Prediction of children’s obesity based on inhibition, anxiety and mother-child relationship

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Abstract

Obesity means increase of excess body fat and increase of children’s weight is the result of interaction between genetic and environmental factors. Activation of behavioral and inhibitory system that occupies an important role in the emergence of negative emotional and affective experience is deficient in individuals with different disorders. Child’s anxiety is caused as the result of the threat that is addressed to the child or lack of individuals or things that provide the child with feelings peace and security. On the other hand, some scientists define attachment to mother as the controlling and organizing system of behavior. As we know, overweight children are considered as lovable and cute particularly in Iranian culture, but obesity in children is known as one of the world’s hygienic problems. Therefore, the present research aims to predict children’s obesity based on inhibition, anxiety and mother-child relationship. The sample of the research comprises 124 students (female=92, male=32) who were selected based on Morgan sampling table and through multi-stratified sampling. Stroop test, Goodenough test, recording the observations and mother-child relationship questionnaires were carried out to gather the data. Findings indicated that, linear relationship between the components of Stroop test (behavioral inhibition) and children’s obesity is significant. Moreover, anxiety is a positive predictor of obesity in children and the relationship between the scores of anxiety and the scores of body mass index (BMI) is bilateral. Furthermore, mother-child relationship exerts significant effect on children’s obesity and with the increase of scores in the subscale of negligence, obesity increases. There’s also significant relationship between behavioral inhibition and anxiety in children, mother-child relationship and anxiety in children. Overall, children’s obesity can be prevented through generalizing the sample to other areas, attracting maternal confidence in more effective methods, carrying out similar studies on the mother-child relationship, investigating the factors that trigger the anxiety in children and recognition of effective factors such as inhibition in children’s obesity.

Keywords: obesity, behavioral inhibition, anxiety, parent-child relationship.

Introduction

Identifying obesity as a chronic and multidimensional disease requires devoting attention to this fact and more efforts are needed for its prevention and comprehensive intervention during childhood. Statistics show that, since 1986 up to now, the number of obese children has doubled. The reason of considerable increase in children’s obesity is not only overeating but psychological factors that lead to overeating. During childhood, not only these factors but also parents’ psychological factors
exert significant effect on obesity. Research indicates that, the rate of consumed energy has not changed in comparison to the last 20 years and different factors contribute to children’s obesity. The main reason of children’s obesity is their limited amount of exercise. Parents are also influential factors of children’s obesity. Parent’s obesity paves the way for children’s obesity and they should regard this point that, environmental factors are more effective. Genes are passed on from parents to children. Sometimes some mutations, such as mutations in leptin or insulin hormone can bring about obesity. But the thing that turns the genotype into phenotype and gene expression from a genetic state to external demonstrations is environmental interaction with genetic factors, including the type, quality and the quantity of food of the individual that can activate the fattening genes. Environmental factors that should be moderated or removed include the food habits, life style and lack of mobility that have an important role in the genesis of obesity.

Parents exert effect in the prevention of obesity during childhood by affecting the surrounding environment and determining children’s hygienic behaviors and habits. Children’s world is replete with vitality and exuberance; however, the anxiety provoking environment that some mothers provide for their children causes them to be anxious and worried and this worry affects children’s performance and creativity. Inappropriate habits in preparing and consuming foods that have high level of energy and low level of nutrition, different kinds of sweets, crisps and chocolate, creamy ice cream and fast food, the tendency for excessive consumption of sweets and fatty foods that is transmitted from parents to children, consumption of high-fat and high-calorie meals, replacing physical activity with entertainments without activity, sitting too long in front of the TV and being given stodgy snacks while watching TV or playing computer games increase the likelihood of children’s weight. Children who spend more than three hours playing video or computer games are three times more likely to suffer from obesity. Parent’s psychological condition has also significant effect on the child. Parents who do not pay enough attention to their children compensate for this negligence by preparing unhealthy food. On the other hand, they exacerbate the situation by such unhealthy food and consider unhealthy foods as reward and reinforcement and punish the child by omitting her/his favorite food. This method is one of the triggering factors in children’s obesity. Parents who insist on the consumption of plenty of food prevent the satiety threshold of the child and turn the intrinsic hunger into intense craving. Consequently, obesity is followed and the parents’ expression of love and kindness gets related to child’s eating. The more food the child eats, the more love s/he receives and with this serious mistake, the child starts to overeat not to satisfy hunger but to receive approval.

