of calories from saturated fat. At least in one scenario, the consumption of saturated fat appears to be where these metabolic risk pathways begin.[27] Therefore, the school-based intervention had a positive effect on the indicators related to diabetes and obesity.

Limitations

The study presents several limitations. One drawback could be the study's brief length and the fact that the interventions solely addressed nutrition and exercise. The second constraint is that only diabetic metrics, such fasting and postprandial blood sugar, were measured. Finally, although the children in the control group were aware of the study's objectives and were assessed for anthropometric and diabetic parameters, the assessment may have had an impact on the intervention and influenced the findings because it did not assess HB1Ac, which may have made it difficult to notice changes in particular.

Conclusion

Despite the fact that a lot of research has focused on the impact of childhood obesity and the significance of the diabetic profile, this study implemented and demonstrated that the physical activity-based school-based intervention helped the obese children significantly in improving their physical health status and reducing complications and health issues related to diabetes. In order to screen diabetic students and conduct screening procedures, additional policy and protocol need be implemented in school settings.

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