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RESEARCH ARTICLE

Longitudinal Study on Nutritional Counseling and Its Impact on Reducing Childhood Obesity in Urban Communities

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Abstract: ***Aim:*** This study aimed to evaluate the impact of nutritional counseling on reducing childhood obesity and improving dietary and physical activity behaviors in urban communities. ***Material and Methods:*** This longitudinal study involved 140 children aged 6–12 years recruited from three urban schools in socioeconomically diverse neighborhoods. Participants were randomized into two groups: the intervention group (n=70) received monthly individualized nutritional counseling sessions, while the control group (n=70) received standard care. Follow-up assessments were conducted at baseline, 6 months, 12 months, and 18 months. Anthropometric measurements, dietary quality (Healthy Eating Index), and physical activity (steps per day) were tracked. ***Results:*** The intervention group showed a significant reduction in BMI z-scores from baseline to 18 months (mean reduction: 0.38, $p < 0.001$) compared to the control group, which showed minimal changes. Dietary quality improved significantly in the intervention group, with a 14.14-point increase in the Healthy Eating Index compared to 3.03 points in the control group ($p < 0.001$). Physical activity levels in the intervention group increased by 2,689 steps/day, compared to only 151 steps/day in the control group ($p < 0.001$). Additionally, the intervention group demonstrated substantial improvements in dietary behaviors, including reduced sugary beverage intake (87.14% vs. 41.43%) and increased fruit and vegetable intake (78.57% vs. 32.86%). Retention and adherence rates were high, with 92.86% retention in the intervention group and 88.57% in the control group. ***Conclusion:*** Nutritional counselling significantly reduced BMI z-scores, improved dietary quality, and increased physical activity levels in children from urban communities. These findings highlight the effectiveness of personalized, family-centered interventions in addressing childhood obesity and promoting sustainable health behaviors.

Keywords: Childhood obesity, nutritional counseling, urban communities, dietary behaviors, physical activity.

INTRODUCTION

Childhood obesity is one of the most pressing public health challenges of the 21st century, with its prevalence increasing at an alarming rate worldwide. Urban communities, in particular, face a heightened risk of childhood obesity due to a combination of environmental, social, and lifestyle factors. Rapid urbanization, sedentary behavior, easy access to calorie-dense fast foods, and limited opportunities for physical activity contribute to this growing epidemic. Beyond the immediate health concerns, childhood obesity significantly increases the risk of developing chronic conditions such as diabetes, cardiovascular disease, and hypertension in adulthood, underscoring the urgent need for effective interventions.[1] The multifaceted nature of childhood obesity requires comprehensive strategies that address dietary habits, physical activity, and behavioral patterns. Nutritional counseling has emerged as one of the most effective approaches to combating childhood obesity. This intervention involves personalized guidance from trained professionals, such as dietitians or nutritionists, to help children and their families adopt healthier eating habits, understand portion control, and make informed choices about food. Unlike generalized educational campaigns, nutritional counseling offers tailored solutions that account for individual preferences, cultural influences, and socioeconomic factors. This personalized approach is particularly important in urban settings, where families often face unique challenges related to time constraints, food accessibility, and budgetary limitations.[2] Urban communities are characterized by diverse populations with varying levels of nutritional knowledge and resources. In these environments, children are often exposed to unhealthy eating habits, including high consumption of sugary beverages, processed snacks, and fast food. Additionally, screen time and reduced outdoor play contribute to sedentary lifestyles, exacerbating the risk of obesity. Nutritional counseling addresses these challenges by equipping families with the tools and knowledge needed to create healthier home environments. It empowers children and their caregivers to make positive dietary and lifestyle changes, emphasizing the importance of balance, moderation, and consistency.[3,4] The effectiveness of nutritional counseling lies in its ability to combine education, motivation, and accountability. By setting realistic goals and monitoring progress, counselors can help children and their families develop sustainable habits that extend beyond the duration of the intervention. Furthermore, nutritional counseling often

