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# Applying the Health Belief Model to Examine Obesity Prevention Behaviors Among Female Adolescents in Sukoharjo, Central Java, Indonesia

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## ABSTRACT

**Background:** Obesity is a growing global health problem, especially among adolescent girls. The increasing prevalence of obesity in Indonesia, including in Sukoharjo Regency, is a serious concern because obesity contributes to various non-communicable diseases. This study aims to analyze the influence of the Health Belief Model (HBM) application on obesity prevention behavior among female adolescents at PPTQ Al Rasyid Kartasura, Sukoharjo, Central Java.

**Subjects and Method:** This study used a cross-sectional Study design. The study was carried out from February to March 2025 at PPTQ Al Rasyid Junior and Senior High School Kartasura, Sukoharjo. The study sample was 210 students who were selected by an exhaustive sampling technique. The data collection instrument was in the form of a structured questionnaire that measured the HBM constructs, namely perceived susceptibility, perceived severity, perceived benefit, perceived barriers, cues to action, and self-efficacy. Data analysis was conducted using multiple linear regression. The dependent variable was obesity prevention behavior.

**Results:** Obesity prevention behaviors increased with high perceived susceptibility (b= 0.17; 95% CI= 0.01 to 0.34; p= 0.022), perceived severity (b= 0.17; 95% CI= 0.01 to 0.34; p = 0.022), perceived benefits (b= 0.31; 95% CI= 0.03 to 0.59; p= 0.028), cues to action (b= 0.25; 95% CI= 0.02 to 0.49; p= 0.033), self-efficacy (b = 0.19; 95% CI= 0.01 to 0.37; p= 0.045), and decreased with the high perceived barriers (b = -0.18; 95% CI= -0.35 to -0.01; p= 0.046).

**Conclusion:** High perceived susceptibility, perceived severity, perceived benefit, cues to action, and self-efficacy, as well as low perceived barriers, contribute to improving obesity prevention behaviors among female adolescents.

**Keywords:** Obesity, adolescent girls, Health Belief Model, obesity prevention behaviors

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## BACKGROUND

Obesity is a condition of excess body fat that has a bad impact on health, both physically and mentally. Based on a report by the World Health Organization (WHO), the prevalence of obesity in adolescents has

increased significantly in recent decades, especially in developing countries including Indonesia (WHO, 2023). Data from Riskesdas 2018 shows that the prevalence of adolescent obesity in Indonesia reaches 16.6% and is estimated to continue to increase (Ministry of Health of the Republic of Indonesia, 2019). Adolescent girls are the most vulnerable group to obesity due to hormonal changes, social pressures, and unhealthy lifestyles such as fast food consumption, lack of physical activity, and the influence of social media. Obesity among female adolescents is not only at risk of causing chronic diseases such as type 2 diabetes, hypertension, and cardiovascular disease, but also impacts psychosocial health, including decreased self-confidence and emotional disorders (Rasmaniar, R., et al. 2022)

Particularly in the Sukoharjo Regency area, the prevalence of adolescent obesity is relatively high compared to other areas in Central Java. PPTQ Al Rasyid Kartasura as the location of this study, is an urban *pesantren* (Islamic boarding school) that combines Qur'an tahfidz activities with formal schools. Busy daily lives, access to fast food around the environment, and exposure to digital media are challenges in preventing obesity. Therefore, behavior-based prevention strategies are needed to overcome this problem.

One of the theoretical models used to understand and change health behavior is the Health Belief Model (HBM). HBM explains that a person's behavior is influenced by perceived susceptibility, severity, benefits, barriers, cues to act, and self-efficacy (StatPearls, 2024). In the context of obesity prevention, HBM helps explain how adolescent girls assess the risk of obesity, the serious impacts it may have, the benefits of prevention efforts, the barriers they face, as well as their readiness to act and confidence in changing their lifestyles.

