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# The Mediating Role of Duration and Intensity of Physical Activity in Increasing Eating Awareness: Adolescent and Parental Participation Study

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**Abstract** Mindful eating is a condition in which a person becomes aware of the moment while eating. Very few studies have investigated eating awareness in environments where physical activity is performed. The aim of this study is to investigate whether the duration and intensity of physical activity in adolescents aged 15–17 affects their nutritional awareness.1117 adolescents aged 15–17 and one parent of each were involved in the study. It is a cross-sectional study. Personal information form, International Physical Activity Questionnaire Short Form (IPAQ-SF) and Mindful Eating Questionnaire (MEQ-30) were used as data collection tools. There were no group differences between scores of vigorous actives and moderate actives from MEQ-30 total and subsamples in eating control, eating discipline and mindful eating, but there was difference between both groups and inactives group($p < 0.05$). Inactives group had the highest level in emotional eating; there was group difference between vigorous actives and moderate actives ($p< 0.05$). The results suggest that there are useful items for exploring more about mindful eating, because the differences between mindful eating total and its subsamples and physical activity are important. A better understanding of mindful eating can lead to the development of more effective intervention strategies to address the risk of overweight and obesity in adolescents

***Keywords:*** *nutrition, physical activity, mindful eating, obesity.*

## 1. Introduction

The World Health Organization (WHO) has reported that four main factors that lead to cardiovascular deaths are unhealthy eating, physical inactivity, tobacco, alcohol use (WHO, 2014). These unhealthy and changeable behaviors usually occur during adolescence (Croezenet al., 2009). Adolescents, at the age of 15-17, skip breakfast and their physical activity declines (Duarte et al., 2020). For this reason, the period between 15 and 17 should be considered as a critical time to promote healthy lifestyles (Patton et al., 2016) and lifestyle deconstruction and eating habits should be established during this period (Das et al., 2017; Gümüş &Yardımcı, 2020). Nutritional behavior, which is a physiological requirement in childhood, begins to turn into a behavior that can be learned and consciously controlled in adolescence. Sudden increase in burning energy and rapid development play a role in determining the eating habits of adolescents (Uzdilet al.,2017). Usually, adolescents consume fast food and the number of meals increases during this period. Rapid development leads them to eat frequently and profusely. In addition, food consumption with high sugar and fat content is common nutritional errors in this period (Lassi et al., 2017; Pereira et al., 2021). These risky behaviors negatively affect the social, emotional, cognitive, and physiological development processes of adolescents (Mairs & Nicholls, 2016). Given that an increase in calorie intake is the basis of obesity, it is extremely important to understand correct factors that influence eating decisions (Nury et al., 2021).

Being overweight or obese in adolescence is associated with lifelong negative health outcomes (Pazin et al., 2020). Excessive consumption of food in adolescence will probably lead to lifelong overweight and obesity (Evensen et al., 2016; Evensen et al., 2017). In addition, obesity in this period is related with the early onset of chronic diseases (Parket al., 2012) and has negative psychosocial consequences (Wang et al., 2019). Many environmental factors can affect eating, such as hunger, the presence of food, the feeling of eating with others, emotional eating, stressful eating, and boredom (Wansink, 2004; Stroebele & de Castro, 2006; Hemiö et al., 2020). Generally, people understand how much they eat and when they will stop eating when they see an empty bowl rather than a feeling of fullness (Guazzelli Williamson et al., 2021). These effects also prevent understanding how much food is eaten (Chen& Antonelli, 2020). Therefore, it is extremely important to develop a better attitude

about the determinants of overweight and obesity in adolescents and to know the health improvement interventions well.

Mindfulness has gained popularity as an adjuvant treatment for adolescents with physical and mental health problems (Linet al., 2019). Raising awareness for eating behavior is a typical approach applied in behavioral interventions for weight management (Kattermanet al., 2014; Sticeet al., 2015). The main goal of it is usually to develop acceptance-based behavioral situations, where the focus is on accepting negative experiences and promoting behaviors that are compatible with goals, rather than completely avoiding the negative experiences highlighted in standard behavioral weight management programs (Tronieri et al., 2020). It has been revealed in the studies that energy intake decreases (Chumachenko et al., 2021) and it helps weight control in individuals with improved awareness (Rocheet al., 2019). For this reason, it is possible that physical activity creates self-awareness in terms of performance.

