RESEARCH ARTICLE

Depressive symptoms and body mass index among adolescents: A moderated mediation model of parental psychological control and age

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SUMMARY

Objective: It is known that the presence of depressive symptoms can increase the risk of elevated body mass index. However, less is known about the underlying processes which may mediate or moderate this relationship. The aim of this study was to examine the mediating effect of parental psychological control and the moderating effect of age in regard to the relationship of depressive symptoms and body mass index. **Method:** This study was carried out with 618 high school students (53.7% female), ranging in age from 14 to 17-years-old. The participants were applied Socio-demographic Information Form, Children's Depression Inventory, Parental Psychological Control Scale as well as Body Mass Index. **Results:** It was found through mediation analysis that the relationship between depressive symptoms and BMI was mediated by parental psychological control. In addition, the predictive effect of depressive symptoms on body mass index and the mediating effect of parental psychological control were moderated by age. More specifically, the direct effect of depressive symptoms and the indirect effect of depressive symptoms over the body mass index through parental psychological control were observed in participants aged 14- years- old, but not in participants older than 14. **Discussion:** The aim of this study is to reveal the role of the psychological control of the parent and the age of the child, which is thought to be important in the relationship between depressive symptoms and body mass index. The findings support the importance of parenting programs that can positively affect both physical and mental health.

Key Words: Depressive symptoms, body mass index, parental psychological control, age, adolescents

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ÖZET

Amaç: Depresif belirtilerde görülen artışın vücut kitle indeksi riskini artırabileceği bilinmektedir. Bununla birlikte, bu ilişkiye aracılık edebilecek ve düzenleyecek altta yatan süreçler hakkında az şey bilinmektedir. Bu çalışmanın amacı, depresif belirtiler ile vücut kitle indeksi arasındaki ilişkide ebeveyn psikolojik kontrolünün aracı etkisini ve yaşın düzenleyici etkisini incelemektir. **Yöntem:** Bu çalışma 14 ila 17 yaş arasında değişen 618 lise öğrencisi (% 53,7 kadın) ile gerçekleştirilmiştir. Katılımcılara Sosyo-demografik Bilgi Formu, Çocuk Depresyon Envanteri, Ebeveyn Psikolojik Kontrol Ölçeği ve Beden Kitle İndeksi uygulandı. **Bulgular:** Arabuluculuk analizi ile depresif belirtiler ve vücut kitle indeksi arasındaki ilişkiye ebeveyn psikolojik kontrolünün aracılık ettiği bulunmuştur. Ayrıca, depresif belirtilerin vücut kitle indeksi üzerindeki yordayıcı etkisi ve ebeveyn psikolojik kontrolünün aracılık etkisi yaşla azalmıştır. Daha spesifik olarak, depresif belirtilerin doğrudan etkisi ve depresif belirtilerin ebeveyn psikolojik kontrolü yoluyla vücut kitle indeksi üzerindeki dolaylı etkisi 14 yaşında görülmekteyken, 14 yaşından büyük katılımcılarda görülmemiştir. **Sonuç:** Bu çalışmanın amacı depresif belirtiler ile vücut kitle indeksi arasındaki ilişkide önemli olduğu düşünülen ebeveynin psikolojik kontrolü ve çocuğun yaşının rolünü ortaya koymaktır. Bulgular hem beden hem de ruh sağlığını olumlu yönde etkileyebilecek ebeveynlik programlarının önemini desteklemektedir.

Anahtar Sözcükler: Depresif belirtiler, vücut kitle indeksi, ebeveyn psikolojik kontrolü, yaş ve ergenler

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INTRODUCTION

Adolescence can be a precarious period for the development of obesity due to a variety of biological, psychological, social and environmental factors (1). Also, obesity during childhood and adolescence may lead to an increased risk of being obese and disabled during adulthood (2). In a survey addressing health behavior among school-aged children within Europe and North America; it is reported that in the 11-, 13-, and 15-year old age groups, 17%, 15% and 13% of the girls respectively and 27%, 24% and 22% of the boys respectively are considered overweight or obese (3). According to the National Health and Nutrition Examination Survey (NHANES), obesity prevalence in the children and adolescents from the United States is 18.5% in 2015-2016 (4). Likewise, among Turkish youth between 6 and 18 years old, 8.2% were found to be obese/fat (overweight), 14.3%, slightly fat, 14.9% thin and 3.9% very thin (5). It is suggested in data provided by the Turkish Statistical Institute (TURKSTAT) that overweight and obese individuals comprise 14.8% and 3.8% of the adolescent population and 33.7% and 19.9% of the population aged 15 years or older, respectively (6,7). The increased rate of childhood and adolescent obesity might be related not only to a genetic predisposition for obesity, but also a variety of other environmental factors (8). Therefore, it is of great importance to identify which factors in particular are associated with the increased weight gain among adolescences.

Conversely, adolescence represents a developmental phase, marked by an increased vulnerability for the occurrence of depressive symptoms (9,10). In a National Survey on Drug Use and Health (NSDUH) survey, it is revealed that there is a 12.8% prevalence rate of major depressive episodes among American adolescents (11). A review of Turkish studies reported even higher rates of depression among high school aged students, ranging between 17.5% to 37% (12). Hence, weight and mood disturbances that seem to be linked together should be considered as significant concerns for public health.

It is suggested in findings from previous studies that increased weight, as defined by a Body Mass Index (BMI) of higher than 25, is associated with depressive symptoms among children and adolescents (13,14,15). Although the relationship between increased weight and depressive symptoms has been widely examined, the nature of this relationship has yet to be clarified. While some scholars suggest that obesity causes depression (16, 17,18,19,20), others suggest otherwise (21,14,15, 22). However, meta-analysis studies have shown that there is a bidirectional association between depression and obesity (23,24,25). Several explanations of the causal mechanisms involved in this relationship have been asserted. One prominent causal model proposes that obesity is a deeply stigmatizing attribute which prompts negative stereotyping and discrimination. Obesity stigma involves actions against people with obesity that can cause exclusion and marginalization, and lead to inequities (26). This may lead to depression and other negative psychological and social consequences (27,28).

A second, alternative causal model recognizes that depression can exert causal effects on obesity. Markowitz et al. claimed that there may be both direct physiological and indirect psychosocial pathways in the relationship between depression and obesity (29). First, it can be a direct pathway through the biological effect of increased stress reactivity with hormonal changes. Second, there may be indirect pathways through mechanisms such as poor adherence, binge eating, negative thoughts, and reduced social support. Depressed individuals may be less likely to adhere to exercise and diet regimens, and may lose the motivation to control impulses to eat overly. (30, 29, 31). All this makes it difficult for the person with depression to care for themselves effectively, leading to weight gain. Because depression is traditionally considered an outcome rather than a causal variable, first model is more intuitive than the alternative model. However, literature approves to the causal effects of depression on an array of chronic illnesses, like hypertension and coronary heart disease (32).

