Maternal emotional states in relation to their offspring weight status and health-related quality of life: Tehran Lipid and Glucose Study

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Abstract

Background: Maternal characteristics have been known to be associated with parenting practices that could eventually influence their child's weight and health-related quality of life (HRQoL). This study aimed to assess the direct and indirect associations of maternal emotional states (depression, anxiety and stress) with body mass index (BMI) and HRQoL in their children.

Methods: This study was conducted within the framework of Tehran Lipid and Glucose Study (TLGS). Participants were children (n=231) who participated in the TLGS during 2014-2016 with complete data on maternal emotional states. Body weight and height of children were measured using standard protocol and BMI-Z scores were determined using Anthroplus. HRQoL in children and emotional states in mothers were assessed using the Iranian version of the pediatric quality of life inventory (PedsQL TM 4.0) and the depression, anxiety and stress scales (DASS-21) respectively. Structural equations modeling (SEM) was used to assess the direct and indirect relations of maternal emotional states with children's BMI Z score and HRQoL.

Results: Mean age, BMI Z-score and HRQoL total score in children were 13.8±3.1 years, 0.74±1.5 and 84.7±11.3 respectively. In mothers, median scores (Interquartile ranges) of DASS-21 in three scales including depression, anxiety and stress were 4(0-10), 6(2-12) and 14(8-20) respectively. Maternal level of education was significantly associated with DASS-21 scores (β=-0.23, 95% CI: -0.37,-0.07). Maternal DASS-21 scores were significantly associated with BMI Z scores only in girls (β=0.25, 95% CI: 0.06, 0.53). Significant determinants of HRQoL in boys were child's age (β=-0.21, 95% CI: -0.40, -0.01), maternal education (β=-0.24, 95%CI: -0.44, -0.02) and emotional state (β=-0.24, 95% CI: -0.44, -0.03). Child's age (β=-0.33, 95%-CI: -0.53, -0.10) and maternal emotional state (β=-0.31, 95% CI: -0.54, -0.08) were significantly associated with HRQoL in girls.

Conclusion: Our results indicate maternal emotional states to be the important determinants of HRQoL in children, regardless of their weight status. Further research is recommended to examine the current hypothesized model in rural and sub-urban populations taking ino consideration more influential factors.

Introduction

Obesity is defined as accumulation of excess body fat that affects individuals' health and wellbeing [1]. According to the World Health Organization (WHO), over than 10% of the world's population is obese, with the sharp rising trend of overweight in children and adolescents indicating childhood obesity to be a global problem [2]. Based on a recent systematic review and meta-analysis conducted on 93 qualified studies, the prevalence of overweight and obesity in Iranian children and adolescents has been estimated at12% and 7% respectively with an incidence rate of 9%, according to WHO criteria [3]. Obesity is accepted as a chronic condition which may lead to several health issues including cardiovascular diseases, type 2 diabetes, stroke, asthma and may eventually end up having certain effects on both psychological and behavioral functions [4, 5]. According to previous findings, children suffering from obesity may have

behavioral problems, low self-esteem and depression which could adversely affect their future academic performance and health-related quality of life (HRQoL) [6, 7].

Health-related quality of life is defined as a comprehensive and multidimensional concept for assessment of the patient's point of view about the impact of health or disease on his/her physical, mental and social well-being and it is now considered to be an important health outcome [8]. The association between children weight status and HRQoL is controversial. While some studies emphasize the negative impact of childhood obesity on HRQoL [9, 10], others have not shown a significant relationship between them [11, 12]. Similar studies from Iran indicate lower HRQol scores in obese children, compared to their over- or normal-weight counterparts [13, 14] which can be observed in a gender-specific pattern [15]. On the other hand results of a longitudinal study conducted on European children revealed bidirectional associations between childhood overweight and psychosocial well-being [16]; findings consistent with previous data indicate that mental health problems and poor psychosocial well-being during childhood increased the risk of future obesity [17-19]. Hence, investigating the association between weight status and HRQoL in children and adolescents, considering the main factors that can affect their weight and HRQoL simultaneously, would provide much needed data on this very important relationship.

