

The indirect effect of family cohesion on children's weight status through maternal quality of life and children's internalizing and externalizing symptoms.

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Conflict of Interest: Author Roberta Frontini has received a PhD scholarship from Portuguese Foundation for Science and Technology [SFRH/BD/86063/2012] and author Helena Moreira was supported by a Post-doctoral scholarship [SFRH/BPD/70063/2010]. The authors declare no conflict of interest.

Accepted for publication in Child & Youth Care Forum | 19 May 2017

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Abstract

Background: Obesity has serious psychosocial consequences for youth and family members and has reached epidemic levels in Portugal.

Objective: This study had two goals: 1) to investigate differences in family cohesion, mothers' quality of life (QoL), and externalizing/internalizing symptoms between children/adolescents with healthy-weight and overweight/obesity; 2) to assess the mediating role of maternal QoL and children/adolescents' externalizing/internalizing symptoms in the association between family cohesion and weight.

Methods: Children/adolescents with healthy-weight (n = 134) and with overweight/obesity (n = 163) and their mothers participated in the study. Mothers completed measures of family cohesion (FC) and QoL and children/adolescents completed measures of externalizing and internalizing symptoms. This study used a cross-sectional design.

Results: Children/adolescents with overweight/obesity reported higher levels of externalizing and internalizing symptoms than children/adolescents with healthy-weight. Mothers of children/adolescents with overweight/obesity reported lower levels of FC and QoL than mothers of children/adolescents with healthy-weight. Mothers' QoL and children/adolescents' externalizing symptoms sequentially mediated the relationship between FC and weight status. Specifically, an increase in FC and QoL resulted in a decreased likelihood of the child/adolescent reporting overweight or obesity, whereas an increase in externalizing symptoms resulted in a higher likelihood of the child/adolescent reporting overweight or obesity.

Conclusions: This study identifies mechanisms that might account for the link between FC and weight, suggesting the importance of mothers' QoL and children's externalizing symptoms. Moreover, it provides a better understanding of the psychosocial outcomes related to pediatric obesity, highlighting the relevance of working with the parents to promote weight reduction in youths.

Keywords: Family Cohesion; Externalizing Symptoms; Internalizing Symptoms; Pediatric Obesity; Maternal Quality of Life.

Introduction

Pediatric obesity reached epidemic levels in Portugal, one of the European countries with the highest prevalence (OECD/EU, 2016; Rito et al., 2012). As in other chronic health conditions (CHC), obesity has negative consequences for the child/adolescent and the family system, but at the same time, it is influenced by the family in an interacting way (e.g., Fiese & Sameroff, 1989; Kazak, Rourke, & Navsaria, 2009). Hence, when studying pediatric overweight/obesity, a systems-oriented conceptualization may be useful (Hooper, Burnham, & Richey, 2009). Given the higher prevalence and alarming physical and psychosocial consequences related to pediatric obesity, the prevention of this CHC and studies in this area are a priority not only in Portugal but worldwide (Filipe, Godinho, & Graça, 2016).

One of the negative consequences of overweight/obesity is in the psychological functioning of children/adolescents. Research has found higher levels of psychopathological symptoms in children/adolescents with overweight/obesity, compared to children/adolescents with healthy-weight or other CHCs (e.g., Braet, Mervielde, & Vandereycken, 1997; Britz et al., 2000; Moreira et al., 2013), suggesting a link between psychological health and weight status. Although some studies point to a strong association between childhood obesity and externalizing symptoms (e.g., impulsivity, hyperactivity, conduct problems; Puder & Munsch, 2010; Zeller, & Modi, 2008), much more attention has been paid to the link between obesity and children's internalizing symptoms (e.g., anxiety, depression, isolation; Zeller, & Modi, 2008). Therefore, in order to overcome this important gap, studies focusing on both internalizing and externalizing symptoms are essential to more thoroughly understand the links between overweight/obesity and the psychological adjustment in youths. Moreover, some studies suggested that parents of children/adolescents with overweight/obesity often describe lower levels of quality of life (QoL) compared, not only to parents of children/adolescents with healthy-weight, but also to parents of children/adolescents with other CHCs (e.g., Modi, Guilfoyle, & Zeller, 2009; Moreira et al., 2013). Understanding the role of maternal QoL on children/adolescents' weight is of utmost importance given that maternal QoL and psychopathology are strongly related to the nutritional status of their sons (Feijó et al., 2011) and to their child's feeding problems (Blissett, Meyer, & Haycraft, 2007). Additionally, more research is needed on the family and parenting characteristics that might be associated with children's weight as well as with their psychological functioning. By identifying which parental and familial characteristics are important correlates of higher pediatric weight and pediatric psychological adjustment,

intervention programs may be more efficient, focusing on changing important variables that might contribute to pediatric weight. In fact, dietary and physical activity patterns occur in the context of the family thus, examining family and child factors, and their potential interrelationships, are needed and will help enhance prevention and intervention (Zeller & Daniels, 2004).

Nonetheless, despite the increasing interest in studying the impact of family functioning in the psychological adaptation of obese youths and on their weight (e.g., Blissett, Meyer, & Haycraft, 2011; Houldcroft, Farrow, & Haycraft, 2014; Washington, Rose, Colombo, Hong, & Coard, 2015), there has been little investigation regarding the sequential association between family environment, parents' adaptation and their child's adaptation (e.g., internalizing and externalizing symptoms). Moreover, the relationship between family and weight does not appear to be straightforward and the mechanisms that may account for this association remain unclear. If research is able to clarify and highlight how familial and parental variables/characteristics are associated with higher weight status, interventions and prevention programs may be better designed in order to decrease or prevent overweight/obesity. The incorporation of a parent-child dyadic perspective in research is important given that parents (most commonly mothers) are usually responsible for accompanying their children at nutritional appointments (Holmbeck, Zebracki, & McGoron, 2009). Therefore, assessing the mother's adjustment and understanding their role in their child's weight may help expand the focus of clinical theory and intervention.