Despite the association between depressive symptoms and increased weight, what is still not clear is how adolescent depression promotes weight gain

(21). Also, the underlying mediating mechanisms (i.e., how depressive symptoms influence BMI) and moderating mechanisms (i.e., when depressive symptoms influence BMI), particularly in adolescents, have not attracted as much research attention. Understanding and managing the mechanisms that link depressive symptoms and increased weight is crucial to the treatment of individuals who suffer from both conditions.

The Mediating Role of Perceived Parental Psychological Control

Parental control means that children's activities and habits are controlled and regulated, their dependence on the family is ensured, and their thoughts and feelings are directed by parents (33). This control is maintained by practices aimed at managing the child psychology and/or behavior. Psychological control is explained as a negative form of control in terms of children's emotional and psychological development. It attempts to intervene without permission in the child's thinking periods, self-expression, and emotions as well as preventing the child's autonomy (33). Barber and Harmon (34) divide this control into two main types; manipulative and constraining parental control. Manipulative parenthood is described as an attempt to shape a child's behavior and provide some level of emotional balance between family and child. Parents utilize three primary strategies in these attempts: guilt induction, love withdrawal, and anxiety inception. Constraining parents, on the other hand, suppress the child's verbal behavior and prevent the child from fully discovering and expressing him/herself (33). Also, parental attempts at psychological control, such as criticizing, accusation, humiliation and exclusion, can create anger among adolescences as well as cause violent behavior or, may instead cause the adolescent to become introverted and develop lack of trust in relationships because of an increased level of anxiety (35). Psychological control is believed to obstruct the development of psychological autonomy in adolescents (36). Thereby, the development of psychological autonomy in adolescence is considered to be very important for one's well-being (37). Accordingly, a violation of the development of psychological autonomy through the use of psychological control might predict the development of adolescents' depressive symptoms (33).

It is demonstrated through research in this field that parental psychological control perceived by adolescents is related to internalized problems such as depressive symptoms, low ego-strength, and anxiety (38, 39, 40, 41, 42, 43, 44). Although parental psychological control is assumed to escalate depressive symptoms, the relationship between these variables is assumed to be mutual (45). From a developmental systems perspective, the relationships between the adolescent and parents are bidirectional or mutually influential. Namely, adolescents affect parents as much as parents affect adolescents (46). For example, Albrecht et al. found that the internalizing behaviors of adolescents predicted increases in perceptions of parents as psychologically controlling (38).

It is stated that parents can influence the weight of children through parenting styles and practices (47, 48). There is evidence that parental psychological control predicts adolescents' engagement in problematic behaviors (49), such as over and under-eating behaviors (50,51). If the adolescent's development of psychological autonomy is not supported by parents, then excessive eating may become a stress response. From another point of view, psychological control is more likely to undermine the adolescent's ability to self-regulate intake (52,50). So, parental psychological control may cause weight gain through the all of this.

In the literature, there was no research located that investigated the mediating role between the relationship of depressive symptoms and BMI. In this current study, it was hypothesized that depressive symptoms might cause parental psychological control, and parental psychological control, ultimately cause weight gain. Thus, depressive symptoms might indirectly influence BMI among adolescences via the mediating role of parental psychological control.

Many studies of parental psychological control have been based only on adolescents' reports (39, 43,44), although some have used parents' or combined parents' and adolescents' reports (42,53). Developmental perspective leads researcher to pay

attention to the adolescent's interpretation and understanding of parents' psychologically controlling behaviors as an important part of the process that forms ongoing interactions between them as well as adolescents' behavior (38). In the present study, it was specifically focused on parental psychological control perceived by adolescents.

The Moderating Role of Age

Although depressive symptoms may influence parental psychological control and BMI, it is unlikely that all adolescents are equally influenced. Therefore, it is important to examine moderators that may buffer the relationship between depressive symptoms and unfavorable outcomes. The present study examined whether the direct effect of depressive symptoms on BMI and the indirect effect of parental psychological control was moderated by age. BMI and depressive symptomatology in childhood may also predict increased BMI in adulthood (15). Therefore, additional studies are warranted to better clarify the timing of depressive symptoms in relation to BMI. Two theories seem to stand out in regard to the age-specific effects of parental psychological control (54). The first of these is self-determination theory (SDT) which asserts that parental psychological control is equally harmful to the adaptation process of children and adolescents, although the manifestations and results of parental psychological control likely vary according to the child's age (55). Social domain theory provides another way to explain how parental psychological control manifests itself as well as how it affects human development across the life span of an individual (56). According to this theory, there are age-related changes in how parents and children regard adequate parental authority on different points in life. Thus, it is reasonable to assume the moderating role of age in regard to the relationship of depressive symptoms with BMI and with parental psychological control. In other words, to be more precise, if parental psychological control mediates the relationship between depressive symptoms and BMI; and age moderates the relationship between depressive symptoms and parental psychological control simultaneously, then the mediating effect of parental psychological cont-rol can possibly be moderated by age. The proposed model for this study is a moderated mediation model, which involves parental psychological control and age in the relationship between depressive symptoms and BMI.

The Present Study

The present study aimed to examine whether the relationship between depressive symptoms and BMI in adolescences was mediated by parental psychological control and whether the indirect effect of depressive symptoms and the mediating effect of parental psychological control on BMI were moderated by age. The specific hypotheses were examined as follows:

Hypothesis 1. Depressive symptoms are associated with BMI.

Hypothesis 2. Parental psychological control mediates the relationship between depressive symptoms and BMI.

Hypothesis 3. Age moderates the relationship between depressive symptoms and BMI.

Hypothesis 4. Age moderates the mediating effect of parental psychological control in the relationship between depressive symptoms and BMI. The indirect effect will be decreased with age.

Testing mediator and moderator variables in a single model could generate more comprehensive information than examining two separate models (57). The moderated mediation model used in the present study (see Fig. 1) was suitable to elaborate on how and when depressive symptoms influence BMI, but would also tell when of the how depressive symptoms influence BMI.

METHOD

Participants

Appropriate sampling, which is one of the non-random purposeful sampling methods, was used in sample selection. This sampling method is based on

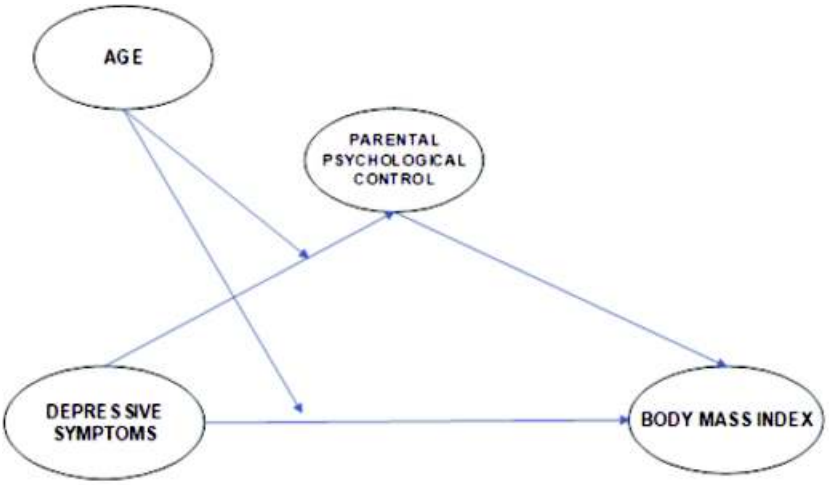

Fig. 1. The hypothesized model concerning the moderated mediation model of age

the participants being easily accessible (58). In this direction, the schools included in the study were determined using an easily accessible sampling method.