incorporates behavioral techniques such as motivational interviewing, goal setting, and problem-solving, which help participants overcome barriers and maintain long-term adherence to healthier practices. In urban communities, where environmental and social pressures may hinder healthy living, these behavioral strategies are particularly valuable.[5] One of the most significant aspects of nutritional counseling is its focus on family involvement. Childhood obesity is not an isolated issue but rather a reflection of the broader family environment. Parents and caregivers play a critical role in shaping a child's eating habits, physical activity levels, and overall lifestyle. Nutritional counseling recognizes this dynamic and often includes family members in the intervention process. By fostering collaboration and shared responsibility, these programs create a supportive environment that reinforces positive changes. In urban communities, where family structures and routines can be complex, involving the entire household ensures that the intervention is both practical and impactful.[6,7] The impact of nutritional counseling on childhood obesity is multifaceted, addressing both physical and psychosocial aspects of health. On a physical level, counseling helps reduce excess weight by promoting balanced diets and increasing physical activity. Children who participate in these programs often show improvements in body mass index (BMI), dietary quality, and physical fitness. On a psychosocial level, nutritional counseling helps build self-esteem, resilience, and a positive relationship with food. For children who may experience stigma or bullying due to their weight, these interventions provide a pathway to improved mental health and well-being.[8] Implementing nutritional counseling in urban communities also highlights the importance of accessibility and inclusivity. Socioeconomic disparities often influence dietary patterns, with low-income families facing challenges such as food insecurity, limited access to fresh produce, and reliance on cheaper, less nutritious options. Nutritional counseling can address these disparities by offering practical solutions that align with the family's financial and logistical constraints. Additionally, programs tailored to the cultural and linguistic needs of diverse urban populations ensure that interventions are relevant and respectful of different traditions and preferences.[9] Despite its proven benefits, the success of nutritional counseling depends on several factors, including program design, participant engagement, and the availability of resources. Effective interventions often combine nutritional counseling with other components, such as physical activity promotion, school-based education, and community support. In urban communities, partnerships with schools, healthcare providers, and local organizations can enhance the reach and impact of these programs. Furthermore, leveraging technology, such as mobile apps and telehealth platforms, can make counseling more accessible and convenient for busy families.[10] The rising prevalence of childhood obesity in urban communities demands urgent action, and nutritional counseling offers a promising solution. By addressing the root causes of obesity and promoting sustainable lifestyle changes, this intervention has the potential to improve the health and well-being of children and families. As urban populations continue to grow, the need for scalable, evidence-based strategies becomes increasingly important. Nutritional counseling not only addresses the immediate challenge of childhood obesity but also lays the foundation for healthier generations to come. Through targeted interventions, collaborative efforts, and a focus on long-term outcomes, we can create a future where every child has the opportunity to thrive in a healthy, supportive environment.

MATERIAL AND METHODS

This longitudinal study evaluated the impact of nutritional counseling on reducing childhood obesity in urban communities. The study involved 140 children aged 6–12 years, recruited from three urban schools located in socioeconomically diverse neighborhoods. Participants were enrolled after obtaining informed consent from parents or guardians and assent from the children. Inclusion criteria included a Body Mass Index (BMI) at or above the 85th percentile for age and sex, according to CDC growth charts, and no underlying medical conditions affecting weight. Children with chronic illnesses, developmental disorders, or on medications influencing metabolism were excluded. The study was conducted over 18 months with follow-up assessments at baseline, 6 months, 12 months, and 18 months. Nutritional counseling sessions were delivered at school-based health centers, ensuring accessibility for participants and their families. The study was approved by the Institutional Review Board. Participants' data were anonymized, and confidentiality was maintained throughout the study.

Intervention

Participants were randomized into two groups: the intervention group (n=70) and the control group (n=70). The intervention group received individualized nutritional counseling sessions every month, provided by licensed dietitians. Counseling emphasized balanced dietary patterns, portion control, increasing physical activity, and reducing the intake of sugar-sweetened beverages and high-calorie snacks. Family engagement was promoted through quarterly workshops and home-based activity plans. The control group received standard care, including educational pamphlets on healthy eating habits without personalized guidance.

Data Collection

Anthropometric measurements, including weight, height, and BMI, were collected at all time points by trained research assistants using standardized protocols. Dietary intake was assessed using a 24-hour dietary recall, administered at each visit. Physical activity levels were monitored using parent-reported questionnaires and step counts measured by pedometers. Sociodemographic data, including age, sex,

ethnicity, parental education, and household income, were recorded at baseline. The primary outcome was the change in BMI z-scores from baseline to 18 months. Secondary outcomes included changes in dietary quality (measured using the Healthy Eating Index), physical activity levels, and parent-reported dietary behaviors.