Family environment and parental characteristics are well-known determinants of both obesity and HRQoL in the early years of life [20, 21]. Previous studies conducted in Iran have also reported the importance of various parental factors including parental age, educational level, employment, and weight status on overweight and obesity among children [22-25]. Our recent study on parental factors influencing children's weight status demonstrated the vital role of maternal socio-demographic and cardio-metabolic characteristics in distinguishing parental risk clusters as one of the main predictors of obesity in children [26]. The role of mothers in shaping children's behavioral patterns and HRQoL plays a crucial role, due to their deep emotional connections [27]. Significant contributions of maternal emotional distress in child obesity is well documented [28, 29]. Also, There is also more evidence indicating that children's whose mothers suffer from emotional distress are much more likely to report poor HRQoL [30, 31]. Considering the evidence documented on the association of maternal negative emotional states with obesity and poor HRQoL in their children, in addition to the adverse effects of childhood obesity on HRQoL, weight status in children and adolescents could be a probable mediating factor that exacerbates the effect of maternal psychological distress on children's HRQoL indirectly. Hence, using structural equation modeling approach, the current study for the first time aimed to investigate direct and indirect effects of maternal emotional states including depression, anxiety and stress simultaneously, on children weight status and HRQoL among a population of Tehranian families.

Methods

The participants of the current study were recruited from among participants of the Tehran Lipid and Glucose Study (TLGS), a prospective research conducted to determine and modify risk factors of non-communicable diseases. Measurements were documented at baseline (1999 - 2001) and were repeated

every three years. Further details regarding rationale and design of the TLGS have been reported elsewhere [32, 33].

Study participants

Data for all school-aged children (aged 8 to 18 years), who participated in the TLGS during 2014-2016 were considered for the current study (n=309). After excluding those with incomplete maternal information (n=78), 231 individuals (51% boys) were recruited for the final analysis.

Measurements

Data on age and anthropometric indices, including weight and height of children were collected by trained interviewers and staff. Participant weight was measured using a digital scale while wearing minimum clothing and no shoes. Participant height was measured in a standing position with shoulders in normal alignment, and without shoes. WHO AnthroPlus (version 3.2.2) and macros software were used to determine BMI-for-age (BMI Z-score).

Health-related quality of life (HRQoL) in children was measured using the Pediatric Quality of Life Inventory™ version 4.0 (PedsQL™ 4.0) Generic Core Scales which consists of 23 items and four subscales (Physical functioning, Emotional functioning, Social functioning and School functioning) [34]. For each item, children choose their answers from the five-point Likert scale ranging from 0-4 (0 = never a problem to 4 = almost always a problem). To score the scale each item is reversely scored and higher scores indicate better HRQoL. Previous studies have assessed and reported the reliability and validity of the Persian version of the PedsQL™ 4.0 in Iranian children (8-12 years) and adolescents (12-18 years) [35, 36].

In addition, in the current study maternal data including age, education, working status and emotional state were assessed. Maternal emotional state was assessed using the depression, anxiety and stress scale - 21 Items (DASS-21), which is applied for measurement of three related states of depression, anxiety and stress [37]. Each scale of DASS-21 contains seven items and each item is scored on a four point Likert scale from 0 to 3 (0=did not apply to me at all and 3= applied to me very much, or most of the time). Scores for each scale are calculated by summing the scores of relevant items and a higher score in each scale of depression, anxiety and stress indicates a more severe condition on the related scale. In the current study, the Persian version of DASS-21 was used, the validity and reliability of which have been confirmed and reported previously [38].