Although people accept that environmental factors affect other people, they think that they do not affect them. However, only about 200 unconscious decisions are made per day for food consumption (Wansink, 2004; Mooret al., 2013). If people consciously direct their attention to eating, they may not eat too much. It can prevent them from unhealthiness. In order to understand this, it is vital to determine the state of awareness in which food is consumed. The duration and intensity of physical activity plays an important role precisely at this stage. Because the level of physical activity adjusts food choices with the physiological satiety signaling system (Blundellet al., 2003). In addition, those who do regular physical activity have good nutritional information, and this can change their attitude (Bakhtiar et al., 2021). Nevertheless, those who do regular physical activity like other individuals can get information from the wrong sources (such as the internet; Devlin & Belski, 2015; Trakmanet al., 2019). It can lead them to develop improper eating behavior. Therefore, the detection of factors affecting the eating behavior of vigorous active, moderate active or inactive adolescents in the middle adolescence period can be a guide in preventing obesity and obesity-related diseases that they may encounter in their old age. In this study, it was aimed to evaluate whether the duration and intensity of physical activity of adolescents between 15 and 17 changed their nutritional awareness by taking the opinions of their families into consideration.

# 2. Method

## 2.1. Participants and Procedure

In this study, cross-sectional method was used. The dependent variable of the research was the score taken from the scales. Before the data was collected, participants and their families were informed about the purposes and procedures of the research and they signed consent forms stating that they were volunteers. They were told that the study was based on voluntariness, and they could leave the study at any time. It was conducted in accordance with the Declaration of Helsinki and permission was obtained from Usak University Ethics Committee (2021-95 numbered decision). The facts that adolescents are between 15 and 17, they do not have chronic health problems, mental and physical disabilities that will prevent them from doing physical activity are considered as criteria for participation in the study. 1117 adolescents aged 15–17 years at equal/similar age, education and BMI levels and their parents, living in different cities in Turkey decisively participated in the study. Of the adolescents, 45.1% (504) were female and 54.9% (613) were male.371 (33.3%) of the respondents were 15, 389 (34.9%) were 16 and 357 (31.8%) were 17. All of the participants were adolescents with a normal body mass index (BMI), as mindful eating and physical activity might have an impact on their results (18.5–24.9). BMI was calculated by dividing weight by height ($kg/m^2$).

## 2.2. Scales

### 2.2.1. Mindful Eating Questionnaire (MEQ-30)

Mindful Eating Questionnaire (MEQ) was developed by Framson et al.(2009) and it included 28 items and 5 sub factors. It is used to evaluate eating behaviors. It is also practiced in many languages and cultures and a valid and reliable measuring tool (Apolzan et al., 2016; Abdul Basir et al., 2021). MEQ was adopted into Turkish by Köse et al., (2016) and MEQ-30 was developed by adding new questions. Scale has 30 items and 7 subfactors as disinhibition (mindless eating), emotional eating, eating control, mindfulness, eating discipline, conscious nutrition and interference. Questions; 1, 7, 9, 11, 13, 15, 18, 24, 25 and 27 are normally scored. The others are reversely scored *. *Reverse scoring is (1=5, 2=4, 3=3, 4=2, 5=1). The items of the questionnaire are scored using a 5-point Likert-style scale as Never (1), Rarely (2), Sometimes (3), Often (4) and Always (5). When scoring the scale, the arithmetic mean of the sub-dimensions and the total score are taken. Score 3 and above taken from the sub-factors indicate that the individual has the characteristics that sub-factor evaluates. The higher score obtained from the scale is, the higher the state of mindful eating is. The Cronbach alpha value of MEQ-30 is 0.733.

### 2.2.2. International Physical Activity Questionnaire Short Form (IPAQ-SF)

IPAQ-SF was developed by Craig et al., (2003) to determine the physical activity levels of everybody in the 15–65. It is applied in many regions of the world (Aibaret al., 2016; Ekelund et al., 2006; Gallardoet al., 2020).Validity and reliability studies were conducted with the Turkish adaptation of IPAQ-SF (Saglam et al., 2010). When scoring IPAQ-SF, it is based on the fact that the activities are performed at least 10 minutes. After determining the day and minute curves, the MET value was calculated. Physical activity levels after the MET value obtained were classified as vigorous active (healthy-beneficial; >3000 MET min/week), moderate active (600-3000 MET min/week) and inactive (<600 MET-min/week; Ridleyet al., 2008; Guidelines for Data Processing and Analysis of the IPAQ-SF, 2005). The answers which contained phrases such as "I don't know," time or days were left incomplete were completely excluded from the analysis. According to the data obtained, 350 people were vigorous active, 398 were moderate active and 359 were inactive. The Cronbach α internal consistency value of our study is $\alpha$= 0.681.