All applications were made in a counseling hour coordinated with the guidance service. School psychological counselors supported both in determining the classes and in applications. The participants of this study were 618 students (53.7% female), recruited from the 9th, 10th and 11th grades of several high schools located at Aydın city center. Eight students (1.3%) did not specify their sex. The mean age of the convenience sample was 15.45±0.95 (range= 14-17) years, the mean weight was 57.23±10.87 (range= 35-115) kilograms, and the mean height was 167.56±8.65 (range= 141-192) centimeters. When computed separately for female and male, the mean weight was 53.96±8.91 (range= 35-89) and 61.26±11.66 (range= 35-115) kg, and the mean height was 163.28±6.49 (range= 141-182) and 172.76±8.11 (range= 147-192) cm, respectively. As the participants' BMI scores suggested, 22.7% of the sample were underweight, 65.2% normal weight, and 12.1% overweight or obese.

Measures

Socio-demographic Information Form: This a form with questions related to gender, age, grade, weight, and height status.

Body Mass Index (BMI): In interpreting BMI in children and adolescents, growth reference levels issued by the World Health Organization (WHO) for 5-19-year-olds have been used (59). Accordingly, adolescents with BMI scores above the 95th percentile for their sex and age were considered obese, those between the 85th and 95th percentile overweight, between the 15th and 85th percentile normal weight, and under 15th percentile thin.

Children's Depression Inventory (CDI): The severity of depressive symptoms in the subjects have been assessed by means of the Turkish version of this self-report instrument consisting of 27 items each rated on a scale ranging from "0" to "2" (60, 61). The CDI was developed to distinguish youth with a psychiatric diagnosis of major depressive or dysthymic disorder from those without (62). The adaptation of CDI to Turkish culture was made by Öy (63). The reliability of the Turkish version of the CDI was reported to be sufficient (Cronbach's alpha = .86).

Parental Psychological Control Scale (PPCS): Developed to assess psychological control that adolescents perceive from their parents, the PPCS consists of 32 items rated on 4-point Likert's scale. The scale was developed in Turkish by combining the items of two original scales related to the subject matter (64). Sixteen items were taken from Psychological Control Scale-Youth Self Report (PCS-YSR) (33) and sixteen items were taken from another scale which included different components of psychological control such as love withdrawal, guilt induction and erratic emotional behaviors

(65). Combined items were designed to tap cultural nuances in the perceived meaning of the behaviors which is consistent with the aim of the study. Explanatory factor analysis revealed two interpretable factors representing the two dimensions of psychological control, namely guilt induction/erratic emotional behaviors and love withdrawal/irrespective. The items with low loadings (less than the cutoff of .33) were excluded, and so, each version of perceived psychological control (mother, father, and mother reported form) was reduced to 25 items. Second order confirmatory factor analyses were confirmed the two-factorial model. These two sub-scale scores are highly reliable as implied by Cronbach's alpha coefficients of .87 and .86, respectively. In the present study, the participants' ratings on the PPCS considering their mothers were included in the analyses. In this study, two-factor model of the perceived maternal control scale had acceptable fit values [χ^2 (54, N=625) = 154.75, χ^2/df=2.8, GFI=.92, AGFI=.90, CFI=.90, RMSEA=.08)]

Procedure

Following the approval taken from the Non-invasive Clinical Trials Ethics Committee of the Faculty of Medicine at Adnan Menderes University, permission was obtained from the Aydın Provincial Directorate of National Education to collect data in schools. The data was collected from volunteering high school students during group sessions organized by the counseling teachers at each school. At the beginning of each session covering about one lecture-hour, the participating students were informed on the objectives of the study, rating the self-report instruments, and the importance of response sincerity. Each student provided data on his/her height and weight if s/he was sure, or was measured by the principal investigator during the session.

Statistical Analysis

In the present study, before testing proposed models, descriptive statistics and correlation analysis were reported. After the preliminary analysis, mediation and moderation analyses were utilized. The analysis of the moderated mediation model was examined using Hayes's (66) PROCESS macro (Model 8). SPSS macro PROCESS has been developed to assess complex models including both mediator and moderator variables. This program is capable of analyzing the mediating effect, moderating effect and moderated mediation effect (66). PROCESS also allows conditional indirect effects to be estimated with bootstrapping methods and the significance of conditional indirect effects to be examined at different levels of the moderation variable (66). Bootstrapping resampling method produces stronger predictions than other mediation analyses (67) as it generates a larger sample number from the dataset and applies them to gain standard error estimates. For the present study, 50,000 bootstrap samples were used. The interval confidence of these standard errors is considered when testing the significance of indirect effects. These standard errors were used to calculate the 95% confidence interval (CI) for each indirect effect. Significant mediation is indicated when the upper and the lower limits of the 95% CI do not include zero.

In the present study, moderated mediation allowed the examination of whether the conditional indirect effects were significantly different for adolescents of different age groups. The index of moderated mediation is an inferential test to evaluate whether the extent of moderated mediation is statistically different from zero.

RESULTS

Preliminary Analyses

The distribution of the variables was examined using skewness and kurtosis values. All values were less than 1.5, ranging from .76 to .95 for skewness and from .54 to 1.41 for kurtosis, indicating that there was no problem with normal distribution for any variable and all variables were normally distributed in the sample. In addition to the skewness and kurtosis analyses, the Kolmogorov-Smirnov test was used and the results ($p>.05$) supported the normality. To check multivariate normality, Mahalanobis distance was examined. Findings provided (10.48) the multivariate normality hypothesis for all scales.

Table 1. Descriptive statistics and correlation among study variables

	MD	*SD*	1	2	3	4
1. Age	15.45	0.95	-			
2. BMI	20.30	3.05	0.06	-		
3. DS	12.91	7.89	0.09*	0.08*	-	
4. PPC	59.19	16.29	0.11**	0.14**	0.40**	-

Note. *N*=618. BMI: Body Mass Index, DS: Depressive Symptoms, PPC: Parental Psychological Control. *p< 0.05, ** p< 0.01

Table 1 displays the means, standard deviations and bivariate correlations between age, depressive symptoms, BMI and parental psychological control. Parental psychological control was positively correlated with depressive symptoms (r=.40, p < .01), and BMI (r=.14, p<.01). Correlations observed between the BMI and parental psychological control, and between BMI and depressive symptoms were rather low.