Based on this background, this study is important to analyze the application of the Health Belief Model to obesity prevention behavior among female adolescents at PPTQ Al Rasyid Kartasura, Sukoharjo. This study is expected to be the basis for the preparation of school- and pesantren-based health program interventions to reduce the prevalence of obesity among adolescents.

## SUBJECTS AND METHOD

### 1. Study Design

This was a cross-sectional study conducted at PPTQ Al Rasyid Kartasura, Central Java, Indonesia.

### 2. Population and Sample

The population in this study was all junior and senior high school students of PPTQ Al Rasyid Kartasura. The sampling technique used was the exhaustive sampling method, where the entire population that meets the inclusion criteria is used as a sample. The total number of samples was 210 students, consisting of 78 high school students and 132 junior high school students.

### 3. Study Variables

The dependent variable in this study was obesity prevention behavior among female adolescents while the independent variables were the constructs of the health belief model, namely perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy.

### 4. Operational Definition of Variables

**Obesity Prevention Behavior**: actions taken by individuals to prevent being overweight, such as maintaining a diet and exercising regularly.

**Perceived Susceptibility:** an individual's belief about the possibility of obesity (Alyafei & Carr, 2024).

**Perceived Severity:** the extent to which individuals assess obesity as a condition that can have serious health impacts (Alyafei & Carr, 2024).

**Perceived Benefits:** the belief that preventive measures such as exercise and a healthy diet will provide benefits in avoiding obesity (Alyafei & Carr, 2024).

**Perceived Barriers:** obstacles encountered in carrying out obesity prevention behaviors such as time, motivation, or access (Alyafei & Carr, 2024).

**Cues to Action:** Triggering factors that motivate individuals to take action, e.g. information from teachers, the media, or the surrounding environment (Alyafei & Carr, 2024).

**Self-Efficacy:** An individual's confidence in his or her own ability to effectively carry out obesity prevention measures (Alyafei & Carr, 2024).

### 5. Study Instruments

The study instrument used for data collection was a questionnaire. A health belief model questionnaire that includes the constructs of perceived vulnerability, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy, as well as obesity prevention behaviors among female adolescents.

### 6. Data analysis

Univariate analysis was conducted to determine the frequency distribution of each variable. Bivariate analysis was carried out by a simple linear regression test. Furthermore, multivariate analysis was performed by double linear regression through STATA 17 software.

### 7. Research Ethics

Research ethics issues, including informed consent, anonymity, and confidentiality, are carefully addressed throughout the study process. The ethical clearance was obtained from the Research Ethics Committee at Dr. Moewardi Hospital, Surakarta, Indonesia, No. 2830/II/HREC/2025, on February 13, 2025.

## RESULTS

### 1. Sample Characteristics

Table 1 shows the characteristics of the 200 sample respondents who participated in the study. The least respondents were less than 14 years old 47 people (23.50%) and the most people over or equal to 14 years old, 153 people (76.50%). Furthermore, as many as 44 respondents were underweight, 54 respondents were normal weight, 32 respondents were overweight, and 16 respondents were obese.

**Table 1. Sample Characteristics Based on Age and Body Mass Index (BMI) Status among female adolescents**

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Age | < 14 years old | 47 | 23.50 |
| | ≥ 14 years old | 153 | 76.50 |
| Body Mass Index (BMI) | Less weight | 44 | 22.22 |
| | Normal weight | 54 | 53.45 |
| | Overweight | 32 | 16.16 |
| | Obesity | 16 | 8.08 |

### 2. Univariate Analysis

Univariate analysis was conducted to determine the characteristics of the study variables, namely the variables of the health belief model constructs, namely perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy, as well as obesity prevention behavior among female adolescents.

From Table 2 of the continuous data of 200 study subjects, it was found that all variables in this study had SD values that were smaller than the mean value. Perceived susceptibility had a mean of 10.55 and SD of 4.20, perceived severity with a mean of 14.85 and SD of 3.70, perceived benefits with a mean of 18.07 and SD of 1.45, perceived barriers with a mean of 13.99 and SD of 3.26, cues to action with a mean of 16.43 and SD of 2.86, and self-efficacy with a mean of 11.94 and SD of 2.96. Thus, all variable data in this study were representative because the standard deviation value was smaller than the average value, which means that the data variation was not too high and tended to be stable.