Statistical analysis

Data were represented as mean ± SD for normal distributed variables and median (quartile 1, quartile 3) for variables with non-normal distribution. Normality assumption was examined by Shapiro-Wilk test. Chi-square test was conducted to compare categorical variables between boys and girls. Independent samples T-test or its alternative non-parametric method, Mann-Whitney U test, was used for mean comparison at two groups. Structural equation modeling (SEM) was used for examining direct and indirect associations among measured variables. The Hypothesized conceptual model has been

proposed to examine interrelationship among variables is illustrated in figure 1. Maternal education, age and employment status which describe the maternal socio-demographic status were exogenous independent variables. Maternal emotional state and children's BMI were entered in the model as mediators and children's HRQoL was considered as the final dependent variable. Maternal emotional state and children's BMI were considered as latent constructs and were measured by their special indicators. Multiple group SEM analysis was conducted for sex-specific evaluations. The Maximum likelihood method and Bayesian analysis were used for parameter estimation. Uniform distribution was set as a prior distribution of parameters and stability and admissibility criteria were examined on prior data: Mean (95% confidence interval) of a marginal posterior distribution are reported as parameter estimates [39]. Fit indices including Chi-Square value to DF (χ^2/df), Goodness of Fit (GFI), Normed Fit Index (NFI), Incremental Fit Index (IFI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) were calculated to measure model adequacy and appropriateness of SEM analysis. The acceptable thresholds of fit indices have been reported by Hooper. D et al. [40]. IBM SPSS statistics23 and AMOS23 have been utilized for data description and SEM analysis respectively.

Results

Mean age, BMI Z score, HRQoL total score of study participants were 13.8±3.1 years, 0.74±1.5 and 84.7±11.3 respectively. Further descriptive statistics of study participants by sex groups are presented in table 1. There were no significant differences between boys and girls in mean age, BMI Z score and HRQoL scores in social functioning and school functioning; however, HRQoL scores were significantly higher in boys, compared to girls in physical and emotional functioning. Mean age of mothers was 42.2±5.8 years, majority of whom were housewives (80.5%) and had secondary levels of education (57.1%). There were no significant differences between mothers of boys and girls in DASS-21 scores or distribution of maternal working status and education.

Based on multiple group analysis, the model in which the effects of maternal characteristics on maternal emotional state and measurement model of maternal emotional state have been considered the same in boys and girls were significantly better fitted on data ($\Delta\chi^2$=27.65, DF= 14, p=0.01), compared to the unconstrained model (in which all the parameters were considered different in boys and girls); therefore, a sex-specific analysis with some mentioned constraints was conducted.

Figure 2 displays the final structural models in boys and girls; the significant associations among variables have been drawn in figures and related standardized estimations are reported above each path;fit indices of SEM models which are reported below figure 2, indicate acceptable thresholds for both boys and girls.

Table 2, displays the examined structural model results in the sex-specific associations of maternal characteristics and children HRQoL. In the hypothesized SEM, maternal age, education and working status as well as children age were exogenous observed variables, the latent construct of maternal

emotional state and children BMI Z score were mediators and children's HRQoL was an endogenous latent construct. The negative effect of maternal education on maternal emotional state was significant for both boys and girls (β=-0.22, 95% CI: -0.37,-0.07). Among the effects of maternal variables, only the positive effect of maternal emotional state on child's BMI Z score was significant in girls (β= 0.25, 95% CI: 0.06 , 0.53). In terms of determinants of child's HRQoL, in boys, child's age (β=-0.21, 95% CI: -0.39,-0.02), maternal education (β=-0.23, 95% CI: -0.43,-0.01) and maternal emotional state (β=-0.24, 95% CI: -0.44,-0.03) and in girls, child's age (β=-0.33, 95% CI: -0.53,-0.11) and maternal emotional state (β=-0.31, 95% CI: -0.53,-0.07) had significant negative effects on the child's HRQoL. Regarding indirect effects, there were no significant effects of maternal variables on child BMI Z score and HRQoL (P> 0.05).