The presence and maintenance of overweight/obesity of a child/adolescent is usually influenced not only by family environment but also by maternal adaptation (Jelalian & Hart, 2009; Puder & Munsch, 2010). For instance, taking into account a key dimension on family environment, which is family cohesion (FC; Holmbeck, Coakley, Hommeyer, Shapera, & Westhoven, 2002), research acknowledged that pediatric obesity arises in families with lower levels of FC (e.g., Mendelson, White, & Schliecker, 1995; Zeller et al., 2007). Additionally, lower FC appears to be a risk factor for lower parental adaptation (e.g., QoL; Field & Duchoslav, 2009) and poor child/adolescent outcomes (Drotar, 1997). Lower FC is also a risk factor for higher weight status, especially because of the effect that FC has on healthy eating (Franko, Thompson, Bauserman, Affenito, & Striegel-Moore, 2008). In a study examining the association between FC and behaviors linked to health or overweight in adolescents, Franko and colleagues (2008) suggested that higher FC could be linked to healthy eating behaviors in a direct way or through the psychological health of the child.

Because childhood obesity has multiple processes interacting mutually (Puder & Munsch, 2010), further studies are needed in this area to better understand the relationships between the variables discussed. In fact, since the etiology of obesity is multifactorial (Loche & Ozanne, 2016; Sancho et al., 2014) with environmental factors being considered as major contributors to the obesity epidemic (Maggi, Busetto, Noale, Limongi, & Crepaldi, 2015), it is of utmost importance to study which family/parent characteristics may contribute to the development of pediatric overweight/obesity, and how these factors may interconnect with child/adolescent outcomes (Zeller & Daniels, 2004). Individual and personal factors from the mother and the child/adolescent could account for the relationship between family factors and weight, as suggested in Kazak's (1989) and Bronfenbrenner's (1979) socio-ecological models. Those models consider the importance of the interaction of many systems, providing a framework that helps identify common parameters of illness and family responses (Kazak et al., 2009). Using those models as frameworks may help us to understand and explain the multiple influences on body weight and have been considered as important models when addressing childhood obesity (Cauchi, Glonti, Petticrew, & Knai, 2016). Moreover, research consistently acknowledges the importance of maternal adaptation on the adaptation of children/adolescents (e.g., Abidin, Jenkins, & McGaughey, 1992; Field & Duchoslav, 2009; Guilfoyle, Zeller, & Modi, 2010), as well as the interrelationship between parents' and children's outcomes (Kazak et al., 2009), especially in the context of pediatric CHCs such as overweight/obesity (Wallander & Varni, 1998). Taken as a whole, these findings suggest that researchers and practitioners can benefit from further research on the interrelationship between family environment, maternal adaptation, children/adolescents adaptation, and pediatric weight.

The Current Study

This study had two main aims. First, to investigate differences in FC, maternal QoL, and children/adolescents' externalizing and internalizing symptoms between families with children/adolescents with healthy-weight and families with children/adolescents with overweight/obesity seeking treatment. It was hypothesized that mothers of children/adolescents with overweight/obesity would report lower levels of FC and QoL compared to mothers with children/adolescents with healthy-weight. We further hypothesized that children/adolescents with overweight/obesity would report higher levels of externalizing and internalizing symptoms compared to children/adolescents with healthy-weight. Children and adolescents were examined separately in the analyses to explore possible age differences for

several reasons: 1) these two phases have different specificities regarding their developmental tasks and so should be considered separately in research (Holmbeck, 2002); 2) Wallander and Varni (1998) reinforce the need to implement a developmental perspective in research on individual and family adjustments to pediatric chronic conditions since youth and their families are in continuous development (Wallander, Thompson, & Alriksson-Schmidt, 2003); 3) finding differences between children and adolescents may help tailor more specific intervention programs for pediatric obesity; 4) adolescents often experience developmental changes that might impact the behaviors of significant others (e.g., mothers' behaviors; Holmbeck, 2002); 5) research has found developmental differences in psychosocial functioning (e.g., Swallen, Reither, Haas, & Meier, 2005); finally, 6) children and adolescents rely on parents differently not only in relation to eating and physical patterns but also in general health guidance, but, younger children may demand more of caregivers and require more supervision (Pereira, Canavarro, Cardoso, & Mendonça, 2009) and adolescents have more autonomy (Erikson, 1982) which may be reflected, for instance, in the use of different parenting styles (Frontini, Moreira, & Canavarro, 2016). By examining the role of age, this study will provide a more comprehensive understanding of the variables at different developmental stages.

