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Investigating the Effect of a Care Program Based on Betty Newman's Systemic Model on the Quality of Life of Obese Adolescents

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Abstract

Background and Aim: Obesity in adolescents can have serious consequences for their physical and mental health. Betty Newman's systems model can be used as an effective framework for designing care programs for obese adolescents. The aim of this study was to determine the effect of a care program based on Betty Newman's systemic model on the quality of life of obese adolescents studying at schools of Khorramabad city, Iran.

Materials and Methods: This research was a semi-experimental study with a pretest-posttest design with a randomized control group. 64 obese adolescents aged 12 to 18 years were selected from obese adolescents studying in the first and second secondary schools of Khorramabad city using a using convenience sampling and then randomly assigned. The intervention group received a care program based on the Betty Newman systemic model in 6 sessions. The data collection tools in the present study were a demographic form and health-related quality of life (HRQoL). The data were analyzed using SPSS version 22 software.

Results: At baseline, the mean quality-of-life score was significantly lower in the intervention group than in the control group (58.7 ± 9.8 vs. 67.8 ± 8.6, p <.001). Following the intervention, the mean quality-of-life score was 57.9 ± 10.3 in the intervention group and 69.9 ± 9.4 in the control group, and the difference between the two groups remained statistically significant (p <.001).

Conclusion: The findings of the present study showed that the intervention based on Betty Neuman's systems model did not lead to an improvement in quality-of-life scores among adolescents with obesity during the study period. Despite the lack of significant improvement observed in the present study, the findings provide useful evidence for the development and refinement of school-based programs aimed at promoting the well-being and quality of life of adolescents with obesity.

Keywords: Betty Newman system model, quality of life, adolescents, obesity.

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Introduction

Obesity is defined as a chronic disease characterized by excessive body fat [1]. This condition is usually measured by using body mass index (BMI), which is defined as the ratio of weight to height squared. For adolescents, there are different values for determining obesity based on age and sex, and percentiles are used for better understanding [2]. According to the World Health Organization (WHO) in 2021, about 39% of adults were overweight and 13% were obese globally [3]. Obesity in adolescents is also on the rise, with approximately 6% of adolescents aged 10–19 years being obese [4]. In Iran, the prevalence of obesity in adolescents is continuously increasing. A review article reported that the prevalence of obesity among Iranian students aged 6–20 years was 11%, while the prevalence of overweight was 12%, and it is more prevalent in boys [5]. According to a 2020 study, about 16% of Iranian adolescents were obese and 20% were overweight [6]. These statistics represent serious public health concerns.

Obesity in adolescents can have serious consequences for their physical and mental health. Physical problems include type 2 diabetes, heart disease, high blood pressure, joint problems, and respiratory disorders [7]. Psychologically, an increased risk of depression, anxiety, and decreased self-esteem may occur [8]. Also, discrimination and misjudgment by peers and society can cause social problems [9]. Finally, obesity may lead to a reduced quality of life and affect adolescents' social and recreational activities [10].

Adolescent quality of life refers to a set of physical, psychological, social, and economic factors that affect their sense of satisfaction and happiness [11]. This quality is especially important during adolescence when an individual is forming identity and personality [12]. Obesity, as a chronic problem, can have profound negative effects on the quality of life of adolescents, and these effects manifest in various forms [13]. They not only harm physical health, but also lead to a decrease in motor abilities and daily activities [14]. As a result, adolescents who suffer from obesity may be less inclined to participate in sports and recreational activities, which in turn leads to a decreased quality of life [15]. Psychologically, obesity can cause low self-confidence and negative self-concept in adolescents. These feelings may lead to depression, anxiety, and loneliness [16]. Obese adolescents may face negative judgments from peers or society, which can lead to social problems and isolation [9]. These psychological factors, in turn, affect their quality of life and can lead to reduced life satisfaction [10].

