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ORIGINAL RESEARCH

A Randomized Control Trial Of Maternal Nutritional Education For BMI Reduction In Obese Students Of A Primary School In Cuttack City.

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Abstract

Background: Childhood obesity is a growing public health concern, particularly in urban areas like Cuttack City, Odisha, where changing lifestyles and dietary habits have contributed to an increasing prevalence of obesity among primary school students. Maternal influence plays a critical role in shaping children's eating behaviours and physical activity levels. This study aimed to evaluate the effectiveness of nutritional education provided to mothers of obese primary school students in reducing their children's Body Mass Index (BMI) over a 6-month follow-up period.

Materials and Methods: A quasi-experimental study was conducted in a primary school in Cuttack City. A total of 100 obese students (BMI ≥ 95th percentile for age and sex) and their mothers were enrolled and divided into two groups: the intervention group (n=50) and the control group (n=50). Mothers in the intervention group attended six structured nutritional education sessions over onemonth, focusing on balanced diets, portion control, healthy snacking, and the importance of physical activity. Anthropometric measurements (height, weight, and BMI) were taken at baseline and after 6 months. Data were analyzed using SPSS software version 17, with paired t-tests for within-group comparisons and independent t-tests for between-group comparisons. A p-value of <0.05 was considered statistically significant.

Results: The mean BMI of students in the intervention group decreased significantly from 23.4 ± 1.2 at baseline to 21.8 ± 1.1 at 6 months ($p < 0.05$). In contrast, the control group showed a slight increase in mean BMI from 23.6 ± 1.3 to 23.9 ± 1.4 ($p > 0.05$). The reduction in BMI in the intervention group was significantly greater than in the control group ($p < 0.05$). Additionally, mothers in the intervention group reported improved knowledge and practices related to healthy eating and physical activity. Dietary habits also improved, with increased consumption of fruits and vegetables and reduced intake of junk food and sugar-sweetened beverages.

Conclusion: This study demonstrates that nutritional education for mothers is an effective strategy for reducing BMI among obese primary school students. The findings align with previous research highlighting the importance of parental involvement in managing childhood obesity. By empowering mothers with knowledge and practical skills, the intervention addressed the root causes of poor dietary habits and sedentary behaviours. The results underscore the potential of school-based programs that involve parents in promoting healthy lifestyles. However, the study's limitations, including single school and short follow-up period, suggest the need for involving more schools , longer-term studies to confirm these findings. Policymakers and educators should consider integrating maternal nutritional education into school health initiatives to combat the growing burden of childhood obesity.

Keywords : obesity , BMI, nutritional education, knowledge, junk food, intervention, dietary habit

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Introduction

Childhood obesity is a global epidemic, with India witnessing a rapid rise in prevalence due to urbanization, sedentary lifestyles, and poor dietary habits.[1] In Cuttack City, a growing urban centre in Odisha, primary school children are increasingly affected by obesity, which predisposes them to long-term health complications such as diabetes, hypertension, and cardiovascular diseases.[2] Maternal influence plays a pivotal role in shaping children's dietary behaviours, making mothers key agents of change in managing childhood obesity.[3] This study explores the effectiveness of nutritional education targeted at mothers in reducing the BMI of obese primary school students over a 6-month period.

Materials and Methods

Study Design and Participants

A quasi-experimental study was conducted in a primary school in Cuttack City after taking permission from the head mistress and written consent from the parents .IEC (Institutional Ethics Committee) permission was also taken to conduct the study. A total of 100 obese students (BMI ≥ 95th percentile for age and sex) and their mothers were enrolled.

Sample Size Calculation

The sample size for comparing two independent groups (intervention vs. control) with a continuous outcome (change in BMI) can be calculated using the following formula:

$$n = \frac{2\times(Z_{\alpha/2}+Z_{\beta})^2\times\sigma^2}{d^2}$$

Where:

- n = sample size per group
- $Z_{\alpha/2}$ = Z-value for the significance level (1.96 for $\alpha = 0.05$)
- Z_{β}= Z-value for the power (0.84 for 80% power)
- σ= standard deviation of the outcome (2.0 units)
- d = effect size (1.5 units)

simplifying the equation we got n = 27.88, rounding off to 28 in each group. Adjusting 20% attrition rate sample size was 34 in each group.We increased the sample size to 50 per group (total 100) for greater statistical power. This ensures that the study can detect smaller differences in BMI changes between the groups, making the results more robust and reliable.With a larger sample size, the study is better equipped to handle variability in the data and reduce the risk of Type II errors (failing to detect a true effect). By enrolling 50 participants per group, the study can accommodate a higher attrition rate (up to 30-35%) while still maintaining sufficient statistical power.A larger sample size allows for subgroup analyses, such as examining the effect of the intervention based on gender, age, or maternal education level. These analyses can provide deeper insights into the intervention's effectiveness across different demographic groups.It was easier to recruit a slightly larger number of participants in school based study increasing its generalizability.

Participants were divided into two groups: the intervention group (n=50) and the control group (n=50).

Intervention

Mothers in the intervention group attended six structured nutritional education sessions over one months. The sessions covered topics such as balanced diets, portion control, healthy snacking, and the importance of physical activity. Educational materials, including pamphlets and recipes for healthy meals, were provided.

Data Collection

Baseline data included anthropometric measurements (height, weight, BMI) of the students and a demographic survey of the mothers. Follow-up measurements were taken at 6 month. BMI was calculated using the formula: BMI = weight (kg) / height (m^2).

Statistical Analysis

Data were analysed using SPSS software version 17. Paired t-tests were used to compare changes in BMI within groups, while independent t-tests were used to compare differences between groups. Chi-square test used for categorical data. A p-value of <0.05 was considered statistically significant.

Results:

The mean BMI of students in the intervention group decreased significantly from 23.4 ± 1.2 at baseline to 21.8 ± 1.1 at 6 months ($p < 0.05$).

In the control group, the mean BMI increased slightly from 23.6 ± 1.3 to 23.9 ± 1.4 ($p > 0.05$).

The reduction in BMI in the intervention group was significantly greater than in the control group ($p < 0.05$).

Mothers in the intervention group reported improved knowledge and practices related to healthy eating and physical activity.

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Table 1: Demographic Characteristics of Participants

Variable	Intervention Group (n=50)	Control Group (n=50)	p-value
Age of Students (Years)	9.2 ± 1.5	9.3 ± 1.4	0.72
Gender (Male:Female)	28:22	26:24	0.85
Maternal Education Level			0.23
Primary School	12 (24%)	15 (30%)	
Secondary School	25 (50%)	22 (44%)	
Graduation or Higher	13 (26%)	13 (26%)	
Family Income (Monthly)			0.41
<₹20,000	18 (36%)	20(40%)	
₹20,000–₹40,000	22 (44%)	21 (42%)	
>₹40,000	10 (20%)	9 (18%)	

Table 2: Changes in Dietary Habits Reported by Mothers

Dietary Habit	Intervention Group (Pre)	Intervention Group (Post)	Control Group (Pre)	Control Group (Post)	p-value
Daily Fruit Consumption	30%	80%	28%	32%	<0.001*
Daily Vegetable Intake	35%	85%	34%	36%	<0.001*
Junk Food Consumption	70%	30%	72%	68%	<0.001*
Sugar-Sweetened Beverages	65%	25%	64%	62%	<0.001*

Table 3: Physical Activity Levels of Students

Activity Level	Intervention Group (Pre)	Intervention Group (Post)	Control Group (Pre)	Control Group (Post)	p-value
Sedentary Lifestyle	80%	40%	82%	80%	<0.001*
Moderate Physical Activity	15%	45%	14%	16%	<0.001*
Vigorous Physical Activity	5%	15%	4%	4%	<0.001*

Table 4 : Changes in BMI Among Obese Primary School Students at 6-Month Follow-Up

Variable	Intervention Group (n=50)	Control Group (n=50)	Statistical Test	p-value
Baseline BMI (Mean ± SD)	23.4 ± 1.2	23.6 ± 1.3	Independent t-test	0.42
6-Month BMI (Mean ± SD)	21.8 ± 1.1	23.9 ± 1.4	Independent t-test	<0.001*
Change in BMI (Mean ± SD)	-1.6 ± 0.5	+0.3 ± 0.4	Independent t-test	<0.001*
BMI Reduction (%)	6.8%	0%	Chi-square test	<0.001*
Maternal Knowledge Score (Pre-Intervention)	5.2 ± 1.1	5.1 ± 1.0	Independent t-test	0.65
Maternal Knowledge Score (Post-Intervention)	8.7 ± 0.9	5.3 ± 1.1	Independent t-test	<0.001*