Discussion

The current study aimed at examining a conceptual model of direct and indirect relations of maternal emotional states with BMI and HRQoL in their children. Our results indicate that while maternal emotional states could directly affect HRQoL in both genders, they were associated with weight status only in girls. Interestingly in both genders, weight status was not associated with HRQoL, which is why its mediating role in the association between maternal emotional states and offspring HRQoL was not confirmed. In addition, among maternal characteristics which have been considered as influential factors in the initial hypothesized model, level of education directly affected mothers' emotional states in both genders and HRQoL only in boys.

The current findings regarding the negative relationship between maternal emotional states and HRQol in children are consistent with data reported by previous studies [31, 41, 42]. Maternal depression and stress are accompanied by inappropriate parenting practices and reduced warmth and sensitivity in interactions with children which lead to delays in achieving developmental milestones and poor self-regulation and executive performance in children, and as a result, problems in their overall functioning [42, 43]. In addition, anxious mothers via transference of negative emotional and thinking patterns to their children and lack of providing motivational environment in family, reduce their children's self-efficacy and success in future experiences [44].

Our results showed that maternal emotional states were associated with higher BMI levels in girls but not in boys. Several studies have reported the relationship between maternal emotional problems and child overweight [28, 30, 45]; however, only one study has explicitly investigated this relationship in a sex-specific pattern, focusing on maternal depression [46],and reported findings consistent with those of ours, which found a significant association between maternal depression and higher BMI only in girls; low levels of physical activity in girls mediated this relationship [46]. Existing literature shows that mothers with emotional problems are more likely to have unhealthy weight-related behaviors [29] and regarding same-gender role modeling, the impact of maternal lifestyle on daughters is greater than that on sons, resulting in higher levels of girl's BMI [47-49].

In the present study, neither in girls nor in boys, no relationship was observed between weight status and HRQoL, findings that contradict our initial assumption regarding the mediating role of BMI in the association between maternal emotional states and HRQoL in their children. Data available on the relationship between weight status and HRQoL in children is controversial. Several studies showed negative associations between children's weight status and HRQoL [9, 10], as demonstrated by the Tsiros et al. systematic review conducted on 22 studies, revealing an inverse linear relationship between children's BMI and HRQoL for both pediatric self-reports and parent proxy-reports [50]. Further evidence indicates Iranian children with higher BMI are more likely to report poorer HRQoL [13]. However, consistent with current results, two other studies from Kuwait and Fiji found no strong association between children weight and HRQoL [12, 51]; both reported that HRQoL scores in children with overweight/obesity did not differ significantly with corresponding values in their normal weight counterparts.

Our findings regarding the negative relationship between maternal education and HRQol in boys, but not in girls, are difficult to compare with those of other studies because there is no gender-specific study comparing this relationship; however, contrary to our results, several studies have documented the positive relationship between maternal education and children's HRQoL worldwide [52, 53] and in Iran [54]. It seems highly educated mothers who cannot work because of child care, have more parenting stress and experience less satisfaction with their mothering roles [55] which, considering the emerging sexuality in early adolescence and increasing complexity in opposite-sex relationships in the family, maternal stress has stronger effects on the son's functioning [56]. However, regarding the inconsistency of our findings with previous studies, more research is needed to clarify the relationship between the education of mothers and HRQoL in children. On the other hand, in our study, maternal education had a positive association with HRQoL in both genders through maternal emotional states, results consistent with those of previous studies [57-59]. Mothers with lower levels of education are more likely to suffer from depression, use negative and harsh parental practices which adversely affect children's mental wellbeing and their ability to learn [57, 59]. Also, given that education is one of the indicators of socioeconomic status, mothers who are less educated have limited access to social support and childcare services and experience excessive parenting stress, which can impede their ability to adequately meet the needs of children [60]. Also, in this study, the HRQoL declined with increasing age of children, results consistent with existing literature [61, 62]. As age increases, around puberty, physical and hormonal changes occur that reduce psychological balance [63]. Also, because of the formation of new values and norms in adolescence, teenagers seeking their new identity, encounter social insecurities, moral contradictions and ambiguity in the future which may ultimately impair their subjective well-being [62].