Second, because of the known association between parents' adaptation and children's adaptation, this study investigated whether the relationship between FC and weight status was mediated sequentially by mothers' QoL and children/adolescents' externalizing and internalizing symptoms. No previous research has tested the relationships between these variables altogether. Nonetheless and taking into account the relationship between the variables (previously explored), we expect that lower levels of FC would be associated with lower levels of maternal QoL which, in turn, would be associated with higher levels of externalizing (or internalizing) symptoms and, in turn, with higher weight. Mediation analyses are important in this study field because they help complement simple descriptive analyses, creating a more functional understanding of the relationships between variables (Preacher & Hayes, 2004). Therefore, by exploring these associations, this study intends to overcome important limitations of previous research. In fact, by enlightening possible mechanisms linking family environment, maternal adaptation, children/adolescents adaptation, and pediatric weight, potential targets of interventions may be acknowledged, adding information to the scarce literature on mediators that may explain the aforementioned associations of the variables.

Methods

Participants

The sample included 297 dyads, comprising a child (8-12 years old) or an adolescent (13-18 years old) and their mothers, organized into two groups according to their BMI: (1) children/adolescents with overweight/obesity (BMI \geq 85th percentile; $n = 163$) seeking treatment; (2) children/adolescents with healthy-weight (BMI: 5th–84th percentile; $n = 134$). The weight condition was based on the growth charts of the National Centre for Health and Statistics (Kuczmarski, Ogden, Guo, et al., 2002) adapted and used in the Portuguese Health System since 2006. The inclusion criteria were: (1) aged between 8-18 years; (2) ability to understand and answer the set of questionnaires; (3) no mental/developmental delay; (4) absence of genetic syndromes that could cause obesity or other CHC; (5) healthy-weight children had no CHC.

Materials and Procedure

The sample of children/adolescents with overweight/obesity undergoing treatment (i.e. attending nutrition appointments to lose weight) and their mothers was recruited in two Portuguese public and urban hospitals and one healthcare center (February 2012 to December 2014). The study was approved by the Ethics Committee and Direction Boards of these institutions. Informed consent was obtained from all individual participants included in the study. The researcher explained the aims of the study, the research procedures, and asked the parent to sign an informed consent form. Children were asked to assent to their own participation. Mothers and children/adolescents completed the self-report questionnaires in a consultation office and a researcher was available to provide assistance.

Children/adolescents with healthy-weight and their mothers were recruited in Portuguese public schools. Authorizations from the Direction Boards were obtained. Children and mothers were each given an informed consent form and the questionnaires and asked to complete them at home and return them a week later. Children were asked to assent to their own participation. Children/adolescents recruited in schools with overweight/obesity were excluded from analyses.

Measures

Family Cohesion. The Cohesion subscale of the Portuguese version of the Family Environment Scale (FES) was used (Matos & Fontaine, 1992; Moos & Moos, 1986) to assess mothers' perceptions of commitment to the family and the degree to which family members are helpful and supportive of one another. It comprises nine items (e.g., "Family members spend a lot of time together and pay attention to each other") answered on a 6-point Likert scale ranging from 1 (*completely disagree*) to 6 (*completely*

agree). Higher scores indicate a higher perception of family cohesion. In previous studies with Portuguese samples, this instrument has demonstrated good psychometric characteristics. In the present study, the Cronbach's alphas were .83 (healthy-weight group) and .81 (overweight/obesity group).

Quality of Life. Mothers' perceptions of their QoL were assessed using the Portuguese version of the EUROHIS-QOL-8 (Pereira, Melo, Gameiro, & Canavarro, 2011; Schmidt, Mühlan, & Power, 2006), a quick indicator of overall QoL. This instrument is a quick and practical indicator of overall QoL (Da Rocha, Power, Bushnell, & Fleck, 2012), containing eight items (e.g., "How would you rate your quality of life") answered on a 5-point Likert scale ranging from 1 (*not at all/very dissatisfied*) to 5 (*completely/very satisfied*). Higher scores indicate a better perception of QoL. In the present study, the Cronbach's alphas were .84 (healthy-weight group) and .80 (overweight/obesity group).

Externalizing and Internalizing Symptoms. Externalizing and internalizing symptoms of children/adolescents were assessed using the Difficulties subscale of the Portuguese self-reported version of the Strengths and Difficulties Questionnaire (Fleitlich, Loureiro, Fonseca, & Gaspar, 2005; Goodman, 2001). This subscale comprises 20 items clustered into externalizing (e.g., "I get very angry and often lose my temper") and internalizing (e.g., "I worry a lot") symptoms, according to recent recommendations (Goodman, Lamping, & Ploubidis, 2010). Items are answered on a 3-point Likert scale ranging from 0 (*not true*) to 2 (*certainly true*). Higher values indicate more psychopathological symptoms. This instrument has better coverage of dimensions such as inattention and peer relationships than other instruments assessing externalizing/internalizing symptoms. Moreover, it has a shorter format providing a balanced coverage of youths' behaviors, emotions, and relationships (Goodman, 1997). The Portuguese version of this instrument has been widely used in clinical practice and research with different ages and health conditions. In the present study, the Cronbach's alphas ranged from .65 (internalizing symptoms in overweight/obesity group) to .73 (externalizing symptoms in the overweight/obesity group).

Weight Condition. The weight and height of children/adolescents recruited in health institutions were measured by the nutritionist. The weight and height of children/adolescents recruited in schools were self-reported by the mothers. The weight condition of children and adolescents was classified as normal, overweight or obese according to the growth charts of the National Centre for Health and Statistics (Kuczmarski et al., 2002) that take into account the percentile values of the BMI for children/adolescents of the same age and gender, calculated from weight (kg) and height (cm) according to the following formula: $\text{weight}/\text{height}^2$. Children/adolescents' BMI was transformed in Z scores (zBMI).

Sociodemographic Data. These were reported by the mothers and included children/adolescents' age and gender, and maternal age, marital status and education.