Lifestyle intervention programs targeting childhood obesity should be tailored to the needs of this vulnerable group [17]. Clinical use of nursing models and theories helps to develop nursing knowledge. Use of nursing model is an essential step towards achieving practical goals of clinical and educational research. Using nursing models and theories in the process of caring for clients can provide a framework for thinking [18]. The choice of nursing models and theories depends on the situation. Betty Newman's systems model is a comprehensive framework for understanding the health and quality of life of individuals by paying attention to the mutual effects of various factors on them [19]. This model is designed based on three

levels of systems: The individual system which includes the personal, physical, and psychological characteristics of the individual. The interpersonal system that includes the individual's social connections and interactions with family, friends, and society. The sociocultural system which includes factors such as culture, politics, and economic conditions that affect the individual [20].

Several studies that have examined the effect of Betty Newman System Model on diseases include the following: A study in Iran by Ghanbari Afra and colleagues examined the effect of Betty Newman Model on patients with heart disease. This study showed that multilevel interventions that included individual education, family support, and changes in health policies led to a reduction in complications and improved cardiac health in patients [21]. Also, a study conducted by Başoğul and Buldukoğlu in 2020 examined the effect of Betty Newman System Model on patients with depression. The results of this study showed that comprehensive interventions that included individual counseling, support groups, and changes in the social environment reduced depressive symptoms and improved the quality of life of patients [22].

Given the importance of obesity in adolescents, the increase in the prevalence of obesity in recent years, especially after Corona period, and the knowledge gap in this field, the present study examined the "effect of a care program based on Betty Newman's systemic model on the quality of life of obese adolescents."

Methods

This is an semi-experimental study with pretest-posttest design and a randomized control group. The research population consisted of obese adolescents aged 12 to 18 who were studying at the junior and senior high schools of Khorramabad city. According to the study of Mahdavifar et al.(2025), assuming equal variance in the two groups, a statistical type I error of 0.05 and a statistical power of 0.8, and using the following formula, the sample size in each group was estimated to be 32 people [23].

$$n=\frac{\left(Z_{1-\alpha/2}+Z_{1-\beta}\right)^2 * 2 * \sigma^2}{d^2} \qquad Z_{0.975} = 1.96$$

$$Z_{0.8} = 0.84 \qquad d=1.25$$

Inclusion criteria for the adolescents included; being between 12 and 18 years old, having a BMI greater than or equal to 30, having no speech or hearing disorders, experiencing no stress such as death of loved one in the past six months, having no known chronic physical or mental illnesses, and no medication use in this regard. If an individual was unable or unwilling to cooperate during the intervention, did not attend more than one training session, or faced severe stress such as death of a family member or any other crisis during the intervention, he/she was excluded from the study. In this study, all students who met the inclusion criteria were initially included in the study through convenience sampling and then randomly assigned to two intervention and control groups using number cards. Ethical considerations in this study was approved by the Ethics Committee of Islamic Azad University, Tehran Medical Sciences (IR.IAU.TMU.REC.1403.453).

After obtaining permission and a code of ethics from the ethics committee, the researcher presented a letter of introduction to the head of education in Khorramabad city, coordinated with school

administrators, and began the sampling process on a specific day and time. This study adhered to the Declaration of Helsinki and national ethical guidelines for research involving minors. Parental informed consent was a prerequisite for any adolescent's enrollment. Adolescents were also free to withdraw from the study at any time without any consequences. In order to comply with the principles of research ethics, a written and oral consent was obtained from the samples and they were assured that all personal information would remain confidential. In this way, a pre-test and post-test were conducted with the control group. Finally, the study samples were divided into two intervention (32 adolescents aged 12 to 18 with obesity who received a care program based on the Betty Newman systemic model) and control groups (32 adolescents aged 12 to 18 with obesity who did not receive any intervention). The intervention group received a care program based on Betty Newman's systemic model. This intervention was held in 6 weekly sessions, each lasted for 60 minutes (Table 1). In some sessions, the researcher and in some sessions, a nutrition counselor was in charge of teaching. Also, the questionnaire was completed before and 6 weeks after the last session. The choice of a 6-week intervention and 6-week follow-up period was pragmatic rather than evidence-based.