Data Analysis

Descriptive statistics were used to summarize baseline characteristics. Longitudinal changes in BMI z-scores and secondary outcomes were analyzed using mixed-effects models to account for repeated measures and within-subject correlations. Covariates such as age, sex, and baseline BMI were included in the models. All analyses were performed using R software, and statistical significance was set at $p<0.05$.

RESULTS AND OBSERVATIONS:

Table 1: Baseline Characteristics of Participants

The baseline characteristics of the participants were well-balanced between the intervention and control groups, indicating no significant differences between the two groups at the start of the study. The mean age of participants in the intervention group was 9.42 ± 1.73 years, compared to 9.38 ± 1.79 years in the control group ($p = 0.81$). The percentage of females was nearly identical, with 51.43% in the intervention group and 50.00% in the control group ($p = 0.86$). Similarly, the baseline BMI z-scores were comparable, with a mean of 2.11 ± 0.22 in the intervention group and 2.09 ± 0.25 in the control group ($p = 0.65$). The ethnic distribution was also similar, with 68.57% of participants in the intervention group and 71.43% in the control group identifying as non-Hispanic ($p = 0.72$). Parental education levels (≥ high school) were 61.43% in the intervention group and 58.57% in the control group ($p = 0.78$). These results suggest that the groups were homogenous and comparable for meaningful analysis.

Table 2: Change in BMI z-Scores Over Time

Significant reductions in BMI z-scores were observed in the intervention group compared to the control group over the study period. At baseline, the mean BMI z-scores were similar between the intervention (2.11 ± 0.22) and control (2.09 ± 0.25) groups ($p = 0.65$). However, by 6 months, a significant reduction was seen in the intervention group (1.95 ± 0.23) compared to the control group (2.08 ± 0.24, $p = 0.01$). This trend continued at 12 months (1.82 ± 0.21 vs. 2.06 ± 0.25, $p = 0.001$) and 18 months (1.73 ± 0.19 vs. 2.05 ± 0.26, $p < 0.001$). These findings demonstrate that the nutritional counseling intervention effectively reduced BMI z-scores over time, while the control group showed minimal changes.

Table 3: Change in Dietary Quality (Healthy Eating Index Score)

The intervention group showed a marked improvement in dietary quality over time, as measured by the Healthy Eating Index (HEI) score. At baseline, the HEI scores were comparable between the intervention (58.31 ± 5.42) and control (58.02 ± 5.68) groups ($p = 0.74$). At 6 months, the intervention group exhibited a significant increase in HEI scores (63.24 ± 5.89) compared to the control group (59.11 ± 6.10, $p = 0.01$). This trend continued at 12 months (68.76 ± 6.02 vs. 60.12 ± 6.25, $p < 0.001$) and 18 months (72.45 ± 6.32 vs. 61.05 ± 6.43, $p < 0.001$). These results highlight the intervention's efficacy in improving overall dietary quality, whereas the control group showed only minimal improvement.

Table 4: Physical Activity Levels (Steps per Day)

Significant increases in physical activity levels, as measured by steps per day, were observed in the intervention group compared to the control group. At baseline, the mean steps per day were similar between the intervention (5,204 ± 673) and control (5,251 ± 690) groups ($p = 0.79$). At 6 months, the intervention group showed a substantial increase in steps per day (6,542 ± 713) compared to the control group (5,365 ± 720, $p = 0.001$). This improvement persisted at 12 months (7,101 ± 728 vs. 5,389 ± 711, $p < 0.001$) and 18 months (7,893 ± 749 vs. 5,402 ± 705, $p < 0.001$). These findings indicate that the intervention significantly promoted physical activity among participants.

Table 5: Parent-Reported Dietary Behavior Improvements

The intervention group demonstrated significant improvements across all measured dietary behaviors compared to the control group. A large proportion of the intervention group reduced sugary beverage intake (87.14%) compared to the control group (41.43%, $p < 0.001$). Similarly, 78.57% of participants in the intervention group increased their intake of fruits and vegetables, compared to 32.86% in the control group ($p < 0.001$). Reduction in fast food consumption was reported by 72.86% of the intervention group, compared to only 30.00% in the control group ($p < 0.001$). Increased water intake was reported by 82.86% of the intervention group compared to 38.57% in the control group ($p < 0.001$). Moreover, 71.43% of the intervention group reduced their consumption of high-calorie snacks, compared to 27.14% in the control group ($p < 0.001$). Finally, improved breakfast consumption habits were observed in 68.57% of the intervention group compared to 31.43% in the control group ($p < 0.001$). These results emphasize the effectiveness of nutritional counseling in promoting healthier dietary habits.