Data Analyses

Data analyses were performed using the Statistical Package for the Social Sciences (IBM SPSS, version 22.0; Armonk, NY). Descriptive statistics were computed for all sociodemographic and study variables. Analysis of variance (ANOVA) and Chi-squared (χ^2) tests were used for between-group comparisons of sociodemographic and clinical characteristics. To assess the associations between study variables, Pearson's bivariate correlation coefficients were computed. Correlations coefficients $\geq .10$ were classified as "small", those $\geq .30$ were classified as "medium", and those $\geq .50$ were classified as "large" (Cohen, 1988).

Differences between weight conditions (healthy-weight or overweight/obesity) and age groups (children and adolescents) on FC and mothers' QoL were assessed through two-way ANCOVAs, controlling for sociodemographic variables that were significantly different between groups. A two-way multivariate analysis of covariance (MANCOVA), with weight condition and age group as independent variables, was performed on internalizing and externalizing symptoms. When a multivariate effect was found, subsequent ANCOVAs were examined, one per dependent variable.

To ascertain whether the direct and indirect effects of FC on children/adolescents' weight condition were mediated by mothers' QoL and children/adolescents' externalizing and internalizing symptoms, two serial mediation models (Model 6, Hayes, 2013) were estimated using PROCESS (Hayes, 2013); an SPSS macro for path analysis-based moderation and mediation analysis. Mothers' perception of FC was used as the independent variable; children/adolescents' weight condition as the dependent variable (DV); and mothers' QoL and children/adolescents' psychopathological symptoms were used as mediators. Internalizing and externalizing symptoms were tested separately in two different models. Children's age was entered as a covariate since it was correlated with the dependent variable, along with maternal education levels, since there were significant differences on these between the two groups. To assess the unconditional indirect effects, a bootstrapping procedure was used (with 10,000 resamples). Bias-corrected and accelerated confidence intervals (95% BCaCIs) were created with an indirect effect being significant if zero was not contained within the lower and upper CIs. Since the criterion variable (DV) is binary, the procedure for the path analyses is binary logistic regression. The use of logistic regression allows the analysis of statistical indicators such as Cox and Snell and Nagelkerk, specifically

indicated to evaluate the explained variance of the criterion variable. We used Wald statistic in order to obtain the significant level for unstandardized regression coefficient. Significance was set at the .05 level. Those types of analyses are extremely important to better understand the processes and relationships between the variables on our data, even using cross-sectional research (Hayes, 2013).

Results

Participants' Characteristics

Sociodemographic characteristics are presented in Table 1. No group differences were found for mothers' age and marital status, and for children/adolescents' age category or gender. Significant group differences were found in children/adolescents' age and zBMI, and in mothers' BMI and education levels. However, children/adolescents' zBMI was not entered as a covariate in subsequent analyses because it is a characterizing variable of the weight condition, and maternal BMI presented a significant amount of missing information ($n = 18$).

Group Differences and Correlations Among Study Variables

Table 2 presents the descriptive statistics for the study variables according to weight condition (healthy-weight, overweight/obesity) and age group (children, adolescents), as well as the main and interaction effects and the correlations among some study variables.

With regard to FC, a main effect of weight condition was found, with mothers of children/adolescents with healthy-weight reporting higher levels of FC compared to mothers of children/adolescents with overweight/obesity. No significant effects were found for age group, or for the interaction between weight condition and age group.

Regarding mothers' QoL, a main effect of weight condition was also found, with mothers of children/adolescents with healthy-weight reporting higher levels of QoL compared to mothers of children/adolescents with overweight/obesity. No significant effects were found for age group, or for the interaction between weight condition and age group.

With regard to internalizing and externalizing symptoms, a significant multivariate effect was found for weight condition, Wilks' Lambda = 0.94, $F(2, 291) = 8.70$, $p < .001$, $\eta^2_p = .056$. Subsequent univariate analyses revealed significant differences between groups on externalizing symptoms, and marginal differences approaching significance ($p = .059$) for internalizing symptoms. Children/adolescents with overweight/obesity reported higher levels of externalizing and internalizing symptoms compared to children/adolescents with healthy-weight. No significant multivariate effect was

found for age group, Wilks' Lambda = 0.99, $F(2, 291) = 1.74$, $p = .177$, $\eta^2_p = .012$, or for the interaction between weight condition and age group, Wilks' Lambda = 0.99, $F(2, 291) = 0.13$, $p = .878$, $\eta^2_p = .001$.

The Mediating Role of Mothers' QoL and Children/adolescents' Externalizing and Internalizing Symptoms in the Relationship Between FC and Weight Status

Mediation model using externalizing symptoms. We tested whether mothers' QoL and children/adolescents' externalizing symptoms sequentially mediated the association of FC with children/adolescents' weight (0 = healthy-weight; 1 = overweight/obesity). Children/adolescents' age and maternal educational level were entered as covariates. All paths for the full process model, as well as unstandardized regression coefficients, are illustrated in Figure 1. FC was significantly associated with mothers' QoL ($b = 8.76$, $p < .001$) explaining 27% of its variance. For children/adolescents' externalizing symptoms, the significant predictor FC ($b = -0.55$, $p = .046$) and the non-significant variable of mothers' QoL ($b = -0.03$, $p = .084$), explained 4.72% of its variance. Mothers' QoL ($b = -0.03$, Wald = 6.03, $p = .014$, OR = 0.97), children/adolescents' externalizing symptoms ($b = 0.13$, Wald = 9.29, $p = .002$, OR = 1.14) and FC ($b = -0.57$, Wald = 7.16, $p = .007$, OR = 0.57) have a significant effect on children/adolescents' weight. The binary criterion children/adolescents' weight (DV) has an explained variance of between .17 (Cox & Snell's R^2) and .23 (Nagelkerke's R^2).