Table 1: Educational content based on Betty Newman's model of systemic care in adolescents with obesity

Session	Content	Objective	Actions	Educations
1	Getting to know each other and setting goals	Getting to know the participants and setting individual and group goals	• Introducing yourself and stating challenges • SMART* goal setting workshop.	Basic concepts of nutrition and the impact of obesity on quality of life
2	Healthy nutrition and eating habits	Promoting awareness about healthy eating	• Healthy and Unhealthy Food Identification Workshop • Group games to learn positive eating habits	• How to read food labels? • Planning healthy meals
3	Physical activity and its benefits	Encouraging physical activity and learning sports techniques	• Hold a sports meeting • Small sports competitions to increase motivation	• Benefits of exercise on physical and mental health • Introducing types of physical activities that can be enjoyable.
4	Managing stress and emotions	Learning stress and emotion management techniques	• Deep breathing and meditation techniques workshop • Group discussion about emotions and how to manage them	• The impact of stress on eating habits and weight • Techniques for coping with stress in everyday life

5	Social support and communication	Creating a sense of social support and fostering positive relationships	• Forming support groups to exchange experiences • Group exercises to strengthen communication	• The importance of family and friends in motivating • Strategies to strengthen positive relationships
6	Evaluating progress and planning for the future	Assessing progress and planning for the future	• Reviewing set goals and assessing progress • Discussing challenges and successes	• Guidance on how to continue after the sessions • Provide additional resources (books, websites) for further reading

** SMART is an acronym for Specific, Measurable, Achievable, Relevant, and Time-bound, a standard framework for goal setting in behavioral interventions.*

The data collection tools included demographic characteristics form and an adolescent health-related quality of life (HRQOL) questionnaire. In the demographic characteristics form, variables such as age, gender, educational status, body mass index, economic status, and parental education level were measured.

The HRQOL questionnaire focused on the physical, psychological, and social aspects of health which are influenced by the individual's personal experiences, beliefs, expectations and feelings. The KidScreen tool is a self-administered questionnaire which is used for healthy children and adolescents aged 8 to 18 years, and surrogate versions are also available for parents or other caregivers. The KidScreen can be used in hospitals, medical centers, and schools. There are currently three versions of the KidScreen with 52, 27, and 10 items. The 27-item version covers five areas including: Physical well-being has 5 items and measures levels of physical activity, energy, and fitness. Psychological well-being has 7 items. Positive emotions measures life satisfaction and balanced emotions. Parental and autonomy has 7 items and measures parental home climate, adequate freedom, and satisfaction with financial resources. Social and peer support has 4 items and measures peer relationships. The School Environment has 4 items and assesses children's and adolescents' perceptions of their cognitive capacity to learn and concentrate, and their feelings about school. The instrument is based on a 5-point Likert scale (1=never, 2=almost never, 3=sometimes, 4=almost always, and 5=always) and indicates the frequency of a specific behavior or feeling or the intensity of an attitude. The subscale scores are linearly converted to a 0–100-point scale, with 100 representing the best and 0 representing the worst quality of life. Scores range from 27 to 135 with higher score indicating better quality of life. Cronbach's alpha coefficient of five areas has been reported to be.78-.84 [24]. In Iran, in 2012, the validity and reliability of this instrument was also assessed by Nik -Azin and colleagues, and the Cronbach's alpha coefficients of areas, except for the school environment, were calculated to be higher than.70, and also the two-week test-retest coefficients for all areas were found to be strong (p<.05) [25]. In the present study, Cronbach's alpha coefficient was also used to examine the internal correlation of the

scale, and the reliability of the instrument was assured by calculating Cronbach's alpha coefficient (.77).

Data were analyzed using descriptive and inferential statistics through SPSS-22 software. The chi-square test was used to compare qualitative data between the groups. The quantitative data such as age and scores obtained from HRQOL questionnaire were first checked for normality with the Shapiro-Wilk test, and since the scores had normal variance, they were compared with one-way ANOVA and repeated measures ANOVA. The significance level for all tests was considered to be less than.05.