Testing the Proposed Model

The mediation analysis was conducted to determine whether parental psychological control mediated the relationship between depressive symptoms and BMI. The mediation model estimates indicated the direct effect of depressive symptoms on parental psychological control (a-path), the direct effect of parental psychological control on BMI (b-path), the direct effect of depressive symptoms on BMI (c-path), and the indirect effect of depressive symptoms on BMI through parental psychological control (c′-path). All continuous variables were standardized to allow for comparability of coefficients across the predictor variables. The total scores were converted to standard scores in order to use the latent features measured indirectly with different measurement tools on the model proposed by the researchers and to compare the results obtained. In this way, the results obtained from different scales were equalized to the same scale level and it was aimed to perform all mathematical operations on the scores obtained from the scales and to obtain more consistent measurement results. Results showed that depressive symptoms predicted parental psychological control (β =1.04, p<.05), parental psychological control predicted BMI (β=.11 p< .05) and depressive symptoms predicted BMI (β=1.38, p<.01). The significant direct relationship between depressive symptoms became insignificant (β=.03, p>.46) when the effect of parental psychological control was controlled. These results indicated parental psychological control fully mediated the relationship between depressive symptoms and BMI. The interaction of depressive symptoms and age had a significant effect on BMI (β =−.09, p<.05) and these results indicated the relationship between depressive symptoms and BMI was moderated by age (see Fig. 2).

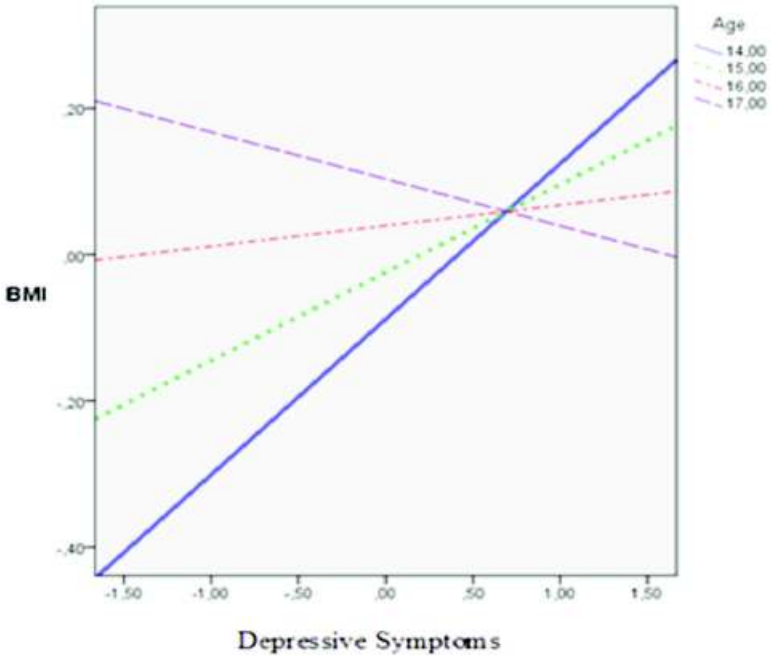

Fig. 2. Age as a moderator in the relationship between depressive symptoms and BMI

Table 2. Conditional process analysis

Mediator variable model (PPC)		*SE*	*t*	*p*
Constant	-1.19	.58	-2.05	<.05
Depressive Symptoms	1.04	.61	1.70	<.05
Age	.07	.03	2.06	<.05
Depressive Symptoms * Age	-.04	.03	-1.06	.28
Dependent variable model (BMI)				
Constant	-.84	.63	-1.33	.18
PPC	.11	.04	2.74	<.01
Depressive Symptoms	1.38	.66	2.08	<.05
Age	.05	.04	1.34	.17
Depressive Symptoms * Age	-.09	.04	-2.04	<.05
Conditional direct effect analysis at IA		*Boot SE*	*Boot LLCI*	*Boot ULCI*
Age 14	.15*	.07	.08	.30
Age 15	.07	.04	-.02	.16
Age 16	-.01	.04	-.11	.07
Age 17	-.10	.07	-.25	.04
Conditional indirect effect analysis at IA		*Boot SE*	*Boot LLCI*	*Boot ULCI*
Age 14	.08*	.02	.02	.13
Age 15	.04	-.01	.02	.09
Age 16	.04	-.01	.02	.08
Age 17	.03	-.01	.02	.08

Note. *N*=618, *p< 0.05, ** p< 0.01
Unstandardized regression coefficients were reported. Bootstrap sample size = 50.000. LL = low limit, CI= confidence interval, UL= upper limit. BMI: Body Mass Index, PPC: Parental Psychological Control.

Results of the conditional direct effect analysis and conditional indirect effect analysis indicated that, only one conditional direct effect (based on the moderator value at age 14) and one conditional indirect effect (based on the moderator values at age 14) were positively and significantly different from zero. More specifically, the direct effect of depressive symptoms on BMI and the indirect effect of depressive symptoms on BMI through parental psychological control were observed when age was moderate to low (age 14), but not when age was higher than 14. The moderated mediation examination showed that when adolescents were aged 14, they were more likely to consider parental psychological control and thus demonstrate a problematic BMI. This relationship was significant at age 14 (B =.053, SE =.023, LCI =.01, UC I =.10) but not significant at ages 15, 16 and 17 respectively, suggesting that age triggers this reaction between depressive symptoms and BMI.

To facilitate the interpretation of this interaction effect, Figure 2 shows BMI values as a function of depressive symptoms and age.

A simple slope test showed that in 14-year-old adolescents, there was a significant, positive relationship between depressive symptoms and BMI. However, in adolescents aged 15, 16 and 17; this relationship became weaker. For fourteen-year-old adolescents, depressive symptoms have been more clearly associated with BMI.

Some alternative models were examined to eliminate the possibility that the fit of the main model was only due to a statistical coincidence and thus to determine the statistical advantage of the main model against the alternatives. The first alternative model tested whether the relations of BMI and depressive symptoms were mediated by parent psychological control. In this model, age also moderates the mediating effect of parental psychological control in the relationship between BMI and depressive symptoms. The moderated mediation examination showed that, the interaction of BMI and age had not a significant effect on depressive symptoms (β=.09, p=.10). The second alternative model tested whether the relation of parent psychological control and BMI were mediated by depressive symptoms. In this model, age was again moderator variable in the relationship between BMI and depressive symptoms. The results of the moderated mediation analysis indicated that the interaction of parent psychological control and age had insignificant effect on BMI (β=.067, p=.08).

This study has also investigated sex as a possible moderator that influences the association between depressive symptoms and BMI. The finding from this study indicated that there was no sex discre-

pancy. In detail, the moderation analysis showed a non-significant effect (β =. 03, p<. 68). The moderated mediation examination also showed that the interaction of depressive symptoms and sex had not a significant effect on BMI (β =.04, p <.55).