Regarding the relationships expressed in this model, considering FC and mothers' QoL, an increase in these variables will result in a decreased likelihood of the participant reporting overweight or obesity. An increase in externalizing symptoms will result in a higher likelihood of the participant reporting overweight or obesity.

Three significant indirect effects were found in the association between FC and weight condition. A significant specific indirect effect of FC on weight condition through mothers' QoL and children/adolescents' externalizing symptoms was found with an estimate value of -0.03, (95% BCaCIs = -.095/-.005). Also an indirect effect was found for FC on weight through only mothers' QoL with an estimate value of -0.26, (95% BCaCIs = -.486/-.053). Finally, another specific indirect effect was found of FC on children/adolescents' weight through only externalizing symptoms, with an estimate value of -0.07, which is also a significant indirect negative effect (95% BCaCIs = -.193/-.013).

Mediation model using internalizing symptoms. In a second model we tested if mothers' QoL and children/adolescents' internalizing symptoms sequentially mediate the influence of FC on children/adolescents' weight. Children/adolescents' age and maternal educational level were entered as

covariates. All paths for the full process model, as well as unstandardized regression coefficients, are illustrated in Figure 2. FC was significantly associated with mothers' QoL ($b = 8.76, p < .001$), explaining 27% of its variance. For children/adolescents' internalizing symptoms the non-significant variable FC ($b = 0.01, p = .982$) and the significant variable of mothers' QoL ($b = -0.04, p = .020$) explained 2.47% of its variance. The binary criterion children/adolescents' weight has an explained variance of between .15 (Cox & Snell's R^2) and .20 (Nagelkerke's R^2). Mothers' QoL ($b = -0.03, \text{Wald} = 6.34, p = .012, \text{OR} = 0.97$) and FC ($b = -0.62, \text{Wald} = 8.80, p = .003, \text{OR} = 0.54$) have a significant effect on this criterion. Children/adolescents' internalizing symptoms ($b = 0.05, \text{Wald} = 1.68, p = .195, \text{OR} = 1.06$) did not have a significant effect on weight condition.

The model suggests that an increase in FC and mothers' QoL will result in a decreased likelihood of the child/adolescent reporting overweight/obesity. When using internalizing symptoms instead of externalizing symptoms, only one significant indirect effect was found, which was the mediating effect of mothers' QoL in the relation between FC and weight status with an estimate value of -0.26, (95% BCaCIs = -.50/-.07).

Discussion

The current study provides innovative data regarding parental and child/adolescent adaptation in pediatric obesity. Mothers of children/adolescents with overweight/obesity reported lower levels of FC and QoL than mothers of children/adolescents with healthy-weight. Children/adolescents with overweight/obesity reported higher levels of externalizing and internalizing symptoms than children/adolescents with a healthy-weight. One of the main findings was that mothers' QoL and children/adolescents' externalizing symptoms sequentially mediated the relationship between FC and weight status. Internalizing symptoms were not a mediator of the relationship between FC and weight status.

Consistent with previous literature, mothers of children/adolescents with overweight/obesity reported lower levels of FC (Mendelson et al., 1995; Zeller et al., 2007) compared with mothers of children/adolescents with healthy-weight. This is particularly important given that familial variables and FC are known to impact healthful eating habits of children/adolescents (Franko et al., 2008; Welsh, French, & Wall, 2011) which, consequently, could impact weight status. Cohesive families may spend more time together sharing mealtimes (Franko et al., 2008) which has been related to healthier eating (Neumark-Sztainer, Hannan, Story, Croll, & Perry, 2003; White, Haycraft, & Meyer, 2014).

Mothers of children/adolescents with overweight/obesity reported lower levels of QoL than mothers of children/adolescents with healthy-weight, which is consistently found in the literature (e.g., Guilfoyle, Zeller, & Modi, 2010; Modi et al., 2009). These lower levels of QoL in mothers of children/adolescents with overweight/obesity could be at least partly related to caring for a child/adolescent with overweight/obesity which typically involves a complete change to family lifestyles. Those lifestyle changes may be related with new eating and activity habits which may have an impact in the family routines and schedules which, in turn, may be related with mother's perception of QoL. Moreover, it could be related to family environment, specifically, lower levels of FC, which would be reflected in a lower QoL of its members. In this study mothers of children/adolescents with overweight/obesity reported higher BMI than mothers of children/adolescents with healthy-weight, which is typically found in literature (e.g., Zeller & Daniels, 2004). The presence of overweight/obesity in those mothers and the physical and psychological consequences of this health condition (e.g., lower self-esteem; stigmatization; dissatisfaction with body image) could contribute to explaining the presence of lower levels of QoL in those mothers. The impact of healthy diets on QoL has been emphasized by recent literature (e.g., Godinho & Marques, 2016). Some research with adults with obesity reports that losing weight may enhance the levels of QoL because losing weight improves overall physical functioning as well as mental health, self-esteem and thus, general satisfaction with life (Fontaine & Barofsky, 2001). Accordingly, sticking to healthy diets may help to raise the levels of QoL (Godinho & Marques, 2016) and, as suggested by the results of mediation in this study, mothers' higher levels of QoL may be important in the weight status of their children/adolescents.