### 2.2.3. Application and Anthropometric Measurements

School administrators, club officials and families who would conduct the study were contacted at the places where measurements and applications would be made before the study. The days and times to go for the measurement were decided in advance. During the specified time period, the adolescent and his/her parent were met at the place where the measurement would be performed. Before the application, the height and weight measurements of adolescents were performed in a separate and privacy-requiring section. Weight measurement was performed with the Jawon Make Body Composition Analyzer (Model IOI-353) with 0.1 accuracy with bare feet when they had light clothing on them. Height measurement was made with a portable stadiometer (Seca Corporation, USA) which had 0.1 cm accuracy. After collecting anthropometric data, participants were taken into the classroom environment in groups (25–30 people). International Physical Activity Questionnaire Short Form (IPAQ-SF) and Mindful Eating Questionnaire (MEQ-30) were projected on the screen respectively. Adolescents and their families were also asked to answer scale questions at the same time. Questions in the IPAQ-SF and MEQ were answered after adolescent and parent agreed. The hand-filled data were collected from the participants for evaluation. There was no section, which include personal information of the participants in IPAQ-SF and MEQ-30 scales.

## 2.3. Statistical Method

SPSS 21.0 was used to analyze the data. Descriptive statistics were given as number, percentage, average and standard deviation. KolmogrowSmirnow test was applied to examine whether the data showed normal distribution. For multiple comparisons in normal distributions One-Way ANOVA Test and for Post- Hoc test Tukey HSD were used. The statistical significance level was considered as $p< 0.05$.

# 3. Results

There was no difference between score of vigorous actives and moderate actives from MEQ-30 total and subsamples in eating control, eating discipline and mindful eating, but there was difference between both groups and inactives group ($p<0.05$). Statistically, no significant difference between disinhibition and mindfulness ($p>0.05$) was observed, but vigorous active adolescents got the highest scores. The highest level in emotional eating belonged to inactives group, there was difference between vigorous actives and moderate actives ($p<0.05$). Although there was no difference statistically, inactive adolescents were mostly affected by external factors ($p>0.05$; Table 1).

**Table 1.** *Comparison of Mindful Eating and Sub-Factors According to Physical Activity*

| | **IPAQ-SF** | ***N*** | ***M*** | ***SD*** | ***F*** | ***p*** |
|---|---|---|---|---|---|---|
| Disinhibition | Vigorous active | 350 | 3.12 | 0.88 | 3.221 | 0.059 |
| | Moderate active | 398 | 3.08 | 0.85 | | |
| | Inactive | 359 | 3.08 | 0. 85 | | |
| Emotional Eating | Vigorous active | 350 | $3.03^{B}$ | 0.99 | 7.612 | 0.001* |
| | Moderate active | 398 | $3.21^{A}$ | 0.96 | | |
| | Inactive | 359 | $3.27^{A}$ | 0.95 | | |
| Control of Eating | Vigorous active | 350 | $3.57^{A}$ | 0.82 | 3.327 | 0.036* |
| | Moderate active | 398 | $3.48^{A}$ | 0.84 | | |
| | Inactive | 359 | $3.42^{B}$ | 0.74 | | |
| Focusing | Vigorous active | 350 | 3.12 | 0.60 | 1.413 | 0.244 |
| | Moderate active | 398 | 3.09 | 0.54 | | |
| | Inactive | 359 | 3.05 | 0.53 | | |
| Eating Discipline | Vigorous active | 350 | $2.91^{A}$ | 0.88 | 11.230 | 0.000* |
| | Moderate active | 398 | $2.88^{A}$ | 0.81 | | |
| | Inactive | 359 | $2.66^{B}$ | 0.75 | | |
| Mindfulness | Vigorous active | 350 | $3.21^{A}$ | 0.58 | 2.656 | 0.040* |
| | Moderate active | 398 | $3.09^{A}$ | 0.48 | | |
| | Inactive | 359 | $3.02^{B}$ | 0.57 | | |
| Interference | Vigorous active | 350 | 3.37 | 1.04 | 0.464 | 0.629 |
| | Moderate active | 398 | 3.41 | 1.07 | | |
| | Inactive | 359 | 3.44 | 0.98 | | |
| MEQ-30 Total | Vigorous active | 350 | $3.22^{A}$ | 0.43 | 4.983 | 0.007* |
| | Moderate active | 398 | $3.17^{A}$ | 0.45 | | |
| | Inactive | 359 | $3.10^{B}$ | 0.42 | | |