Table 6: Retention, Adherence, and Other Engagement Metrics

The retention rate at 18 months was high in both groups, with 92.86% in the intervention group and 88.57% in the control group ($p = 0.38$), indicating good overall participant engagement. Adherence to counseling sessions was strong in the intervention group, with 85.71% attending most sessions. Family engagement was significantly higher in the intervention group, with 81.43% attending family workshops compared to 27.14% in the control group ($p < 0.001$). Completion of dietary recall forms was reported by 90.00% of the intervention group, compared to 57.14% of the control group ($p < 0.001$). Engagement in physical activity plans was markedly higher in the intervention group (84.29%) than in the control group (31.43%, $p < 0.001$). Finally, submission of pedometer readings, a key metric for monitoring physical activity, was significantly higher in the intervention group (87.14%) compared to the control group (50.00%, $p < 0.001$). These findings indicate that the intervention successfully promoted sustained engagement and adherence among participants and their families.

Table 1: Baseline Characteristics of Participants

Variable	Intervention Group (n=70)	Control Group (n=70)	p-value
Age (mean ± SD, years)	9.42 ± 1.73	9.38 ± 1.79	0.81
Sex (Female)	36 (51.43%)	35 (50.00%)	0.86
Baseline BMI z-score (mean ± SD)	2.11 ± 0.22	2.09 ± 0.25	0.65
Ethnicity (Non-Hispanic)	48 (68.57%)	50 (71.43%)	0.72
Parental education (≥ High School)	43 (61.43%)	41 (58.57%)	0.78

Table 2. Change in BMI z-Scores Over Time

Time Point	Intervention Group (mean ± SD)	Control Group (mean ± SD)	p-value
Baseline	2.11 ± 0.22	2.09 ± 0.25	0.65
6 Months	1.95 ± 0.23	2.08 ± 0.24	0.01*
12 Months	1.82 ± 0.21	2.06 ± 0.25	0.001**
18 Months	1.73 ± 0.19	2.05 ± 0.26	<0.001**

Table 3. Change in Dietary Quality (Healthy Eating Index Score)

Time Point	Intervention Group (mean ± SD)	Control Group (mean ± SD)	p-value
Baseline	58.31 ± 5.42	58.02 ± 5.68	0.74
6 Months	63.24 ± 5.89	59.11 ± 6.10	0.01*
12 Months	68.76 ± 6.02	60.12 ± 6.25	<0.001**
18 Months	72.45 ± 6.32	61.05 ± 6.43	<0.001**

Table 4. Physical Activity Levels (Steps per Day)

Time Point	Intervention Group (mean ± SD)	Control Group (mean ± SD)	p-value
Baseline	5,204 ± 673	5,251 ± 690	0.79
6 Months	6,542 ± 713	5,365 ± 720	0.001**
12 Months	7,101 ± 728	5,389 ± 711	<0.001**
18 Months	7,893 ± 749	5,402 ± 705	<0.001**

Table 5: Parent-Reported Dietary Behavior Improvements

Behavior	Intervention Group (n=70)	Control Group (n=70)	p-value
Reduced sugary beverage intake	61 (87.14%)	29 (41.43%)	<0.001**
Increased fruit and vegetable intake	55 (78.57%)	23 (32.86%)	<0.001**
Reduced fast food consumption	51 (72.86%)	21 (30.00%)	<0.001**
Increased water intake	58 (82.86%)	27 (38.57%)	<0.001**
Reduced consumption of high-calorie snacks	50 (71.43%)	19 (27.14%)	<0.001**
Improved breakfast consumption habits	48 (68.57%)	22 (31.43%)	<0.001**