Group differences were found in children/adolescents with overweight/obesity reporting significantly higher levels of externalizing and marginally higher levels of internalizing symptoms than children/adolescents with a healthy-weight, a finding consistent with previous literature (Braet et al., 1997; Britz et al., 2000; Pine et al., 2001). These results may be a consequence of the social stigma, weight-related teasing and victimization that sometimes children/adolescents with overweight/obesity may face, or even a lower satisfaction with their body image (Jelalian & Hart, 2009).

A novel finding was that mothers' QoL and children/adolescents' externalizing symptoms sequentially mediated the relationship between FC and children/adolescents' weight status whereas internalizing symptoms did not. Both the mediators and independent variable are each showing incremental prediction. The mediators carried a substantial (statistically significant) portion of the

variance in the partial mediation (Weems & Stickle, 2012). As previously discussed, some authors suggest that the link between FC and healthy eating and activity behaviors could be direct (Franko et al., 2008) or mediated by the psychological health of the child (Lucia & Breslau, 2006), but to the best of our knowledge this is the first study to examine sequentially maternal QoL and children's/adolescents' outcomes as mediators in the relationship between FC and weight status. Since the family is a bigger system, it might affect the individual adaptation of its members (e.g., maternal adaptation) and, consequently, the adaptation of the child. In fact, the interrelationship between parents' and children's outcomes has been acknowledged in past research (Kazak, Rourke, & Navsaria, 2009). A more cohesive family may positively interact with healthy eating (Franko et al., 2008), because it may provide sharing moments between their members (e.g., family meals). Those sharing moments may be associated with the mothers' adaptation. Mothers who perceive a lower QoL may be less prone to share meals, time and healthy activities with their child which could be related to the symptoms in their youths. Members of a more cohesive family may be encouraged to openly express feelings (Overstreet et al., 1995), worries and emotions, as well as offer support to one another, which may contribute to a better maternal perceived QoL and also be link to fewer externalizing symptoms in the family members. Mothers with less cohesive families may lack the support, help and commitment from other members of the family (Moos & Moos, 1986) which can increase parental maladjustment, especially since FC appears to be a protective factor for parental adaptation (Field & Duchoslav, 2009). Receiving more support may help mothers feel better adjusted which impact on the way mothers and children could positively interact. This is highlighted also from the negative correlation we found between mothers' QoL and externalizing symptoms.

Regarding the mediating role of externalizing symptoms, the results are in line with previous studies on other CHCs that suggest that a cohesive family can protect children against poor outcomes (e.g., Soliday, Kool, & Lande, 2001). This result was particularly interesting given that existing literature suggests that externalizing symptoms can be related to external eating (that is, eating in the absence of hunger cues); a behavior which has been related to higher energy intake and weight in children/adolescents (Braet & Strien, 1997; Webber, Hill, Saxton, Jaarsveld, & Wardle, 2009). Braet and Strien (1997) found a positive association between externalizing behaviors and external eating in children with obesity, which could contribute to explaining the mediational role that externalizing symptoms play in the relationship between FC and weight status. Some authors suggest that externally regulated eating behavior is a personality disposition (Schachter & Rodin, 1974) and so it is possible that externalizing

symptoms are more common in children/adolescents with more externalizing traits, which could be related to weight status via more external eating. This could also be due to a possible increased reward sensitivity or the dysfunctional capacity of self-regulation usually present in children/adolescents with externalizing symptoms such as hyperactivity (Puder & Munsch, 2010). Furthermore, children/adolescents with higher levels of externalizing symptoms may use food to regulate their emotions which may lead to increasing weight. In fact, research has shown that youths with higher externalizing symptoms may have difficulty decreasing negative emotions (Macklem, 2008). Therefore, they may use food in order to influence their emotions, or in order to help express them (Murphy, Bui, & Grier, 2013), which may impact their weight status.

While this study generates some novel findings, it also has some limitations. Because of the bidirectional association between the study variables and the cross-sectional design of the study, causal inferences are not possible. Although it is extremely important to better understand the processes and relationships between the variables on our data, even using cross-sectional research (Hayes, 2013), longitudinal research are valuable when addressing studies with mediational model analyses. Future studies should focus on longitudinal research, specifically when using advanced methods such as mediational models, when searching for theoretically intermediary processes (Weems & Stickle, 2012). A convenience sample was enrolled, and participants were only recruited in the central region of Portugal. The clinical sample comprised children/adolescents already attending nutrition appointments, limiting the generalizability of our results. Due to the lower number of children/adolescents with overweight/obesity in schools, it was not possible to create a group of children/adolescents with overweight/obesity not seeking treatment to compare on the analyses. Finally, two different data collection procedures were used regarding height and weight of children/adolescents. In children/adolescents with overweight/obesity they were measured by the nutritionist whereas for children/adolescents with healthy-weight these data were self-reported. This could prevent accurate answers regarding these measures in the healthy-weight group, specifically taking into account that research has found that mothers can be unreliable at reporting their child's weight (Aparício et al., 2013; Silva, Junior, Nascimento, Bertoli, & Gallo, Leone, 2016).

Strengths of this study include: a good sample size; the recruitment of a clinical sample of children/adolescents seeking weight loss treatment and a control group; the use of self-reported measures to assess more personal outcomes (e.g., QoL, internalizing and externalizing symptoms) instead of relying on proxy reports, which gives the possibility to access to the subjective and personal point of view of the

child/adolescent about their own problems and life; the assessment of children's and parents' adaptation; and, a focus on developmental differences (by considering children and adolescents separately). We also brought together various important parent and child variables in a sequential mediation model in order to better understand the relations between the variables, therefore contributing to the study of pathways which is likely to be important for intervention programs targeting young children and their parents.