DISCUSSION

In this present study, a moderated mediation model was constructed in order to analyze the mechanism underlying the association of depressive symptoms and BMI. The results demonstrated the mediating effect of parental psychological control and the moderating effect of age in the relationship of depressive symptoms and BMI among adolescents.

The relationship between depression and obesity is widely examined in the literature (16,17,68,19,15). Nemiary et al. state that with respect to the association of depression and obesity, it might be more practical to examine the specific interactions between these two variables (69). In their model, the emphasis is on the mediator role of variables such as peer bullying and weight-based teasing. In this current study, as suggested in the hypothesis 1, a positive relationship was observed between depressive symptoms and BMI.

Depression is thought to affect eating habits and activity levels which lead to fluctuations in BMI (15). It is stated that people with depression may be less likely to adhere to exercise and diet regimens, and may lose the motivation to control impulses to eat overly. They may also experience low self-efficacy to keep their weight under control (30,29,31). Namely, it may be more difficult for a person experiencing depressive symptoms to engage in the meal planning and exercise recommendations. An experimental study has confirmed that negative mood can promote overeating (70). Therefore, these people may be more likely to gain weight in depression. Eventual loss of motivation causes a reduction in physical activity and thus paves the way for an increased BMI, which may lead to a vicious cycle of weight gain, loss of motivation, a reduction in activity, and so on. In this study, the possible mediator role of parental psychological control between depressive symptoms and BMI was investigated. Following the gathering and analysis of the research data, the findings of this study lead to support of the stated research hypothesis 2. Extant research already demonstrates that parental psychological control perceived by adolescents is related to depressive symptoms (33,39,40,43,44, 71). Yet, within the relevant literature no prior study has been encountered that examined the association of parental psychological control with BMI and its mediator role in the relationship between depressive symptoms and BMI. Though, in this current study a positive correlation was found between depressive symptoms and parental psychological control. It has been suggested previously that psychological control harms the parent-child relationships by impairing feelings of being connected or related which are among the basic needs of adolescents. Parents who carry out psychological control may believe that they are protecting their authority and their dominant positions within the parent/child relationship, but by carrying out a position of psychological control, the parents may inadvertently be disregarding adolescents' psychological needs as well as imposing their wishes onto their children (34).

The relationship between parental psychological control and depressive symptoms are thought to be reciprocal (45). Adolescents with escalated depressive symptoms tend to gradually perceive their parents as interventionists/controllers. People with depression may engage in a clinging and excessively reassurance-seeking interpersonal approach. Parents can react to such behavior by accusing the adolescent and/or by arousing guilt within them, which might be perceived by adolescents as controlling, and as a result, may produce a vicious cycle is within the parent/child relationship.

Specifically, adolescents with depressive symptoms may be more sensitive to particular aspects of psychological control, which involve criticism and rejection, making them more likely to internalize such negative parenting behaviors. The internalization of criticism and rejection in turn may lead to adolescents feeling insecure about the stability of their relationship with their parents. These adolescents may be more likely to interpret psychologically controlling parents as direct threats to the security of the parent-adolescent relationship, placing

them at a greater risk for the problem behaviors associated with psychological control. Through psychological control the child is not allowed to develop individual feelings of competence (33,72). On the other hand, adolescents with fewer depressive symptoms may be less sensitive to parental rejection and criticism, making them less likely to focus on or internalize such negative parenting behaviors. These adolescents may be less likely to interpret psychologically controlling parents as direct threats to the security of the parent-adolescent relationship (49).

Thus, it is possible that adolescents with depressive symptoms may be more likely to engage in overeating behaviors when faced with parental psychological control. Parents using a manipulative or constraining parenting style may ultimately influence adolescents' eating behavior. Specifically, they react to such parental conflict and pressure by overeating. In the adolescents who feel themselves as under pressure and deterred, overeating habit can be a symbolic behavior. In situations in which we cannot control what is happening at our surrounding, it can be thought that we become keener of eating behavior, which largely seems under our initiative.

The findings were consistent with the proposed association between psychological control and internalized problems, such as eating disorder. Parental psychological control has been found to uniquely predict eating disorders (73) in adolescents. A study that examines both perceived parental psychological control and perfectionism in relation to eating disorder symptomatology reveals that, paternal rather than maternal perceived psychological control was significantly related to the severity and diagnosis of the disorder (51).

The findings from this study indicated that perceived parental psychological control might be an important risk factor in terms of the development and maintenance of obesity, such that depressive symptoms may increase parental psychological control, and increased parental psychological control may lead to an increase in BMI.

Hypothesis 3 was supported, age moderated the relationship between depressive symptoms and BMI; consistent with this, hypothesis 4, age moderated the mediating effect of parental psychological control in the relationship between depressive symptoms and BMI. The effects of depressive symptoms that were exerted on BMI via parental psychological control were moderated by age groups. The direct and indirect effects of depressive symptoms on BMI through parental psychological control were observed exclusively when the participants' age was within the moderate to low category (14- years- old). Apparently, early adolescents aged 14 were more likely to consider parental psychological control effective, and as a result, experience increases in their BMI. Various explanations might be provided for the moderating effect of age in regards to the relationship of depressive symptoms with parental psychological control as well as with BMI. First, SDT identifies three universal psychological needs that must be satisfied for effective functioning and psychological health; namely autonomy, competence, and relatedness (74). Soenens and Vansteenkiste (54) asserted that parental psychological control can have a direct influence on all three needs which is why parental psychological control is related to a lack of well-being among affected adolescents. In particular, through their intrusive behaviors, psychologically controlling parents can force children to comply with the parents' own personal standards and needs, regardless of the children's needs and values. As a result, psychological control can thwart experiences of autonomy among children and adolescents (75). Adolescence is characterized by normative increases in separation and independence from the parenting and/or authority figures (76). According to this information, psychological control has been defined by various researchers as a parental strategy hinders adolescents' independent functioning and instead fosters dependency. Thus, a parent's psychological control can cause depressive symptoms in the adolescent by preventing child's need for autonomy from the parent and vice versa (45). In Turkey, around the age of 14, adolescents begin to transfer from junior high school into high school. Therefore, parental psychological control perceived by the adolescent, whose needs of autonomy are increasing during this period, can give rise to fluctuations in his/her BMI, thus leading to depressive symptoms.

Secondly, according to SDT, younger children and parents are inclined to agree upon the acceptability and extent of parental intervention into several areas of their lives, while the two parties in many cases tend to develop inconsistent views regarding these matters as the child matures. Parents and children eventually come to believe that interventions in the personal domain are unjustified, yet they might disagree upon what is considered as personal. Such disputes may be a source of psychological interactions regarding to control between parents and children (56). Thus, mother of a 14-year-old adolescent may regard her child's eating behavior as a personal issue while the adolescent may think otherwise. Therefore, the conflict between the two parties over the mother's psychological control may intensify during this age period. This conflict may exacerbate fluctuations in BMI as well as the depressive symptoms of these adolescents. Because the sample did not include the participants under age of 14, it is not possible to elaborate on whether this effect can be more pronounced among adolescents younger than this age. Hence, in the future, further studies conducted with samples representing younger ages are necessary.Based on the data suggesting that the mothers' interference unlikely exerts adverse effects on eating behavior of their children older than 14- years- old, prevention and intervention programs targeting adolescent obesity need to be implemented at an earlier age.