*$p< 0.05$ means significant difference. A.B: Different letters in the same column indicate the difference between the groups. MEQ-30: Mindful Eating Questionnaire. IPAQ-SF: International Physical Activity Questionnaire-Short Form

# 4. Discussion

Soon after a short period of intense physical activity, a number of disadvantages can be experienced in food choices, leading to delicious and high-energy foods (fatty and sweet; Gustafson et al., 2018; Koehler et al., 2021). Because intense physical activity increases neural responses in reward-related areas of the brain (Schmitt et al., 2020), but it is a temporary case. Physical activity can positively change food consumption due to improved appetite control combined with a higher motivation to engage in healthy behavior (Joo et al., 2019). Cavadini et al. (2000), Croll et al. (2006), and Meng et al. (2018) found that adolescents engaged in physical activity exhibited healthier eating habits than adolescents who did not. There were no group differences between scores of vigorous actives and moderate actives from MEQ-30 total and subsamples in eating control, eating discipline and mindful eating, but there was difference between both groups and inactives group. Statistically, there was no significant difference in mindfulness ($p$>0.05) factor, but vigorous active adolescents got the highest scores. These results show that physical activity during adolescence has a significant effect on eating. Appetite control develops and positive changes in food preferences occur in accordance with an overall improvement in parallel with physical activity training (Beaulieu et al., 2020). Knowing the effect of conscious eating on sports performance motivates those who do physical activity for healthy eating (Stokes et al., 2018). Friends, coaches, dieticians in the sports community have a positive effect on healthy eating and they can be factors that positively affect eating control, eating discipline, and mindful eating (Ecket al., 2021; Hackmanet al., 1992; Kalavanaet al., 2010). These resources can enable adolescent athletes to exhibit healthy eating behavior.

Emotional eating behavior (eating in response to negative emotions) usually occurs during adolescence and can lead to excessive energy consumption (sugar; van Strien, 2018). Emotional eating is either a learned behavior affected by genetic factors compared to environmental factors (Russell, & Russell, 2020) or it can occur when the mechanisms that control food intake stimulates the sensory pleasures of eating delicious food (Finlaysonet al., 2009). The results are consistent with the research showing the links between emotional eating deceptions and stress, poor food selection, and diet quality (Heo et al., 2018; Wallaceet al., 2021). According to the results of our study, inactives group had the highest level in emotional eating; there was difference between vigorous actives and moderate actives ($p$<0.05). Although there was no difference statistically, inactive adolescents were mostly affected by external factors. According to these results, physical activity is one of the most important factors to be considered in terms of enabling eating regulation. In other words, psychological stress can have a significant regulatory effect on eating and emotional functioning in addition to reducing lubrication through energy balance (Messerli-Bürgy et al., 2019; Smith et al., 2021). It is confirmed with the outcomes of the present study that the more physical activity is related with the more mental health (more positive effect), better appetite regulation, less food sensation, less binge eating (Cadenas-Sanchez et al., 2021; Luoet al., 2018). Increased positive effect and decreased negative effect due to physical activity may have revealed impacts on eating and appetite (Liaoet al., 2015), because physical activity can affect body regulation at both individual and instant levels through its effects on emotional eating behavior (Smith et al., 2021). Physical activity can regulate eating behavior by reducing food-craving activity in brain reward regions (Blanchet et al., 2018; Luoet al., 2018). Increased physical activity can achieve this by suppressing the hedonic urge on overeating (Josephet al., 2011).

Interpreting the results, it should be taken into account that there are some strengths and limitations in this study. The study sample represented a large population that was fairly well balanced (age, gender, education).Although it consisted largely equal male and female participants, the balance within the groups was not clear. Providing more balanced groups in terms of gender could contribute more to the results of the study. Our study is cross-sectional and inferences about causal relationships cannot be made. On the other hand, having two different variables (adolescents and their families) strengthens the accuracy of the data, especially adding validity to reports of adolescent awareness and eating habits reported by parents.

While our study results indicate the impact of physical activity on eating control, eating discipline and mindful eating among MEQ-30 total and sub factors, there is no statistical difference and PA may have a positive effect on emotional eating activity and negative eating behavior towards external factors. The results suggest that there are useful outcomes for exploring more about eating awareness. A better understanding of mindful eating can lead to the development of more effective intervention strategies to address the risk of overweight and obesity in adolescents.

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