**Table 2. Results of univariate analysis of continuous data of the Health Belief Model constructs and obesity prevention behavior among female adolescents.**

| Variable | n | Mean | SD | Minimum | Maximum |
|---|---|---|---|---|---|
| Perceived Susceptibility | 200 | 10.55 | 4.20 | 5 | 18 |
| Perceived Severity | 200 | 14.85 | 3.70 | 5 | 20 |
| Perceived Benefits | 200 | 18.07 | 1.45 | 12 | 20 |
| Perceived Barriers | 200 | 13.99 | 3.26 | 4 | 20 |
| Cues to Action | 200 | 16.43 | 2.86 | 10 | 20 |
| Self-Efficacy | 200 | 11.94 | 2.96 | 5 | 20 |
| Obesity Prevention Behavior | 200 | 31.66 | 3.08 | 20 | 43 |

### 3. Bivariate Analysis

Bivariate correlation analysis was performed to test the relationship between each construct in the Health Belief Model. Based on the data in Table 3, a bivariate correlation is presented between the obesity prevention behaviors of female adolescents and each health belief model construct. The table shows that each variable, except the perceived barriers, was positively correlated with obesity prevention behaviors among female adolescents, and the correlation was statistically significant. The perceived barriers negatively correlated with female adolescents' obesity prevention behaviors.

**Table 3. Results of a bivariate correlation between female adolescents' obesity prevention behavior and the constructs of the health belief model.**

| Variables | Correlation coefficient (r) | p |
|---|---|---|
| Perceived Susceptibility | 0.38 | <0.001 |
| Perceived Severity | 0.50 | <0.001 |
| Perceived Benefits | 0.45 | <0.001 |
| Perceived Barriers | -0.30 | <0.001 |
| Cues to Action | 0.50 | <0.001 |
| Self-efficacy | 0.35 | <0.001 |

### 4. Multivariate Analysis

Multiple linear regression test in Table 5 shows that perceived susceptibility had a positive influence on obesity prevention behavior with a regression coefficient value of 0.17 (b = 0.17; 95% CI= 0.01 to 0.34; p = 0.046), which showed that the higher the perceived susceptibility, the higher the tendency of female students to take obesity prevention measures. Similarly, the perceived severity had a positive effect on obesity prevention behaviors (b= 0.20; 95% CI= 0.03 to 0.37; p= 0.022), which means that awareness of the serious impact of obesity drives increased preventive measures.

Perceived benefits showed a significant positive influence (b= 0.31; 95% CI= 0.03 to 0.59; p = 0.028), which indicated that the more confident a student was in the benefits of healthy behavior, the stronger their motivation to prevent obesity. In contrast, the perceived barriers showed a negative effect on obesity prevention behaviors (b= -0.18; 95% CI= -0.35 to -0.00; p= 0.046), meaning that the higher the perceived barrier, the lower the likelihood of female students implementing obesity prevention behaviors.

Cues to action also had a positive and significant effect on preventive behavior (b= 0.25; 95% CI= 0.02 to 0.49; p =0.033), indicating that the more external cues or triggers that adolescents receive, the higher the preventive behaviors carried out. Self-efficacy also had a positive effect on obesity prevention behavior (b= 0.19; 95% CI= 0.01 to 0.37; p= 0.045), which means that the higher the confidence of students in their ability to control a healthy lifestyle, the greater their tendency to prevent obesity.

Overall, this multiple linear regression model showed a fairly good fit rate with an Adjusted $R^2$ value of 37.18%, which means that all six independent variables in this model were simultaneously able to explain the variation in obesity prevention behavior by 37.18%..