Children who suffer from depression, insecurity, restlessness and unhappiness have more food; therefore, the reasons of overeating should be sought and treated and stress and anxiety should be removed. Results indicate that, some areas of the brain that control the emotions and stress reactions along with the desire and energy can affect the obesity. Moreover, behavioral inhibition of children is regarded as implicit but basic deficiency that exerts significant effect on children. Kamei (2012) concluded in a study that, children who live with divorced mothers or without one of the parents for two years have higher levels of body max index in comparison with children who live in harmonious and cemented marriages. Adriyan, Kameron et al (2011) concluded that, combined models of obesity are related to the existence of some behaviors in children and their mothers. The results of this research indicated that, behavioral model of immobility in children and establishing a specific environment by parents can affect children’s behaviors. Dena et al (2011) concluded in their recent research that, increase of weight is related to the anxiety and depression in childhood that can be indicated by the increase in the value of BMI. Body max index is determined by the ratio of height and weight and is adjusted based on sex and age. Tamara (2013) carried out a study in Germany on a sample of 498 children in the age range of 6 to 7, out of which 49.8% were male. Results indicated that, obese children have less significant inhibition control as compared to children without excess weight.

As observed, experts and professional have carried out considerable studies on children such as the study by Rabiee (2010) and Mashhadi (2011) who worked on behavioral inhibition; the research by Jabejayi (2010), Kourosh Niya (2007), Naeeni Niya (2009), Zolfaghari Motlagh (2007) and Soltani

Method and materials

The research population included all the students studying in the pre-elementary and elementary schools located in Tehran in the school year of 2012-2013, out of which a sample of 124 students (female=92, male=32) was selected based on Morgan sampling table and through multi-stratified sampling (5 boroughs). The height and weight of the subjects were measured and body max index was determined. Stroop test, Goodenough test, recording the observations and mother-child relationship questionnaires were carried out to gather the data. The height was measured based on centimeter using a portable and sturdy tape that was attached to the wall. The students were asked to stand without shoes with the back of head, buttocks and soles of the feet tangent with the wall. The height was determined after the tangential of oblique with the scalp of the head.

Weight was measured by kilograms using a digital scale with a precision of lightweight clothing without shoes. The reliability of the scale was set to zero each time before the measurement. In this study, the percentile curve of BMI for age and sex which belonged to World Health Organization was used and children with BMI above the 95th percentile were considered as obese children. Tool used for the Stroop test is computer software. In this test, 48 matching color word which has 3-color word with the same meaning (red, yellow, green and blue) and 48 incongruent color word with 3 color word that doesn’t have the same meaning (for example the word of blue is shown with the color red) are presented with an interval of 800 ms stimulus presentation and stimulus presentation time of 2000 ms. The subject’s task is to choose the correct color.

The reliability of this test has been reported to be in the range of 80% to 91% (Baron, 2004; Macleod, 1991; Macleod and Gorfien, 2007; lezak,heussen, loring, hanay 2004). For Goodenough drawing painting, the subject should sit freely provided with a sheet of white paper, colored pencils and an eraser and is asked to draw a picture of a person. (Groth - Marnat, 2000). McCarty has estimated the reliability coefficient of the test to be .68 (third grade of school) and .99 (fourth grade of school). Harris has estimated its reliability using re-test to be .68 and .91 in a time interval of one week to 3 months. Tashakkori et al have estimated the reliability using bisection to be .80. Moreover, he estimated the re-test coefficient to be .75 in a time interval of 12 weeks. Mother-child relationship questionnaire is a 48-item questionnaire that is scored on 5-point Likert scale. The reliability of the questionnaire has been evaluated using Cronbach alpha on a sample of 30 individuals. The validity of the questionnaire has been confirmed by experienced professors.

Results and findings

First, the statistical indices including descriptive indices related to mother-child relationship questionnaire, anxiety and Stroop test in children have been presented in the section of data description. The research hypotheses have been analyzed using appropriate statistical tests and statistical evaluations have been carried out using SPSS software.

1- What’s the contribution of behavioral inhibition in the prediction of children’s obesity?

The correlation coefficient between the scores of behavioral inhibition (obtained scores of interventions in Stroop test) and the scores of BMI which is indicative of children’s obesity have been calculated and the results are presented in table 1.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number</th>
<th>Correlation Coefficient</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI -Behavioral inhibition</td>
<td>124</td>
<td>.218*</td>
<td>.015</td>
</tr>
</tbody>
</table>
As observed in table 1, there exists significant and positive correlation between the scores of behavioral inhibition (obtained scores of the intervention in Stroop test) and BMI scores (r=.218, P<.05) at significance level of .05. Therefore, it can be concluded that, with the increase in the scores of behavioral inhibition, the scores of BMI (obesity) increases in children. It’s worth mentioning that, the relationship is not indicative of causality; therefore, the relationship between behavioral inhibition and the scores of BMI (obesity) in children is a bilateral relationship.