Conclusions

These results have theoretical and practical relevance. They provide a better understanding of the psychosocial outcomes related to pediatric obesity, and suggest that it may not be enough to work only with a child to promote weight reduction. Rather than including just the child/adolescent in interventions, and instead of focusing only on youth's adjustment, interventions should take into consideration family environment and maternal adjustment as well. The results may help clinicians to identify vulnerable groups of children/adolescents and mothers that might benefit from greater attention (e.g., families with lower FC; mothers with low QoL; children with more externalizing symptoms). By being aware of some of these factors, clinicians can refer children/adolescents and/or their mothers to other health professionals, or work together with them towards a greater weight loss. This is particularly important considering that a mother's adjustment has important implications not only for her child's weight but also for her child's adjustment (Drotar, 1997). Thus, health professionals should assess maternal QoL and intervene whenever possible. Addressing mothers' QoL in family-centered interventions may be important to promote better psychological adjustment in children/adolescents with overweight/obesity with possible repercussions on their weight. Moreover, mothers are usually primarily responsible for their children's health concerns, and those results emphasize the importance of having a family-oriented approach to pediatric care (Schor & American Academy of Pediatrics, 2003). Furthermore, understanding the role of FC and the way it impacts children's/adolescents' weight status is extremely important for the development of preventing programs (Franko et al., 2008). Family-centered interventions (promoting, for example, positive communication patterns and support between family members) may help mothers to cope with the demands of their children/adolescents' CHC, and consequently promote their QoL. Raising the levels of FC may be particularly useful for reducing their externalizing symptoms and, consequently, their youth's weight. In fact, this study also highlights the importance of youth's externalizing symptoms and maternal adaptation for children's weight status. Thus, parenting approaches and strategies should also be addressed when working with children/adolescents

with overweight/obesity to optimally support positive changes. Interventions towards pediatric obesity should focus not only on weight reduction through alteration of diet patterns, but also through the formation of positive and cohesive relationships between family members.

Compliance with Ethical Standards:

Funding: This study was funded by the Portuguese Foundation for Science and Technology (grant number SFRH/BD/86063/2012 and number SFRH/BPD/70063/2010).

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Integrity of the data and accuracy of the data analysis: This study includes original data. All authors had access to the data. The authors take responsibility for the integrity of the data and the accuracy of the data analysis.

We declare no conflict of interest.

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Table 1.

Demographic Characteristics of Children/Adolescents and Their Mothers

	Healthy-Weight	Overweight/Obesity	<i>F/p</i>
	<i>N</i> = 134	<i>N</i> = 163	
	Mean (<i>SD</i>); observed range	Mean (<i>SD</i>); observed range	
Child/Adolescent age (years)	12.13 (3.19); 8-18	12.90 (2.60); 8-18	5.31/.022
Maternal Age (years)	41.69 (5.54); 29-56	41.35 (4.76); 30-59	0.33/.564
z_BMI (children/adolescents)	-0.11 (0.81); -3.84-1	1.86 (0.43); 0.62-2.73	723.05/<.001
Mothers' BMI	24.13 (2.99); 17.58-35.03	28.60 (5.63); 17.53-48.07	65.72/<.001
	<i>n</i> (%)	<i>n</i> (%)	χ^2/p
Child/Adolescent age category			
8-12 years	71 (53)	72 (44.2)	2.29/.130
13-18 years	63 (47)	91 (55.8)	
Child/Adolescent gender			
Male	51 (38.1)	76 (46.6)	2.21/.138
Female	83 (61.9)	87 (53.4)	
Mothers' marital status			
Not living with a partner	18 (13.4)	30 (18.5)	1.40/.237
Living with a partner	116 (86.6)	132 (81.5)	
Mothers' Education Level			
≤ High school	98 (73.1)	142 (87.1)	9.27/.002
≥ College or graduate degree	36 (26.9)	21 (12.9)	

Table 2.

Means, Standard Deviations, and Comparisons Between Children/Adolescents with Healthy-Weight and Children/Adolescents with Overweight/Obesity and Their Mothers

Variables	Healthy-Weight			Overweight/Obesity			Group Effect		Age Effect		Interaction Effect		Correlations			
	N = 134			N = 163			F	η^2_p	F	η^2_p	F	η^2_p	1	2	3	4
	8-12 years n = 71 M (SD)	13-18 years n = 63 M (SD)	Total n = 134 M (SD)	8-12 years n = 72 M (SD)	13-18 years n = 91 M (SD)	Total n = 163 M (SD)										
1. Family Cohesion	5.18 (0.76)	5.11 (0.65)	5.15 (0.71)	4.75 (0.83)	4.60 (0.73)	4.67 (0.77)	26.09***	.082	1.24	.004	0.27	.001	-			
2. Quality of Life	70.69 (12.88)	69.00 (13.06)	69.89 (12.94)	63.59 (12.86)	60.58 (11.68)	61.91 (12.27)	24.48***	.077	2.05	.007	0.28	.001	.520**	-		
3. Externalizing symptoms	4.73 (2.79)	4.76 (2.82)	4.75 (2.79)	6.31 (3.63)	6.46 (3.19)	6.39 (3.38)	16.84***	.055	0.01	.000	0.07	.000	-.193**	-.185**	-	
4. Internalizing symptoms	5.44 (3.07)	4.67 (2.97)	5.08 (3.04)	6.03 (3.18)	5.58 (3.08)	5.78 (3.12)	3.59~	.012	3.16	.011	0.25	.001	-.081	-.157**	.296**	-

Note. * $p < .05$; ** $p < .01$; *** $p < .001$; ~ $p = .059$.