**Table 4. The results of multiple linear regression analysis of the Health Belief Model constructs on obesity prevention behavior among female adolescents.**

| Variable | Regression coefficient (b) | 95% Cl | | p |
|---|---|---|---|---|
| | | Lower limit | Upper limit | |
| Perceived Susceptibility | 0.17 | 0.00 | 0.34 | 0.046 |
| Perceived Severity | 0.20 | 0.03 | 0.37 | 0.022 |
| Perceived Benefits | 0.31 | 0.03 | 0.59 | 0.028 |
| Perceived Barriers | -0.18 | -0.35 | -0.00 | 0.046 |
| Cues to Action | 0.25 | 0.02 | 0.49 | 0.033 |
| Self-Efficacy | 0.19 | 0.00 | 0.37 | 0.045 |
| N observation = 200 | | | | |
| Adj R2 = 37.18 % | | | | |
| P < 0.001 | | | | |

## DISCUSSION

### 1. The effect of perceived susceptibility on obesity prevention behavior.

This study showed a positive effect of the perceived susceptibility on obesity prevention behaviors among female adolescents. These results indicated that the higher the adolescents' belief in their risk of obesity, the more likely they were to implement preventive measures. This is in line with the Health Belief Model (HBM) theory, which states that risk perception is an important component in encouraging behavior change. Fadilah et al. (2022) find that adolescents with a high perceived susceptibility tend to adopt a healthy diet and actively exercise. The same thing is stated by Suparman et al. (2021), that the perception of risk encourages the formation of healthy living habits in adolescence.

In the context of PPTQ Al Rasyid, regular nutrition status monitoring and education by the School Health Unit and Community Health Center are important to shape the perception of obesity risk from an early age. Interventions such as counseling about the dangers of obesity and providing visual information can be a form of cues to action, which reinforces the female stu-

dents' perceived susceptibility to obesity. Therefore, the higher the perceived susceptibility of female adolescents, the higher their likelihood of obesity prevention, it is in line with HBM theory and previous findings.

**2. The effect of perceived severity on obesity prevention behavior.**

The results showed a positive effect of the perceived severity on obesity prevention behavior among female adolescents. This showed that the greater the adolescents' perceived severity of the impact of obesity, the higher their tendency to take preventive measures. Within the framework of the Health Belief Model (HBM) theory, the perceived severity reflects the extent to which an individual is aware of the dangers and complications of a disease condition. A study by Putri & Suryani (2021) states that the perceived severity correlates with increased motivation of adolescents to avoid unhealthy lifestyles. These findings are reinforced by Amalia et al. (2022), who mention that perceptions of the consequences of obesity such as metabolic disorders and decreased self-confidence, encourage healthy behaviors.

In the context of life at PPTQ Al Rasyid, awareness of the long-term impact of obesity can be instilled through educational media and counseling by the School Health Unit or Community Health Center. Visual presentation of information that emphasizes obesity complications, such as the risk of diabetes, hypertension, and reproductive disorders, can improve the perceived severity. With adolescents' increasing understanding of the impact of obesity, their tendency to maintain their diet and physical activity also increases. These results are consistent with HBM theory and various previous studies that state that the high perceived severity contributes to better disease prevention behaviors.

**3. The effect of perceived benefits on obesity prevention behavior.**

The results showed that there was a significant positive effect of the perceived benefits on obesity prevention behavior among female adolescents. This means that the higher the adolescents' belief in the benefits of healthy behaviors—such as eating nutritiously and exercising regularly the greater their tendency to take obesity prevention measures. In the Health Belief Model (HBM) theory, perceived benefit is an individual's consideration of the effectiveness of an action in preventing health risks. This is supported by a study by Carico et al. (2021), which shows that high perceived benefits can improve adherence to healthy behaviors. Ogunrinde et al. (2021) also mention that the perceived benefits is an important motivator in individual decisions to maintain a healthy lifestyle.