Results

A total of 64 obese students participated in the study and were equally assigned to the intervention (n = 32) and control (n = 32) groups. In both groups, 53.1% of participants were boys and 53.1% were middle school students. Regarding economic status, 40.6% of participants in each group reported a moderate economic condition. The mean age of participants was 14.6 ± 1.6 years in the intervention group and 14.6 ± 1.7 years in the control group. The mean BMI was 31.1 ± 3.3 and 31.0 ± 3.4 in the intervention and control groups, respectively. No statistically significant differences were found between the two groups in terms of sex, educational level, parental education, economic status, age, and BMI (all p>.05), indicating baseline comparability between the groups (Table 2).

The comparison of quality-of-life scores between the intervention and control groups is presented in Table 3. At baseline, the mean quality-of-life score was significantly lower in the intervention group than in the control group (58.7 ± 9.8 vs. 67.8 ± 8.6, p <.001). Following the intervention, the mean quality-of-life score was 57.9 ± 10.3 in the intervention group and 69.9 ± 9.4 in the control group, and the difference between the two groups remained statistically significant (p<.001). Within-group comparison showed a slight decrease in the mean quality-of-life score in the intervention group and a slight increase in the control group after the intervention.

Table 2: Demographic characteristics of participants

Variables	Intervention group n (%)	Control group n (%)	*p*
Sex			
Girl	15 (46.9)	15 (46.9)	.001
Boy	17 (53.1)	17 (53.1)	
Education			
Middle school	17 (53.1)	17 (53.1)	.001
High school	15 (46.9)	15 (46.9)	
Mother’s education			
Elementary	3 (9.4)	3 (9.4)	.932
Middle school	6 (18.8)	6 (18.8)	
Diploma	14 (43.8)	15 (46.9)	
Bachelor’s degree	5 (15.6)	4 (12.5)	
Master’s degree	3 (9.4)	4 (12.5)	
PhD	1 (3.1)	0 (0.0)	
Father’s education			
Elementary	2 (6.3)	2 (6.3)	.978

Middle school	8 (25.0)	9 (28.1)	
Diploma	11 (34.4)	11 (34.4)	
Bachelor's degree	5 (15.6)	4 (12.5)	
Master's degree	5 (15.6)	4 (12.5)	
PhD	1 (3.1)	1 (3.1)	
Economic situation			
Poor	10 (31.3)	9 (28.1)	.954
Moderate	13 (40.6)	13 (40.6)	
Good	9 (28.1)	10 (31.3)	
Age (Mean ± SD)	14.6 ± 1.6	14.6 ± 1.7	.931
BMI (Mean ± SD)	31.1 ± 3.3	31.0 ±3.4	.884

Table 3. Comparison of quality of life scores between intervention and control groups

Time of measurement	Intervention group (n=32) Mean ± SD	Control group (n=32) Mean ± SD	*p*
Before intervention (baseline)	58.7 ± 9.8	67.8 ± 8.6	<.001
After intervention	57.9 ± 10.3	69.9 ± 9.4	<.001

Discussion

The present study investigated the effect of an intervention based on Betty Neuman's systems model on the quality of life of adolescents with obesity. The findings showed that quality-of-life scores differed significantly between the intervention and control groups both before and after the intervention. However, no improvement in quality-of-life scores was observed in the intervention group following the intervention, while only a slight increase was found in the control group. Therefore, the findings do not support a positive short-term effect of the intervention on the quality of life of obese adolescents.

These findings are inconsistent with the results reported by Diao et al. (2020), who demonstrated that comprehensive interventions addressing multiple dimensions of health could improve health-related quality of life in obese adolescents [26]. Similarly, Falakdami et al. (2025) reported that the application of Betty Neuman's systems model was effective in improving quality of life and nursing care among patients with cancer [27]. The discrepancy between these studies and the present findings may be attributed to differences in the target population, duration of intervention, intervention content, and the multidimensional nature of quality of life. In addition, according to Betty Neuman's systems model, strengthening the lines of resistance and restoring system stability may require a longer period before measurable changes become apparent. In this regard, Mastorci et al. (2024) suggested that enhancement of resilient defenses is usually a gradual process and may not be adequately reflected during short-term follow-up periods [35].