Table 5: Maternal Feedback on Nutritional Education Program

Feedback Parameter	Percentage of Mothers Agreeing
Improved Knowledge	92%
Practical Application	88%
Willingness to Continue	95%
Satisfaction with Program	90%

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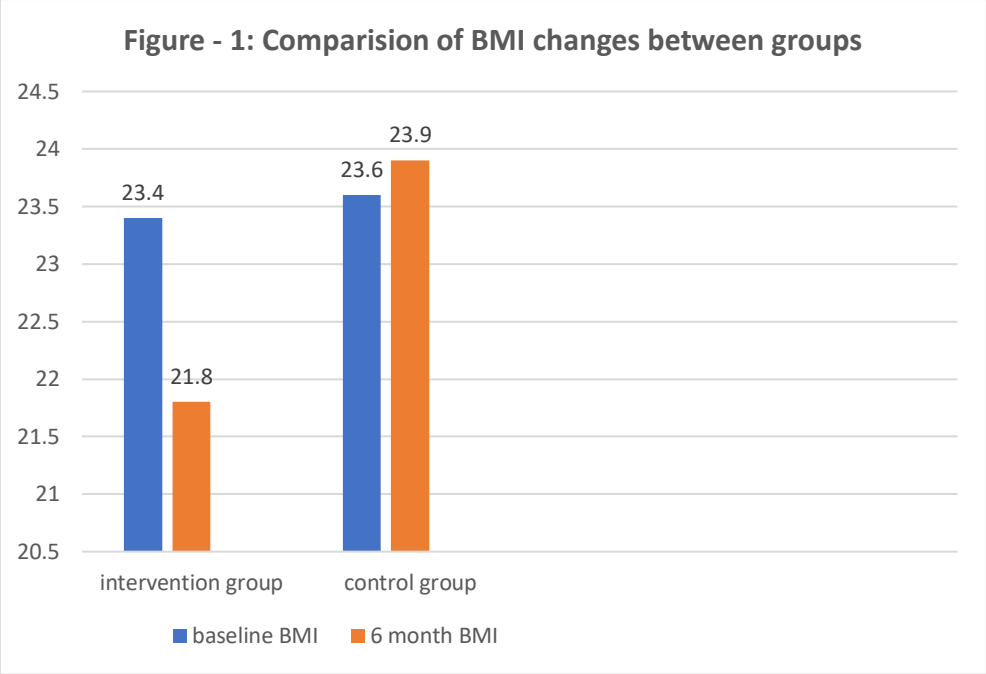
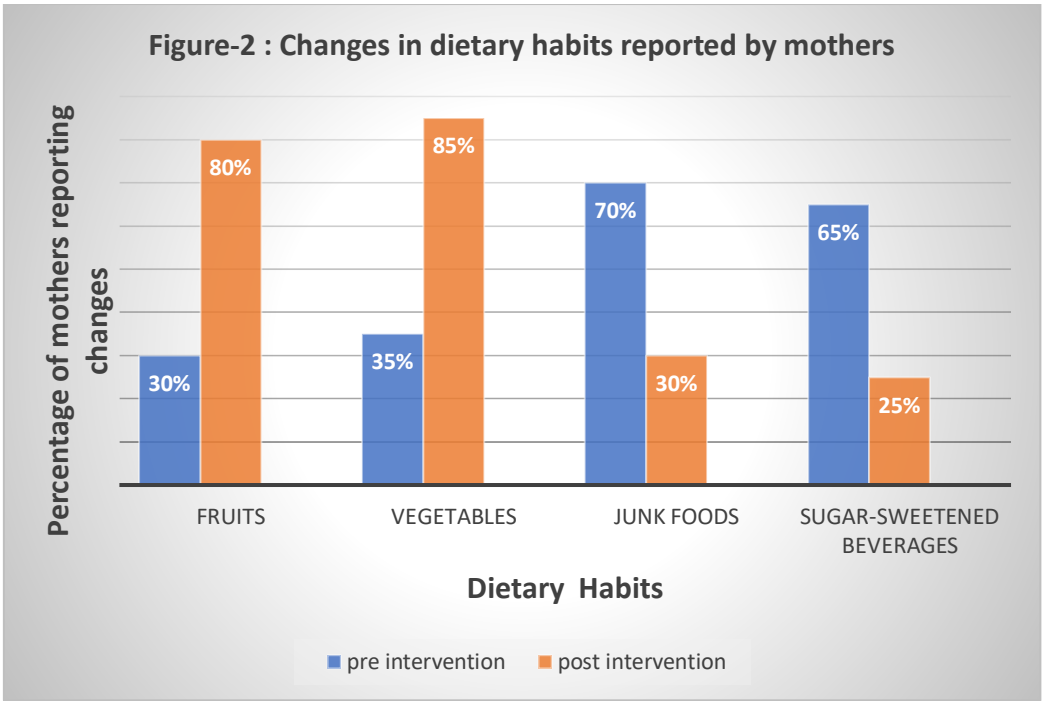