In the context of PPTQ Al Rasyid, increasing perceived benefits can be strengthened through education programs and habituation of healthy behaviors that are integrated in pesantren activities, such as morning gymnastics together or counseling on the benefits of a nutritious breakfast. In addition, testimonials from students who have succeeded in losing weight or maintaining a healthy lifestyle can be a peer-modeling strategy that emotionally strengthens the perceived benefits. Thus, the higher the perceived benefits that adolescents have, the higher the obesity prevention behaviors they will carry out, as explained in the HBM theory and supported by previous studies.

**4. The effect of perceived barriers on obesity prevention behavior.**

The results showed that the perceived barriers had a negative effect on obesity

prevention behaviors among female adolescents. This means that the higher the barriers an individual feels—whether in terms of time, environment, motivation, or social support—the lower their tendency to take obesity prevention measures. Within the framework of the Health Belief Model (HBM) theory, the peceived barriers is one of the key factors that can prevent a person from taking health measures, even if he or she is aware of the benefits and threats of the disease. Weale et al. (2022) state that the high perceived barriers is a major predictor of failure in the adoption of healthy behaviors. Rakhmani et al. (2018) also assert that barriers such as a lack of family support and laziness often lower adherence to preventive behaviors.

In an Islamic boarding school environment, such as at PPTQ Al Rasyid, the barriers experienced by teenagers can stem from time constraints due to the busy daily schedule, as well as the lack of healthy food options in the canteen. For this reason, strengthening the School Health Unit program can be focused on providing alternative light physical activities that do not interfere with *tahfidz* activities or time management and motivation training. Additionally, a participatory approach from homeroom teachers and dormitory administrators can be used to create a supportive environment. By lowering the perceived barriers through realistic and contextual approaches, obesity prevention behaviors among adolescents can be further improved.

**5. The effect of cues to action on obesity prevention behaviors.**

Cues to action were revealed to have a significant positive effect on obesity prevention behaviors among female adolescents. This shows that external and internal triggers—such as reminders from School Health Unit teachers, educational posters, or notifications through WhatsApp groups—can increase student involvement in obesity prevention behaviors. Montanaro & Bryan (2014) define cues to action as a signal that initiates the decision-making process to accept a health intervention. Rahmah & Nugroho's (2021) study proves that poster and short message campaigns significantly increase the frequency of adolescent physical activity in schools.

In the PPTQ Al Rasyid environment, cues to action can be developed through routine scheduling of morning gymnastics which is informed via the dormitory bulletin board and the sending of daily motivational messages by the coach. Lestari & Fadli (2023) show that the use of social media such as Instagram Stories to convey health tips is also effective in triggering an increase in adolescent participation in sports activities. By integrating various cues, both digital and face-to-face, obesity prevention programs in Islamic boarding schools will be easier to accept and implement by female students.

**6. The effect of self-efficacy on obesity prevention behavior.**

The results showed that self-efficacy had a significant positive effect on obesity prevention behavior among female adolescents. This indicates that the higher an individual's confidence in their ability to lead a healthy lifestyle—such as eating a healthy diet and exercising consistently—the more likely they are to engage in obesity-prevention behaviors. In the context of the Health Belief Model (HBM), self-efficacy is an important predictor in determining whether a person will actually take the recommended health measures (Annan et al. 2022). A study by Annan et al. (2022) shows that self-efficacy is the most powerful predictor in the prevention of diseases, including obesity, followed by environmental knowledge and support. In addition,

a study by Handayani & Prasetya (2022) finds that adolescents with high self-efficacy tend to have higher adherence to lifestyle changes.

At PPTQ Al Rasyid, strategies to improve self-efficacy can be carried out through motivational coaching, time management training and healthy activities, and giving appreciation to students who manage to maintain their ideal weight. Through this approach, students will be more confident in overcoming challenges such as laziness or the temptation of unhealthy food. Fatimah et al. (2023) also show that peer support in school-based programs contributes greatly to improving self-efficacy. Thus, the higher the self-efficacy of female adolescents, the more likely they are to be actively involved in obesity prevention, as emphasized in the HBM theory and supported by previous studies.

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**CONFLICT OF INTEREST**

There was no conflict of interest in this study.

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