Thirdly, it can be argued that the relationship between manipulative and constraining parental behavior and depressive symptomatology are likely to decrease as adolescents mature and the influence of non-parental adults (e.g. teachers and mentors), peers and romantic partners becomes increasingly more important (77). Thus, the effect of perceived parental psychological control loses its power on the adolescents aged 15 years or older that might rather be more prone to be affected by comments by their peers and/or mentors. Results indicated the relationship between depressive symptoms and BMI was not moderated by sex. This finding is compatible with the literature. While some studies show a significant association between depression and obesity in females, but not in males (78), other studies have not found gender differences (79,80,81)

This present study had several limitations, for example, because of its cross-sectional nature, the data obtained from was not conducive to investigate the presence of a causal relationship between depressive symptoms and BMI. Cross sectional studies have shown that there is a bi-directional association between depression and obesity. Using advanced statistical analyses (e.g. random intercept cross lagged panel model) time series data can provide more reliable result about the direction of the variables. An important limitation was the use of adolescent-reported data for all measures. Future studies can include multi-informant data from teachers and/or parents which might provide more objective and credible measures than self-reported data from the student participants. The fact that the information on the subjects' height and weight were collected basically through self-reporting was another limitation. Additionally, depressive feeling can change in short term. Thus, more depression assessment over time is a better way to examine the association between depression and other variables. Overweight and obese subjects were grouped together (BMI 85% and above). As this group was composed mostly of overweight adolescents, this could also be a source of potential bias. It is recommended that future longitudinal or experimental studies should be conducted with separate samples of overweight and obese adolescents so that the results will be more representative. Further studies are necessary in regards to comparing participants from divergent categories of the normal, under and overweight. Furthermore, taking the sample from a single city and not being controlled socio-demographically are also an important limitation.

In this present study, an attempt was made to examine the mediating role of parental psychological control and moderating role of age in the association between depressive symptoms and BMI in adolescents. It was indicated in the results that depressive symptoms and parental psychological control were vulnerability factors for BMI, and both warrant greater attention by researchers. Because an adequate amount of behavioral control can be of use during developmental processes of adolescents (82,42), it is crucial to educate parents that psychological control is considered to be a universally negative parenting strategy, and as a result, help parents identify, avoid and ultimately elimi-

nate the use of these ineffective and detrimental parenting behavior. Given that the perceived parental psychological control seemed to have increased the risk for the development of obesity in the face of depression within 14-year-olds but not in older adolescents, parenting programs should primarily target the parents of early adolescents rather than the parents of middle and/or late adolescents. As to the treatment model formulated for the weight control strategies in obese adolescents, the treatment directed toward depressive symptomatology should be complemented with interventions directed toward correcting parental psychological control. It is vital for the families to be aware of the psychological dimensions of obesity, to behave more sensibly and to seek out mental health professionals if needed. In conclusion, it was implied in the findings of this study that the efficiency of the school-based prevention and intervention programs for obesity can be considerably enhanced through add-on psychotherapeutic techniques aimed at improving adolescents' skills for more effectively coping with parental psychological control.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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REFERENCES

1. Dietz WH. Critical periods in childhood for the development of obesity. Am J Clin Nutr 1994; 59: 955-959.

2. Must A, Strauss RS. Risks and consequences of childhood and adolescent obesity. Int J Obes 1999; 23 (Suppl 2): S2-S11.

3. Inchley J, Currie D, Jewell J, Breda J, Barnekow V. (Eds.). Adolescent Obesity and Related Behaviours: Trends and Inequalities in the WHO European Region, 2002-2014: Observations From the Health Behaviour in School-Aged Children (HBSC) WHO Collaborative Cross-National Study. Denmark, WHO Regional Office for Europe, 2017.

4. Hales CM, Carroll MD, Fryar CD, Ogden CL. Prevalence of Obesity Among Adults and Youth: United States, 2015-2016. NCHS Data Brief, No. 288, Hyattsville, MD, National Center for Health Statistics, 2017.

5. Republic of Turkey, Ministry of Health. Türkiye Beslenme ve Sağlık Araştırması 2010: Beslenme Durumu ve Alışkanlıklarının Değerlendirilmesi Sonuç Raporu (Sağlık Bakanlığı Yayın No. 931 [Turkey Nutrition and Health Survey 2010: Nutritional Status and Habits Evaluation Outcome Report (Ministry of Health Publication No. 931)]. Retrieved from: https://hsgm.saglik.gov.tr/depo/birimler/saglikli-beslenme-hareketli-hayat-db/Yayinlar/kitaplar/diger-kitaplar/TBSA-Beslenme-Yayini.pdf, 2014.

6. Turkish Statistical Institute. İstatistiklerle Gençlik, 2012. Haber Bülteni (Sayı: 13509) [Youth in Statistics, 2012. Press Release (No: 13509)]. http://www.tuik.gov.tr/PreHaberBultenleri.do?id=13509/, 2013. Accessed Date: 27 June 2016.

7. Turkish Statistical Institute. Türkiye Sağlık Araştırması, 2014. Haber Bülteni (Sayı: 18854) [Turkey Health Survey, 2014. Press Release (No: 18854)]. http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18854/, 2015. Accessed Date: 29 June 2016.

8. Ministry of Health, Public Health Institution of Turkey. Türkiye Sağlıklı Beslenme ve Hareketli Hayat Programı (2013-2017) (Sağlık Bakanlığı Yayın No. 773) [Turkey Healthy Eating and Active Life Program (2013-2017) (Ministry of Health Publication No.773)]. Retrieved from: https://dosyaism.saglik.gov.tr/Eklenti/8861,turkiye-saglikli-beslenme-ve-hareketli-hayat-programipdf.pdf?0, 2013.

9. Ge X, Lorenz FO, Conger RD, Elder GH, Simons RL. Trajectories of stressful life events and depressive symptoms during adolescence. Dev Psychol 1994; 30: 467-483.

10. Kerig PK, Ludlow A, Wenar C. Developmental Psychopathology from Infancy Through Adolescence. Sixth Edition, London, Mc Graw Hill, 2012.

11. Substance Abuse and Mental Health Services Administration. Key Substance Use and Mental Health Indicators in the United States: Results from the 2016 National Survey on Drug Use and Health (HHS Publication No. SMA 17-5044, NSDUH Series H-52). Rockville, MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration. Retrieved from: https://www.samhsa.gov/data/, 2017.