2- What’s the contribution of anxiety in the prediction of children’s obesity?

The correlation coefficient between the scores of anxiety and the scores of BMI which is indicative of children’s obesity has been presented in table 2.

Table 2- Results of correlation coefficient for the relationship between anxiety and the scores of BMI (obesity)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number</th>
<th>Correlation Coefficient</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI -anxiety</td>
<td>124</td>
<td>.281**</td>
<td>.002</td>
</tr>
</tbody>
</table>

**P<.01 *P<.05

As observed in table 2, there exists significant and positive correlation between the scores of anxiety and BMI scores (r=.281, P<.01) at significance level of .01. Therefore, it can be concluded that, with the increase in the scores of anxiety, the scores of BMI (obesity) increases in children. It’s worth mentioning that, the relationship is not indicative of causality; therefore, the relationship between anxiety and the scores of BMI (obesity) in children is a bilateral relationship.

3- What’s the contribution of mother-child relationship in the prediction of children’s obesity?

The correlation coefficient between the scores of mother-child relationship and the scores of BMI which is indicative of children’s obesity has been presented in table 3.

Table 3- Results of correlation coefficient for the relationship between mother-child relationship and the scores of BMI (obesity)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number</th>
<th>Correlation Coefficient</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI -Acceptance</td>
<td>124</td>
<td>.028</td>
<td>.756</td>
</tr>
<tr>
<td>BMI -Over-Support</td>
<td>124</td>
<td>.055</td>
<td>.544</td>
</tr>
<tr>
<td>BMI -Negligence</td>
<td>124</td>
<td>.183*</td>
<td>.042</td>
</tr>
<tr>
<td>BMI -Rejection</td>
<td>124</td>
<td>.072</td>
<td>.429</td>
</tr>
</tbody>
</table>

**P<.01 *P<.05

As observed in table 3, there exists significant and positive correlation between the scores of mother-child relationship and BMI scores (r=.281, P<.01) at significance level of .01. Therefore, it can be concluded that, with the increase in the scores of mother-child relationship, the scores of BMI (obesity) increases in children. It’s worth mentioning that, the relationship is not indicative of causality; therefore, the relationship between mother-child relationship and the scores of BMI (obesity) in children is a bilateral relationship.

4- What’s the contribution of the subscales of mother-child relationship, anxiety and behavioral inhibition in the prediction of obesity?

Multivariate regression analysis was used to investigate the prediction of children’s obesity based on the subscales of mother-child relationship, anxiety and behavioral inhibition. Multivariate regression analysis was done with regard to the confirmation of linearity assumptions, normality, constant variance, outliers and linear multiple regression analysis. The results of simultaneous multivariate regression analysis have been presented in table 4.
Table 4- Results of significance for the regression model

<table>
<thead>
<tr>
<th>Source of change</th>
<th>SS</th>
<th>df</th>
<th>R</th>
<th>R^2</th>
<th>F</th>
<th>Level of sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>389.287</td>
<td>6</td>
<td>.394</td>
<td>.155</td>
<td>3.59</td>
<td>.003</td>
</tr>
<tr>
<td>Remainder</td>
<td>2114.375</td>
<td>117</td>
<td>.205</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2503.662</td>
<td>123</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R^2 indicates the common variance percent of the subscales of mother-child relationship, anxiety and behavioral inhibition in the prediction of children's obesity. The results of table 5 indicate that, these variables predict 15.5 percent of the total variance of children's obesity. Regarding that estimated F is significant at the level of .01, the linear regression model is also significant and therefore, the subscales of the mother-child relationship, anxiety and behavioral inhibition have significant linear relationship with obesity. The regression coefficient and level of significance have been presented in table 5.

Table 5- Regression coefficients and testing their significance

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>Standard error</th>
<th>Beta</th>
<th>t</th>
<th>Level of sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed</td>
<td>9.928</td>
<td>6.444</td>
<td>.101</td>
<td>1.002</td>
<td>.318</td>
</tr>
<tr>
<td>Children’s Acceptance</td>
<td>.091</td>
<td>.091</td>
<td>.101</td>
<td>1.002</td>
<td>.318</td>
</tr>
<tr>
<td>Over-Support</td>
<td>-.016</td>
<td>.086</td>
<td>-.020</td>
<td>-.186</td>
<td>.853</td>
</tr>
<tr>
<td>Negligence</td>
<td>.193</td>
<td>.086</td>
<td>.226</td>
<td>2.239</td>
<td>.027</td>
</tr>
<tr>
<td>Rejection</td>
<td>-.053</td>
<td>.100</td>
<td>-.059</td>
<td>-.527</td>
<td>.599</td>
</tr>
<tr>
<td>Behavioral Inhibition</td>
<td>.002</td>
<td>.001</td>
<td>.205</td>
<td>2.358</td>
<td>.020</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.392</td>
<td>.132</td>
<td>.262</td>
<td>2.978</td>
<td>.004</td>
</tr>
</tbody>
</table>