The absence of a favorable effect of the intervention is in line with the findings of Steinbeck et al. (2018), who reported that short-term interventions lasting less than 12 weeks may have limited effects on quality of life among obese adolescents [28].

Likewise, Diao et al. (2020) emphasized that sustainable improvements in quality of life require long-term and multidimensional interventions [26]. Therefore, the relatively short duration of the intervention in the present study may partly explain the lack of improvement observed in the intervention group.

An important finding of this study was that the control group exhibited a slight increase in quality-of-life scores despite receiving no specific intervention. One possible explanation is the Hawthorne effect, whereby participation in a study and repeated completion of questionnaires may increase health awareness and promote behavioral changes. Berkhout et al. (2022) reported that participation in research itself can influence health-related behaviors and perceptions [29]. Moreover, school environments may provide natural sources of social support that positively affect adolescents' psychological and social well-being. This interpretation is consistent with the findings of Wu et al. (2015), who suggested that educational settings may act as supportive environments that contribute to adolescents' health and quality of life [30].

Another explanation for the changes observed in the control group may be contamination between groups. In school settings, students interact closely with one another, and information regarding healthy behaviors may be transferred from participants in the intervention group to those in the control group. Previous studies by Stephenson et al. (2018) [32] and VanderWeele et al. (2013) [33] have highlighted the possibility of spillover effects in educational environments, which may reduce the magnitude of differences between groups. From a methodological perspective, Siddiqui et al. (2018) emphasized the importance of including control groups in intervention studies to avoid overestimating intervention effects [34].

Another issue that should be considered when interpreting the findings is the significant difference in quality-of-life scores between the two groups at baseline. The intervention group had significantly lower quality-of-life scores before the intervention than the control group, indicating that the groups were not fully comparable regarding the outcome variable. This baseline imbalance may have affected the post-intervention comparisons and limited the ability to attribute changes exclusively to the intervention. Future studies should consider stratified randomization or statistical adjustment methods to minimize baseline differences between groups.

Several limitations should be acknowledged. First, the intervention period was relatively short and may not have been sufficient to produce measurable changes in quality of life. Future studies should compare different intervention durations and follow-up intervals to determine the optimal timeframe for improving quality of life in obese adolescents.Second, some potentially important confounding variables, such as family support and socioeconomic factors, were not controlled. Third, the absence of an active comparison group prevented comparison of Betty Neuman's model with alternative intervention approaches. Finally, the baseline differences in quality-of-life scores between the two groups may have influenced the interpretation of the intervention effects. Future studies with larger sample sizes, longer follow-up

periods, and more rigorous control of confounding variables are recommended to clarify the effectiveness of Betty Neuman-based interventions in improving quality of life among adolescents with obesity.

Conclusion

The findings of the present study showed that the intervention based on Betty Neuman's systems model did not lead to an improvement in quality-of-life scores among adolescents with obesity during the study period. Although slight changes in quality-of-life scores were observed after the intervention, the intervention group did not demonstrate a favorable trend, and significant differences between the intervention and control groups persisted following the intervention. These findings suggest that short-term interventions based on Betty Neuman's model alone may not be sufficient to produce measurable improvements in quality of life among adolescents with obesity.

The slight increase observed in the control group may have been influenced by factors unrelated to the intervention, including natural social support within the school environment, increased health awareness resulting from participation in the study, or possible contamination between groups. Given the multifactorial nature of obesity and its impact on quality of life, more comprehensive and long-term interventions addressing individual, family, and environmental factors may be required to achieve sustainable improvements.

Furthermore, the baseline difference in quality-of-life scores between the two groups should be considered when interpreting the findings. Future studies are recommended to employ larger sample sizes, longer follow-up periods, and more rigorous control of confounding variables and baseline imbalances to better evaluate the effectiveness of Betty Neuman-based interventions. Despite the lack of significant improvement observed in the present study, the findings provide useful evidence for the development and refinement of school-based programs aimed at promoting the well-being and quality of life of adolescents with obesity.

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Conflict of interest

The authors declare no competing interests.

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