12. Binbay T, Direk N, Aker T, Akvardar Y, Alptekin K, Cimilli C, Cam B, Deveci A, Kadri Gültekin B, Sar V, Taycan O, Ulaş H. Türkiye'de psikiyatrik epidemiyoloji: Yakın zamanlı araştırmalarda temel bulgular ve gelecek için öneriler [Psychiatric epidemiology in Turkey: Main advances in recent studies and future directions]. Turk Psikiyatri Dergisi 2014; 25: 264-81.

13. Franko DL, Striegel-Moore RH, Thompson D, Schreiber GB, Daniels SR. Does adolescent depression predict obesity in black and white young adult women? Psychol Med 2005; 35: 1505-1513.

14. Goodman E, Whitaker RC. A prospective study of the role of depression in the development and persistence of adolescent obesity. Pediatrics 2002; 110: 497-504.

15. Pine DS, Goldstein RB, Wolk S, Weissman MM. The association between childhood depression and adulthood body mass index. Pediatrics 2001; 107: 1049-1056.

16. Arslan E, Karaman D, Yavaşloğlu I, Algül A, Erdem M.

Genç erkek olgularda obezite ve depresyon arasındaki ilişkinin incelenmesi [A study on correlation between obesity and depression in young male population]. Klinik Psikofarmakoloji Bülteni 2009; 19(Suppl.1): S196-S197.

17. Boutelle KN, Hannan P, Fulkerson JA, Crow SJ, Stice E. Obesity as a prospective predictor of depression in adolescent females. Health Psychol 2010; 29: 293-298.

18. Chen Y, Jiang Y, Mao Y. Association between obesity and depression in Canadians. J Womens Health 2009; 18: 1687-1692.

19. Erermis S, Cetin N, Tamar M, Bukusoglu N, Akdeniz F, Goksen D. Is obesity a risk factor for psychopathology among adolescents? Pediatr Int 2004; 46: 296-301.

20. Ting WH, Huang CY, Tu YK, Chien KL. Association between weight status and depressive symptoms in adolescents: role of weight perception, weight concern, and dietary restraint. Eur J Pediatr 2012; 171: 1247-1255.

21. Blaine B. Does depression cause obesity? A meta-analysis of longitudinal studies of depression and weight control. J Health Psychol 2008; 13: 1190-1197.

22. Rofey DL, Kolko RP, Iosif AM, Silk JS, Bost JE, Feng, W, Szigethy EM, Noll RB, Ryan ND, Dahl, RE. A longitudinal study of childhood depression and anxiety in relation to weight gain. Child Psychiatry Hum Dev 2009; 40: 517-526.

23. Luppino FS, de Wit LM, Bouvy PF, Stijnen T, Cuijpers P, Penninx BW, Zitman FG. Overweight, obesity, and depression: A systematic review and meta-analysis of longitudinal studies. Arch Gen Psychiatry 2010; 67: 220-9.

24. Mannan M, Mamun A, Doi S, Clavarino, A. Prospective associations between depression and obesity for adolescent males and females- A systematic review and meta-analysis of longitudinal studies. PloS One 2016; 11: e0157240.

25. Rooke SE, Thorsteinsson EB. Examining the temporal relationship between depression and obesity: Meta-analyses of prospective research. Health Psychol Rev 2008; 2: 94-109.

26. Puhl RM. Weight stigmatization toward youth: a significant problem in need of societal solutions. Child Obes 2011; 7: 359-363.

27. Eisenberg ME, Neumark-Sztainer D, Story M. Associations of weight-based teasing and emotional well-being among adolescents. Arch Pediatr Adolesc Med 2003; 157: 733-738.

28. Puhl RM, Brownell KD. Confronting and coping with weight stigma: An investigation of overweight and obese adults. Obesity 2006; 14: 1802-1815.

29. Markowitz S, Friedman MA, Arent SM. Understanding the relation between obesity and depression: Causal mechanisms and implications for treatment. Clinical Psychology: Science and Practice 2008; 15: 1-20.

30. Agras WS, Telch CF. The effects of caloric deprivation and negative affect on binge eating in obese binge-eating disordered women. Behav Ther 1998; 29: 491-503.

31. Somerset SM, Graham L, Markwell K. Depression scores predict adherence in a dietary weight loss intervention trial. Clin Nutr 2011; 30: 593-598.

32. Schulz R, Beach SR, Ives DG, Martire LM, Ariyo AA, Kop WJ. Association between depression and mortality in older adults: The Cardiovascular Health Study. Arch Intern Med 2000; 160: 1761-1768.

33. Barber BK. Parental psychological control: revisiting a neglected construct. Child Dev 1996; 67: 3296-3319.

34. Barber BK, Harmon EL. Violating the Self: Parental Psychological Control of Children and Adolescents. In Intrusive Parenting: How Psychological Control Affects Children and Adolescents. Edited by Barber BK. Washington, DC, American Psychological Association, 2002.

35. Kerr M, Stattin H. What parents know, how they know it, and several forms of adolescent adjustment: Further support for a reinterpretation of monitoring? Dev Psychol 2000; 36: 366-380.

36. Barber BK, Olsen JE, Shagle SC. Associations between parental psychological and behavioral control and youth internalized and externalized behaviors. Child Dev 1994; 65: 1120-1136.

37. Deci EL, Ryan RM. The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. Psychol Inq 2000; 11: 227-268.

38. Albrecht AK, Galambos NL, Jansson SM. Adolescents' internalizing and aggressive behaviors and perceptions of parents' psychological control: A panel study examining direction of effects. J Youth Adolesc 2007; 36: 673-684.

39. Bullock A, Liu J, Cheah CSL, Coplan RJ, Chen X, Li D. The role of adolescents' perceived parental psychological control in the links between shyness and socio-emotional adjustment among youth. J Adolesc 2018; 68: 117-126.

40. Ha JH, Jue J. The mediating effect of emotion inhibition and emotion regulation between adolescents' perceived parental psychological control and depression. Sage Open 2018; 8: 1-11.

41. Özdemir Y. Parental behavioral and psychological control: Relationships to self-esteem, life satisfaction, depression, and antisocial behaviors. International Journal of Human Sciences [Online] 2012; 9: 1581-1590.

42. Pettit GS, Laird RD, Dodge KA, Bates JE, Criss MM. Antecedents and behavior-problem outcomes of parental monitoring and psychological control in early adolescence. Child Dev 2001; 72: 583-598.

43. Rogers AA, Padilla-Walker LM, McLean RD, Hurst JL. Trajectories of perceived parental psychological control across adolescence and implications for the development of depressive and anxiety symptoms. J Youth Adolesc 2020; 49: 136-149.

44. Van Assche E, Moons T, Van Leeuwen K, Colpin H, Verschueren K, Van Den Noortgate W, Goossens L, Claes S. Depressive symptoms in adolescence: The role of perceived parental support, psychological control, and proactive control in interaction with 5-HTTLPR. Eur Psychiatry 2016; 35: 55-63.

45. Soenens B, Luyckx K, Vansteenkiste M, Duriez B, Goossens L. Clarifying the link between parental psychological control and adolescents' depressive symptoms: reciprocal versus unidirectional models. Merrill Palmer Q 2008; 54: 411-444.