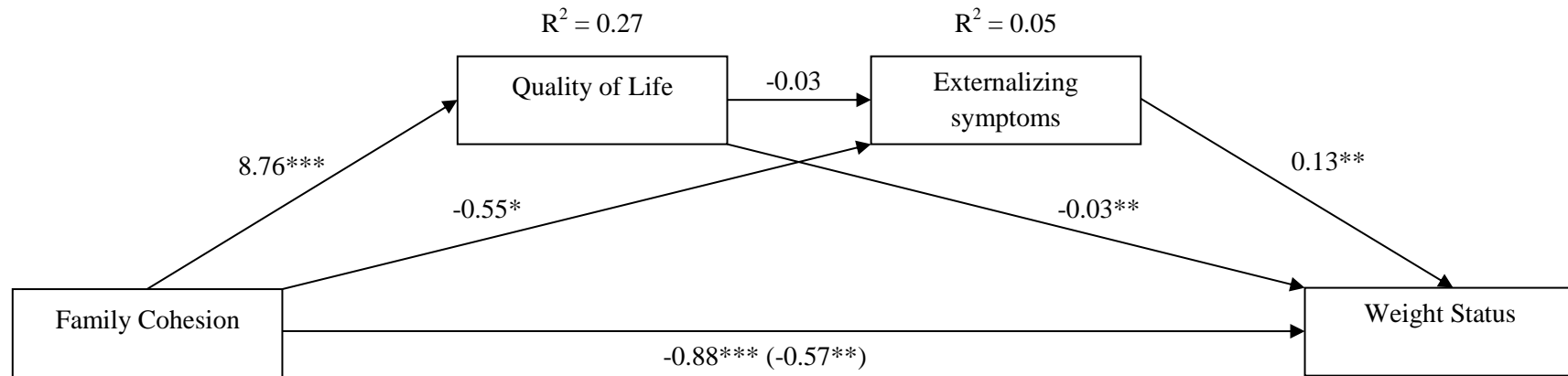


Figure 1. Statistical diagram of the serial mediation model for the presumed influence of maternal QoL and children's/adolescents externalizing symptoms on the association between family cohesion and weight (controlling for child/adolescent age and maternal education).

Note. Path values represent unstandardized regression coefficients. In the arrow linking family cohesion and weight, the value without parentheses represents the total effect of family cohesion on weight before the inclusion of the mediators. The value in parentheses represents the direct effect, from the bootstrapping analysis, of family cohesion on weight after the inclusion of the mediators.

* $p < .05$; ** $p < .01$; *** $p < .001$.

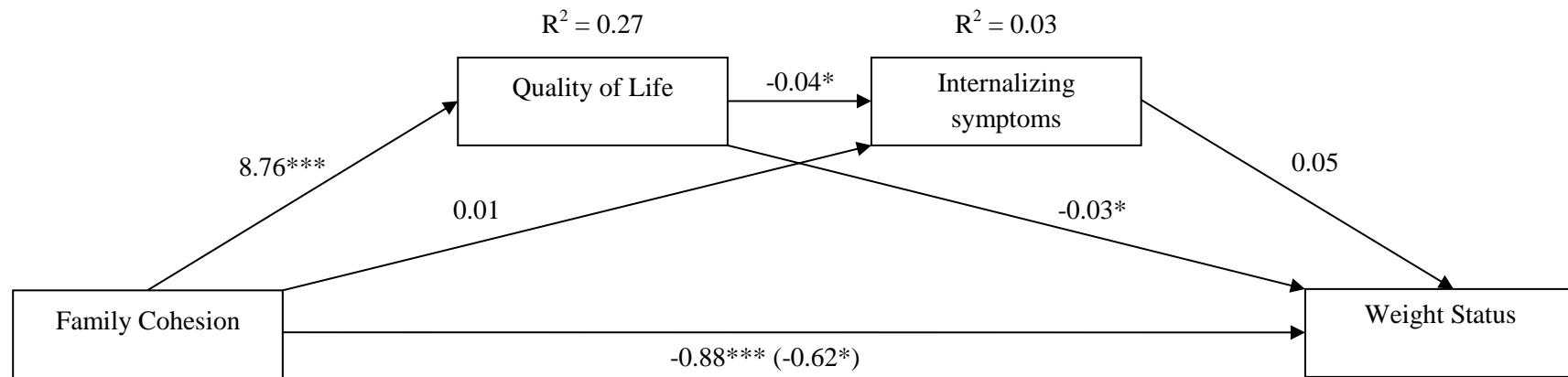


Figure 2. Statistical diagram of the serial mediation model for the presumed influence of maternal QoL and children's/adolescents internalizing symptoms on the association between family cohesion and weight (controlling for child/adolescent age and maternal education).

Note. Path values represent unstandardized regression coefficients. In the arrow linking family cohesion and weight, the value without parentheses represents the total effect of family cohesion on weight before the inclusion of the mediators. The value in parentheses represents the direct effect, from the bootstrapping analysis, of family cohesion on weight after the inclusion of the mediators.

* $p < .05$; ** $p < .01$; *** $p < .001$