This study is one of the first efforts to explore the direct and indirect effects of maternal emotional states on children's weight status and HRQoL using a structural equation modeling approach. Its findings also add important information to the literature available regarding the gender differences in the mentioned associations. However, certain limitations also need to be considered. First, the cross-sectional nature of this study did not allow us to derive causal relationships between studied variables. This study was conducted on an urban population of Tehran, which may limit the generalizability of current findings to

rural and sub-urban populations. Finally, considering other influential factors including parents' relationship quality and children's coping strategies can provide a more accurate picture of the association between mothers' emotional states and their children's weight status and HRQoL.

In conclusion, our results highlight the impact of maternal emotional state on subjective health status of children in both genders irrespective of their BMI. Further research is definitely required to confirm our gender-specific findings.

Abbreviations

BMI: Body mass index, DASS-21: Depression, anxiety and stress scale-21 Items, HRQoL: Health-related quality of life, PedsQLTM4.0: Pediatric quality of life inventory, SEM: Structural Equation Modeling, TLGS: Tehran Lipid and Glucose Study, WHO: World Health Organization.

Declarations

Ethics approval and consent to participate

This study was approved by the research ethics committee of the Research Institute for Endocrine Sciences (RIES), Shahid Beheshti University of Medical Sciences. All participants of this study signed informed consent forms prior to data collection.

Availability of data and materials

Data would be available on the request of corresponding author based on the TLGS rules.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

PP, PA and SJF designed the study. PP, SJF and MME drafted the manuscript. MK carried out the statistical analysis and contributed to interpretation of data. FA revised the manuscript critically for important intellectual content. PA supervised and revised the manuscript. All authors read and approved the final manuscript.

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Tables

Table 1. Descriptive statistics of study participants

	Total (n=231)	Boys (n=118)	Girls (n=113)	P value
Children's characteristics				
Age (years)	13.8±3.1	13.9±3.0	13.8±3.2	0.85
BMI z score	0.74±1.5	0.63±1.5	0.86±1.4	0.23
HRQoL (PedsQoL)				
-Physical functioning	89.6±11.3	91.5±9.9	87.6±12.3	0.008
-Emotional functioning	73.5±18.7	77.1±15.7	69.7±20.8	0.003
-Social functioning	89.1±13.0	90.2±11.3	88.0±14.5	0.19
-School functioning	83.7±14.5	83.2±13.8	84.2±15.3	0.59
Total HRQoL	84.7±11.3	86.3±9.9	83.0±12.4	0.03
Maternal characteristics				
Maternal age (years)	42.2±5.8	42.4±6.2	41.9±5.3	0.54
Maternal level of education n (%)				
-Primary	36(15.6)	21(17.8)	15(13.3)	0.38
-Secondary	132(57.1)	69(58.5)	63(55.8)	
-Higher	63(27.3)	28(23.7)	35(31.0)	
Maternal job status n (%)				
-Housewife	186(80.5)	94(79.7)	92(81.4)	0.86
-Working/student	45(19.5)	24(20.3)	21(18.6)	
Maternal emotional state (DASS-21)				
-Depression	4(0-10)	4(0-10)	4(0-10)	0.89
-Anxiety	6(2-12)	6(2-14)	6(2-12)	0.97
-Stress	14(8-20)	16(8-20)	14(6-22)	0.38

Table 2. Sex-specific associations between maternal characteristics and child's HRQoL