46. Lerner RM. Diversity in individual context relations as the basis for positive development across the life span: A developmental systems perspective for theory, research, and application. Res Hum Dev 2004; 1: 327-346.

47. Rhee K. Childhood overweight and the relationship between parent behaviors, parenting style, and family functioning. Ann Am Acad Pol Soc Sci 2008; 615: 12-37.

48. Taylor A, Wilson C, Slater A, Mohr P. Parent- and child-reported parenting. Associations with child weight-related outcomes. Appetite 2011; 57: 700-706.

49. Romm KF, Metzger A. Parental psychological control and adolescent problem behaviors: The role of depressive symptoms. J Child Fam Stud 2018; 27: 2206-2216.

50. Snoek HM, Engels RCME, Janssens JMAM, van Strien T. Parental behavior and adolescents' emotional eating. Appetite 2007; 49: 223-230.

51. Soenens B, Vansteenkiste M, Vandereycken W, Luyten P, Sierens E, Goossens L. Perceived parental psychological control and eating-disordered symptoms: maladaptive perfectionism as a possible intervening variable. J Nerv Ment Dis 2008; 196: 144-52.

52. Birch LL, Fisher JO. Development of eating behaviors among children and adolescents. Pediatrics 1998; 101: 539-549.

53. Soenens B, Vansteenkiste M, Luyten P. Toward a domain-specific approach to the study of parental psychological control: distinguishing between dependency-oriented and achievement-oriented psychological control. J Pers 2010; 78: 217-256.

54. Soenens B, Vansteenkiste M. A theoretical upgrade of the concept of parental psychological control: Proposing new insights on the basis of self-determination theory. Dev Rev 2010; 30: 74-99.

55. Pomerantz EM, Eaton MM. Developmental differences in children's conceptions of parental control: "They love me, but they make me feel incompetent". Merrill Palmer Q 2000; 46: 140-167.

56. Smetana JG, Daddis C. Domain-specific antecedents of parental psychological control and monitoring: the role of parenting beliefs and practices. Child Dev 2002; 73: 563-580.

57. Fairchild AJ, MacKinnon DP. A general model for testing mediation and moderation effects. Prev Sci 2009; 10: 87-99.

58. Fraenkel JR, Wallen NE, Hyun HH. How to Design and Evaluate Research in Education (8th edt.). New York, McGram-Hill Companies, 2012.

59. World Health Organization. Growth Reference Data for 5-19 Years. http://www.who.int/growthref/who2007_bmi_for_age/en/, 2007. Accessed Date: 04 September 2018.

60. Kovacs M. Rating scale to assess depression in school aged children. Acta Paedopsyhiatrica 1981; 46: 305-315.

61. Kovacs M. The Children's Depression, Inventory (CDI). Psychopharmacol Bull 1985; 21: 995-998.

62. Kovacs M. Children's Depression Inventory Manual. North Tonawanda, NY, Multi-Health Systems, 1992.

63. Öy B. Çocuklar için depresyon ölçeği: Geçerlik ve güvenirlik çalışması [Depression scale for children: Validity and reliability study]. Turk Psikiyatri Derg 1991; 2: 132-136.

64. Harma M. The Impact of Parental Control and Marital Conflict on Adolescents' Self-Regulation and Adjustment. The Middle East Technical University, Unpublished Master's Thesis, 2008.

65. Olsen SF, Yang C, Hart CH, Robinson CC, Wu P, Nelson DA, Nelson LJ, Jin S, Wo, J. Maternal Psychological Control and Preschool Children's Behavioral Outcomes in China, Russia, and the United States. In Intrusive Parenting: How Psychological Control Affects Children and Adolescents. Edited by Barber BK. Washington, DC, American Psychological Association, 2002.

66. Hayes AF. Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach. New York, Guilford Press, 2013.

67. Fritz MS, MacKinnon DP. Required sample size to detect the mediated effect. Psychol Sci 2007; 18: 233-239.

68. de Wit L, Luppino F, van Straten A, Penninx B, Zitman F, Cuijpers P. Depression and obesity: A meta-analysis of community-based studies. Psychiatry Res 2010; 178: 230-235.

69. Nemiary D, Shim R, Mattox G, Holden K. The relationship between obesity and depression among adolescents. Psychiatr Ann 2012; 42: 305-308.

70. Chua JL, Touyz S, Hill AJ. Negative mood induced overeating in obese binge eaters: An experimental study. Int J Obes 2004; 28: 606-610.

71. Werner LLAA., Van der Graaff, J. Meeus WHJ, Branje SJT. Depressive symptoms in adolescence: Longitudinal links with maternal empathy and psychological control. J Abnorm Child Psychol 2016; 44: 1121-1132.

72. Gruner K, Muris P, Merckelbach H. The relationship between anxious rearing behaviours and anxiety disorders symptomatology in normal children. J Behav Ther Exp Psychiatry 1999; 30: 24-35.

73. Jensen BS, Barber BK. Eating Disorders Among Female Adolescents: An Analysis of Family Predictors. Paper Presented at the Annual Meeting of the National Council on Family Relations, Portland, 1995, November.

74. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. Am Psychol 2000; 55: 68-78.

75. Vansteenkiste M, Simons J, Lens W, Soenens B, Matos L. Examining the motivational impact of intrinsic versus extrinsic goal framing and internally controlling versus autonomy-supportive communication style upon early adolescents' academic achievement. Child Dev 2005; 76, 483-501.

76. Steinberg, L, Silverberg SB. The vicissitudes of autonomy in early adolescence. Child Dev 1986; 57: 841-851.

77. Steinberg L, Silk JS. Parenting Adolescents. In Handbook of Parenting: Vol. 1. Children and Parenting. Edited by Bornstein MH. Mahwah, NJ, Erlbaum, 2nd Ed., 2002, pp. 103-133.

78. Korczak DJ, Lipman E, Morrison K, Szatmari P. Are children and adolescents with psychiatric illness at risk for increased future body weight? A systematic review. Dev Med Child Neurol 2013; 55: 980-987.

79. Haukkala A, Uutela A. Clinical hostility, depression, and obesity: the moderating role of education and gender. Int J Eat Disord 2000; 27: 106-109.

80. Herva A, Laitinen J, Miettunen J, Veijola JT, Karvonen JT, Läksy K, Joukkamaa M. Obesity and depression: results from the longitudinal northern Finland 1966 birth cohort study. Int J Obes 2006; 30: 520-527.

81. Mühlig Y, Antel J, Föcker M, Hebebrand J. Are bidirectional associations of obesity and depression already apparent in childhood and adolescence as based on high-quality studies? A systematic review. Obes Rev 2016; 17: 235-249.

82. Fletcher AC, Steinberg L, Williams-Wheeler M. Parental influences on adolescent problem behavior: revisiting Stattin and Kerr. Child Dev 2004; 75: 781-796.