The results of table 5 indicate that, the subscales of negligence, behavioral inhibition and anxiety can predict the obesity in children and t-test is significant for the significance of regression coefficients of the subscales of negligence, behavioral inhibition and anxiety.

(B) is the non-standard coefficient of regression and the comparison of standard coefficients (Beta) which is not affected by the scores’ distribution is more useful. Comparison of standard regression coefficients indicate that, the contribution of anxiety (Beta=.262) is more than the contribution of the subscale of mother’s negligence (Beta=.226) and behavioral inhibition (Beta=.205). The positivity of these coefficients indicates the positive relationship between the subscales of anxiety, negligence, behavioral inhibition and children’s obesity. Regression equation for the prediction of children’s obesity based on the predictor variables and standard scores of Beta is equal to:

Z (behavioral inhibition) Z+.205 (mother’s negligence) Z+.226 (anxiety) .262= children’s obesity

Hypothesis: there will be significant relationship between behavioral inhibition and anxiety in children.

The correlation coefficient between the scores of anxiety and behavioral inhibition (obtained scores of intervention in Stroop test) has been estimated in children and the results have been presented in table 6.
As observed in table 6, there exists significant and positive correlation between the scores of behavioral inhibition and anxiety (r=.213, P<.05) at significance level of .05. Therefore, it can be concluded that, with the increase in the scores of behavioral inhibition, the scores of anxiety increases in children. It’s worth mentioning that, the relationship is not indicative of causality; therefore, the relationship between anxiety and behavioral inhibition in children is a bilateral relationship.

Hypothesis: there will be significant relationship between mother-child relationship and anxiety in children.

The correlation coefficient between the scores of mother-child relationship and anxiety has been estimated in children and the results have been presented in table 7.

As observed in table 7, there exists significant and positive correlation between the scores of rejection and anxiety (r=.204, P<.05) at significance level of .05. Therefore, it can be concluded that, with the increase in the scores of rejection, the scores of anxiety increases in children. It’s worth mentioning that, the relationship is not indicative of causality; therefore, the relationship between the scores of rejection and anxiety in children is a bilateral relationship.

What’s the contribution of the subscales of mother-child relationship and behavioral inhibition in the prediction of children’s anxiety?

Multivariate regression analysis was used to investigate the prediction of children’s obesity based on the subscales of mother-child relationship and behavioral inhibition. Multivariate regression analysis was done with regard to the confirmation of linearity assumptions, normality, constant variance, outliers and linear multiple regression analysis. The results of simultaneous multivariate regression analysis have been presented in table 8.

R² indicates the common variance percent of rejection as the subscale of mother-child relationship can predict children’s anxiety. The results of table 5 indicate that, this variable predicts 4.2 percent of the total variance of children’s anxiety. Regarding that estimated F is significant at the level of .05, the linear regression model is also significant and therefore, rejection as the subscales of the
mother-child relationship and anxiety have significant linear relationship with obesity. The regression coefficient and level of significance have been presented in table 9.

Table 9- Regression coefficients and testing their significance

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable</th>
<th>B</th>
<th>SD</th>
<th>Beta</th>
<th>t</th>
<th>Level of sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>First step</td>
<td>Fixed</td>
<td>-.973</td>
<td>1.924</td>
<td>-.506</td>
<td>.614</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rejection</td>
<td>.123</td>
<td>.053</td>
<td>.204</td>
<td>2.303</td>
<td>.023</td>
</tr>
</tbody>
</table>

The results of table 9 indicate that, t-test for the significance of regression coefficient of the subscales of rejection and inhibition is significant at significance level of .05. Comparison of standard regression coefficients indicate that, the contribution of the subscales of rejection is equal to (Beta=.204). The positivity of this coefficient indicates the positive relationship between the subscales of rejection and children's anxiety.

The equation for the prediction of children’s anxiety based on the predictor variables and standard scores of Beta is:

Children’s anxiety=.204 (mother’s rejection) Z

Is behavioral inhibition different in children with different age range?