Predictor	Response	Boys		Girls	
		Estimate*	**95% CI**	**Estimate***	**95% CI**
Maternal age (years)	**Maternal emotional state**	-0.12	(-0.26 , 0.02)	-0.12	(-0.26 , 0.02)
Maternal education		**-0.23**	**(-0.37, -0.07)**	**-0.23**	**(-0.37, -0.07)**
Maternal working status		0.01	(-0.14 , 0.15)	0.01	(-0.14 , 0.15)
Maternal age (years)	**Child's BMI Z score**	-0.10	(-0.31 , 0.13)	-0.06	(-0.33 , 0.22)
Maternal education		0.10	(-0.16 , 0.36)	0.11	(-0.17 , 0.39)
Maternal working status		-0.13	(-0.37 , 0.12)	-0.21	(-0.46 , 0.07)
Maternal emotional state		0.12	(-0.13 , 0.37)	**0.25**	**(0.06 , 0.53)**
Child age (years)	**Child's HRQoL**	**-0.21**	**(-0.40 , -0.01)**	**-0.33**	**(-0.53 , -0.10)**
Child BMI Z score		0.02	(-0.25 , 0.28)	0.21	(-0.10 , 0.51)
Maternal age (years)		-0.12	(-0.03 , 0.06)	0.19	(-0.05 , 0.41)
Maternal education		**-0.24**	**(-0.44 , -0.02)**	-0.14	(-0.35 , 0.08)
Maternal working status		0.05	(-0.15 , 0.24)	0.12	(-0.10 , 0.34)
Maternal emotional state		**-0.24**	**(-0.44 , -0.04)**	**-0.31**	**(-0.54 , -0.08)**

*Standardized path coefficients and their 95% confidence intervals (CI)