The bar graph shows a significant reduction in BMI in the intervention group compared to the control group after 6 months.



The bar graph illustrates the improvement in dietary habits among mothers in the intervention group, with increased consumption of fruits and vegetables and reduced intake of junk food and sugar-sweetened beverages.

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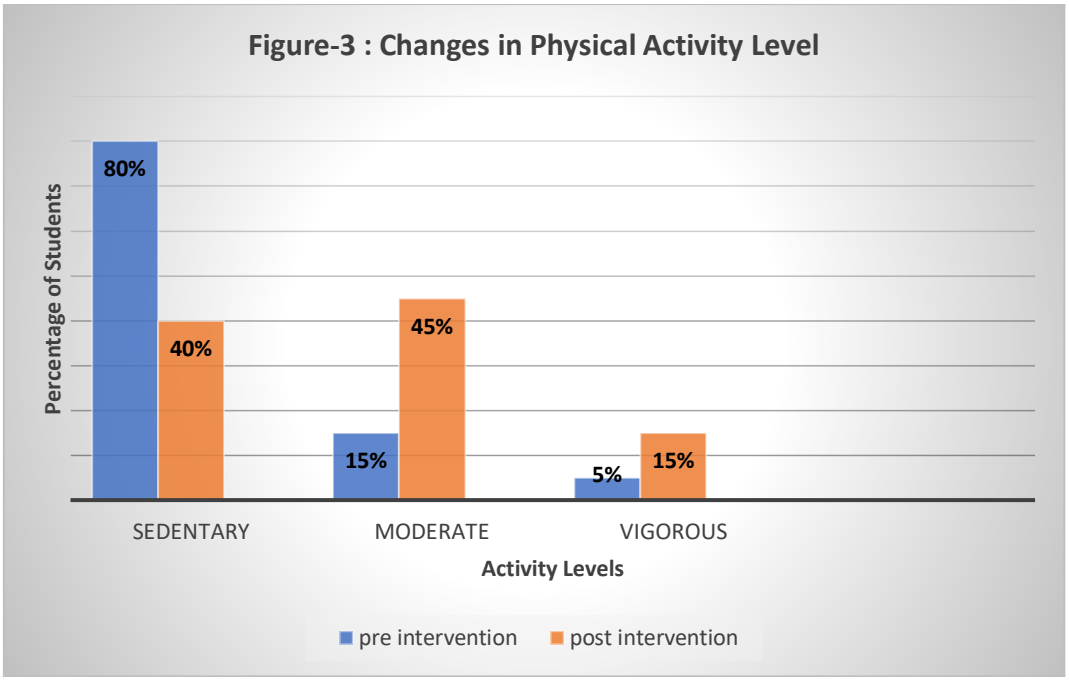
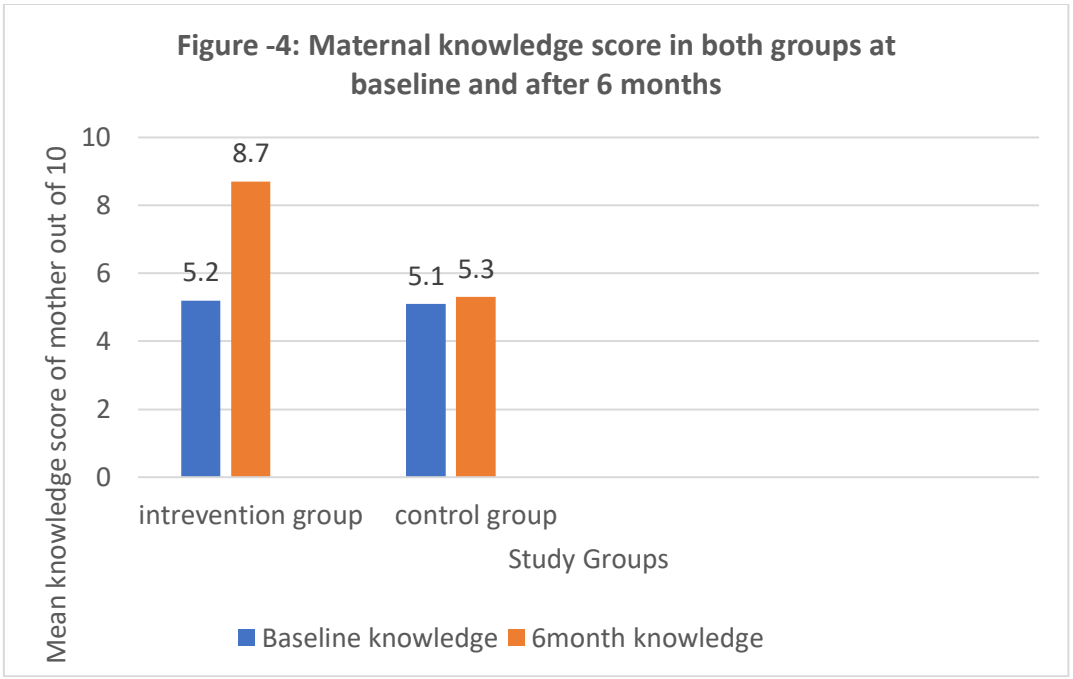