Descriptive indices related to the scores of behavioral scores in children were estimated based on the classification of three different age groups and the results are presented in table 10. As observed, the mean of behavioral inhibition increases with the increase of age.

Table 10- Descriptive indices of the scores of behavioral inhibition of children in three age groups

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 years and below</td>
<td>34</td>
<td>116.94</td>
<td>484.17</td>
<td>-0.0185</td>
<td>0.0185</td>
</tr>
<tr>
<td>8 to 10 years old</td>
<td>67</td>
<td>123.34</td>
<td>341.75</td>
<td>-0.582</td>
<td>0.1685</td>
</tr>
<tr>
<td>11 to 13 years old</td>
<td>23</td>
<td>250.73</td>
<td>481.02</td>
<td>-0.5</td>
<td>0.1520</td>
</tr>
</tbody>
</table>

One-way ANOVA was used in order to investigate the difference between the mean of behavioral inhibition means in three age groups of children. Results are presented in table 11.

Table 11- Results of variance analysis for behavioral inhibition in children’s three age groups

<table>
<thead>
<tr>
<th>Source of change</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Level of sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-group factor</td>
<td>315343.69</td>
<td>2</td>
<td>157671.85</td>
<td>.929</td>
<td>.398</td>
</tr>
<tr>
<td>Between-group factor</td>
<td>20535037.42</td>
<td>121</td>
<td>169711.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>20850381.12</td>
<td>123</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Results of table 11 indicate that, the estimated F (F=.929, P>.05) is not significant in the three age groups. Therefore, there is no significant difference between the means of behavioral inhibition scores in these age groups.

Discussion and conclusion

Investigating prediction of children’s obesity with behavioral inhibition in relation to the research’s first question indicated that, with regard to the results of the test, the relationship between the linear combination of the components in Stroop test or in fact the behavioral inhibition and obesity is significant.

The results of this research that showed significant relationship between the obesity and behavioral inhibition are in line with the results of the research by Tamara writ and colleagues (2014)
in Germany which showed that, children with excess weight have less inhibition control. The obtained result was in harmony with the research finding by Rabeei (2010) in terms of the difference in the scale of reaction time and not in line in the error of false committing which is the indicator of inhibition. Moreover, Mashhadi (2011) in a study concluded that, there existed significant difference in the number of true and false items in congruent and incongruent stimulus and the intervention was not significant in the component of reaction time and this finding was not in line with the results of the research.

As we all know, this is also related to the research methodology and the rate of the relationship is not also clear and we can witness significant changes with the development of educational and recreational utilities for students and using the computer and internet which are the influencing factors of behavioral inhibition over time. What's the contribution of the anxiety in the prediction of children’s obesity? It can be stated that, there is significant relationship between the children’s obesity and anxiety. This finding is in line with the results of the research by Jabejayi (2010), Kourosh Niya (2007), Naeeni Niya (2009), Zolfaghari Motlagh (2007) Soltani Far (2009), and cameroon (2011). Moreover, Dena et al (2011) indicated that, increase of weight is strongly correlated with the symptoms of anxiety. Investigating the relationship between mother-child and children’s obesity in relation with the third question of the research indicated that, the relationship between mother and child has significant effect on children’s obesity.

This finding is in line with the results of the research by Kammi (2012) and Seyyed Amini (2007). In the research by Noghayi (2008) significant relationship was observed between the child’s obesity and parents’ educational level. The results of the research by Karbandi (2010) showed no significant relationship between parent’s child rearing style and children’s obesity. Moreover, Nabavi (2010) indicated no significant relationship between the parents’ educational level and children’s obesity.

The research had some limitations including the statistical population which was limited to Tehran City, mothers’ resistance in revealing the information about themselves and their children. This means that, the questionnaires were answered cautiously in case of being given to the school principals. Moreover, different people have different perceptions of a single incidence, a piece of news, a sentence or a word in the questionnaires. Implementing the Goodenough and Stroop test triggered feelings of fatigue in each of the subjects which decreased their validity. In order to decrease the effects of fatigue, the tests were held in different time intervals. However, this does not guarantee the lack of negative effects of fatigue.

Large numbers of the questions in mother-child questionnaire resulted in subjects’ inaccuracy and difficulty in understanding some of the items. On the other hand, children’s obesity is regarded as a crucially important subject. Therefore, the results of such studies should be compared with the results of the research carried out in other countries with regard to the effect of the factors of culture and thought. It’s proposed that, the same studies should be carried out on larger population to be able to generalize the findings. Mother’s trust can also be derived with effective methods to carry out the research to determine the relationship between the mother and the child.

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