Figures

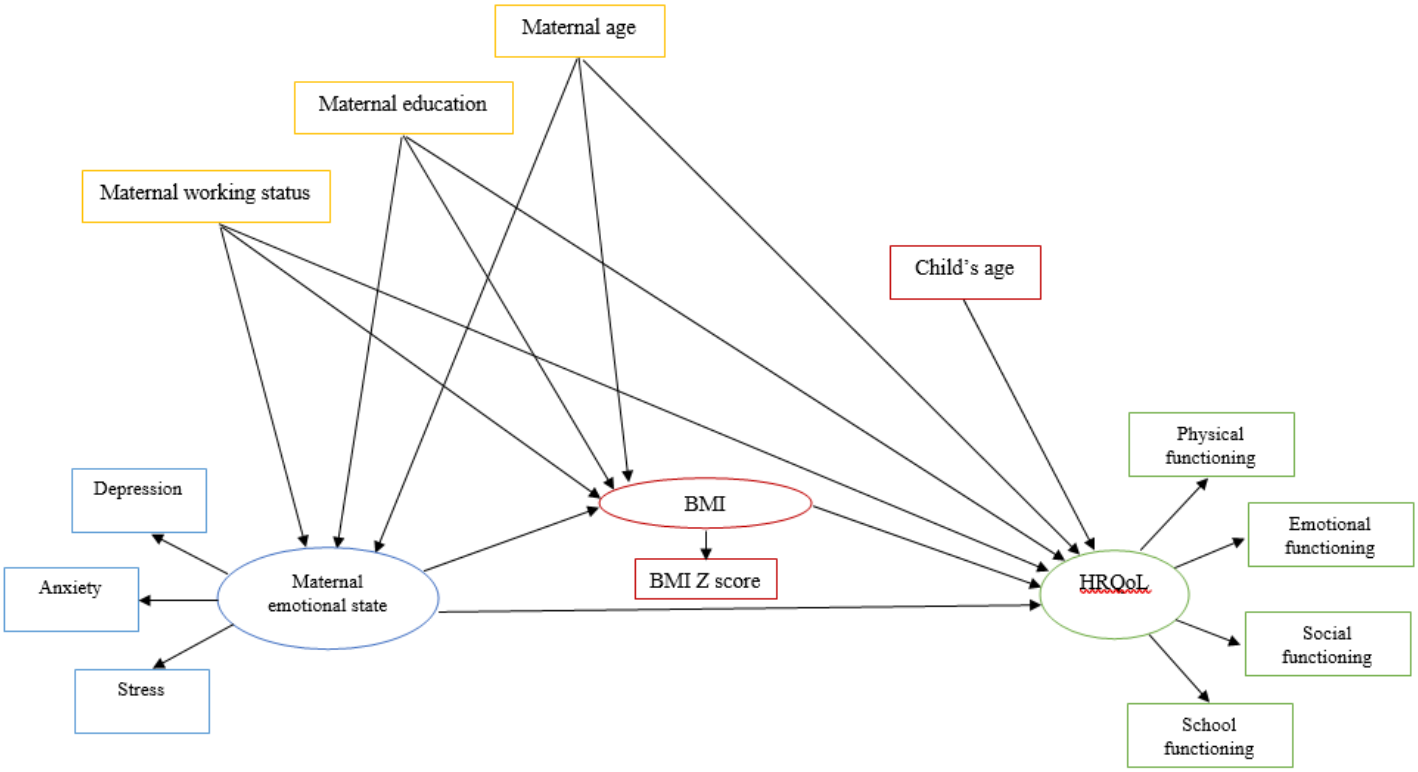

Figure 1

A conceptual model for the relation of maternal characteristics and emotional states with children's BMI Z- scores and health-related quality of life

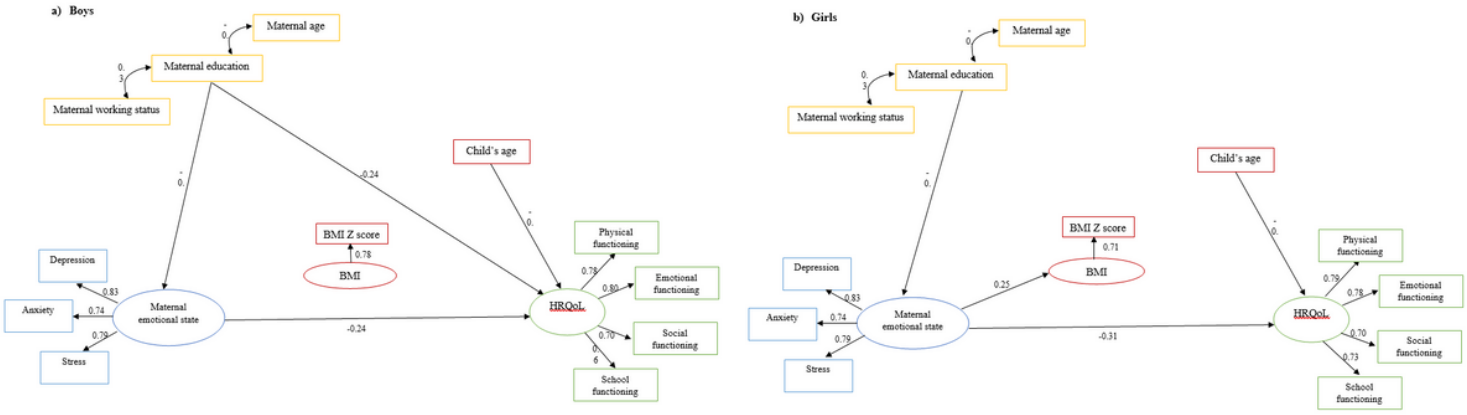

Figure 2

Final structural models after testing the relation of maternal characteristics and emotional states with children's BMI Z- scores and health-related quality of life (a- men and b- women). Fit indices were acceptable for both SEM models in boys ($\chi2$ = 69.8, DF = 42, $\chi2$/DF = 1.66, RMSEA = 0.75, GFI = 0.91, CFI = 0.93, IFI = 0.93, NFI = 0.90) and girls ($\chi2$ = 74.3, DF = 42, $\chi2$/DF = 1.77, RSMEA = 0.80, GFI = 0.90, CFI = 0.91, IFI = 0.92, NFI = 0.91)