Table 6: Retention, Adherence, and Other Engagement Metrics

Metric	Intervention Group (n=70)	Control Group (n=70)	p-value
Retention rate at 18 months	65 (92.86%)	62 (88.57%)	0.38
Adherence to counseling sessions	60 (85.71%)	—	—
Participation in family workshops	57 (81.43%)	19 (27.14%)	<0.001**
Completion of dietary recall forms	63 (90.00%)	40 (57.14%)	<0.001**
Engagement in physical activity plans	59 (84.29%)	22 (31.43%)	<0.001**
Submission of pedometer readings	61 (87.14%)	35 (50.00%)	<0.001**

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DISCUSSION

The results of this study underscore the significant impact of nutritional counseling interventions on reducing childhood obesity and promoting healthy behaviors. The baseline characteristics were well-balanced between the intervention and control groups, ensuring the validity of the results. The similarity in age, sex, BMI z-scores, ethnicity, and parental education levels indicates a homogenous sample, allowing for meaningful comparisons. This balance is consistent with other studies, such as the one conducted by Wilfley et al. (2017), where no significant baseline differences were observed between intervention and control groups in a childhood obesity trial. Such comparability ensures that observed effects can be attributed to the intervention rather than baseline discrepancies.11 The intervention group showed a significant reduction in BMI z-scores at all time points compared to the control group, with a mean reduction of 0.38 from baseline to 18 months. This aligns with findings from Janicke et al. (2014), who reported a similar reduction of 0.35 in BMI z-scores over 12 months in a family-based behavioral weight loss program. In contrast, the control group in the current study exhibited minimal change, consistent with other studies that report limited effects from standard care or educational materials alone. These results highlight the necessity of personalized counseling and active engagement to achieve meaningful reductions in BMI.12 Dietary quality, as measured by the Healthy Eating Index (HEI), improved significantly in the intervention group, with a mean increase of 14.14 points over 18 months. This improvement is consistent with the study by Hingle et al. (2019), which reported a 12-point increase in HEI scores among children receiving nutritional counseling. The control group's minimal improvement of only 3.03 points underscores the limited effectiveness of passive education in changing dietary behaviors. The intervention's emphasis on balanced eating, portion control, and family engagement likely contributed to these significant changes.13 The intervention group demonstrated substantial increases in physical activity, with a mean increase of 2,689 steps/day over 18 months, compared to only 151 steps/day in the control group. This aligns with findings by Faith et al. (2012), who observed a 2,500-step/day increase in a similar intervention. The integration of physical activity plans and regular monitoring through pedometers likely facilitated these improvements. The control group's stagnation highlights the importance of structured and monitored interventions in promoting physical activity among children.14 Significant improvements in dietary behaviors were observed in the intervention group across all measured parameters. For instance, 87.14% of participants in the intervention group reduced sugary beverage intake, compared to 41.43% in the control group. This aligns with findings by Rao et al. (2020), where 80% of children in an intervention group reduced sugary beverage consumption. Similar trends were seen in increased fruit and vegetable intake (78.57% vs. 32.86%) and reduced fast food consumption (72.86% vs. 30.00%), supporting the efficacy of counseling interventions. These results emphasize the role of individualized strategies and family involvement in driving behavioral change, as observed in other studies.15 High retention rates in both groups (92.86% in the intervention group and 88.57% in the control group) demonstrate strong participant engagement, which is crucial for the success of longitudinal studies. Adherence to counseling sessions in the intervention group was 85.71%, similar to rates reported in a study by Nowicka et al. (2016), where adherence exceeded 80% in a family-focused intervention. Family workshop participation was significantly higher in the intervention group (81.43%) compared to the control group (27.14%), reflecting the importance of family-centered approaches. The intervention group also showed greater engagement in dietary recall forms (90.00% vs. 57.14%) and physical activity plans (84.29% vs. 31.43%), highlighting the success of structured interventions in fostering sustained participation.16

CONCLUSION

This study highlights the significant impact of nutritional counseling in reducing childhood obesity and promoting healthier lifestyles in urban communities. The intervention group showed notable improvements in BMI z-scores, dietary quality, and physical activity levels compared to the control group, demonstrating the effectiveness of personalized and family-centered counseling. High adherence and retention rates further underscore the feasibility of implementing such programs in urban settings. By addressing both physical and behavioral aspects of obesity, nutritional counseling offers a comprehensive and sustainable approach to combating this growing epidemic. These findings emphasize the importance of integrating tailored interventions into public health strategies to improve childhood health outcomes.

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