The bar graph shows **a significant increase in moderate and vigorous physical activity levels** among students in the intervention group, while the control group remained largely sedentary.



Maternal knowledge scores improved significantly in the intervention group after the nutritional education sessions.

Discussion

This study demonstrates that nutritional education for mothers can significantly reduce the BMI of obese primary school students in Cuttack City. The findings align with previous research highlighting the role of parental involvement in managing childhood obesity.[3] By empowering mothers with knowledge and practical skills, this intervention addresses the root causes of poor dietary habits and sedentary behaviors, leading to a mean reduction of 1.6 units in BMI over 6 months. This reduction is clinically significant, as even modest decreases in BMI during childhood can lower the risk of long-term health complications such as type 2 diabetes, hypertension, and cardiovascular diseases.[2,4]

The improvement in dietary habits among students in the intervention group, including increased consumption of fruits and vegetables and reduced

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intake of junk food and sugar-sweetened beverages, is consistent with global recommendations for preventing and managing childhood obesity.[5] Similar findings have been reported in other studies, where maternal education led to positive changes in children's dietary behaviors.[6,7] The increase in moderate and vigorous physical activity levels among students in the intervention group further underscores the importance of addressing both dietary and activity-related factors in obesity management.[8]

The success of this intervention can be attributed to its structured and culturally appropriate design, which empowered mothers to make informed decisions about their children's diets and lifestyles. This approach is supported by evidence from family-based interventions, which

have been shown to be more effective in promoting sustainable lifestyle changes than interventions targeting children alone.[3,9] The high satisfaction rates and willingness of mothers to continue the program further highlight its acceptability and feasibility in similar settings.

However, the study has some limitations. The small sample size and short follow-up period may limit the generalizability of the findings and the ability to assess long-term sustainability. Future studies should include larger, multi-centre samples and longer follow-up periods to confirm these findings.[10] Additionally, the reliance on self-reported dietary and physical activity data may introduce recall bias. Objective measures such as food diaries or accelerometers could improve accuracy in future studies.[11]

The findings of this study have important policy implications. Integrating maternal nutritional education into school health initiatives can provide a cost-effective and scalable strategy to combat childhood obesity.[12] Policymakers and educators should prioritize parental involvement in promoting healthy lifestyles for children, as parents play a critical role in shaping their children's eating and activity behaviours.[13]

Conclusions

Nutritional education for mothers is an effective strategy for reducing BMI among obese primary school students in Cuttack City. Integrating such programs into school health initiatives can help combat the growing burden of childhood obesity.

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