

# Comparison of Body Mass Index on Children with Functional Constipation and Healthy Controls

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## ABSTRACT

**Background:** Constipation is one of the most common pediatric disorders, especially in developed population, which categorized to organic or functional (non-organic) constipation. Furthermore, obesity is a growing chronic pediatric problem that could cause any compromise in weight and height. The aim of this study is the evaluation of probable relation between obesity and pediatric functional constipation. **Methods:** This study was conducted as a case-control investigation on 2-14-years-old children those referred to Baqiyatallah University clinic during 2009-2011. The constipated children with organic causes were excluded. The control group of children was those who had not any disorders affecting on height and weight. Quantitative variables were expressed by mean and standard deviation and the correlation was tested with chi2 through SPSS version 17. **Results:** A total of 259 children (male 51.7%) consisting 124 cases and 135 controls were enrolled. The mean age in constipated and normal children was  $69.47 \pm 35.03$  and  $74.15 \pm 39.68$ , respectively. BMI over 95% in the control group was 11.9% and in the constipated group was 17.7% that the difference was not statistically significant either ( $P = 0.188$ ). The only significant association was found between obesity and the duration of constipation and also age ( $P = 0.008, 0.042$ , respectively). **Conclusion:** Although we found a significant relationship between duration of constipation and obesity, there was not a clear association between obesity and presence of constipation. Furthermore, we suggest extended cohort or clinical trial study regarding to the regional nutritional and growth patterns to confirm weight decrease or increase the effect on defecation.

**Keywords:** Body mass index, children, non-organic constipation, obesity

## Introduction

A normal bowel habit is a sign of good health in children. Constipation is defined as a condition in which the bowel movements (BM) are infrequent or hard to pass and in children it usually occurs due to bowel malfunction.<sup>[1]</sup> Constipation is so common that accounts for 3% of all visits to pediatric out-patient clinics and as many as 25% of all visits to pediatric gastroenterologists. About 90% of the cases are idiopathic or functional constipation.<sup>[2]</sup> A prevalence rate of 34% in all children has been reported for constipation while 5% of children aging 4-11 years old in Britain are chronically constipated (lasting more than 6 months). The North American Society of gastroenterology defines constipation as “a delay, disorder or any sort of difficulty in defecation, present for 2 weeks or more and sufficient to cause

significant distress to the patient.” At the age of four, as for adults, the BM frequency rates of 3 times/day to 3 times/week are accepted as normal.<sup>[3,4]</sup> In general, the cause of constipation can be divided into two categories: Functional and organic; the latter only accounts for 5% of the cases.<sup>[5]</sup> Organic causes include congenital malformations such as anal tightness, pelvic masses, neural and muscular disorders like hirschsprung disease and metabolic causes such as hypothyroidism, hypocalcaemia, systematic diseases, etc.<sup>[6,7]</sup>

Obesity, as one of the increasingly common problems in children, is being extensively discussed world-wide. Obesity prevalence in children is rapidly growing all over the world. The children with body mass index (BMI) above 95 percentile (taking into account age and gender) are considered “obese” and those with BMI in the range 85-95 percentile are presumed “overweight.”<sup>[4,8,9]</sup> Obesity in children is accompanied with numerous problems including hyperlipidemia, diabetes, hypertension, fatty liver and

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skeletal disorders.<sup>[10,11]</sup> In the former studies, obesity percentage in adults was estimated to be 16% in people aging 6-18 years. Childhood obesity before 6 years continues up to adult ages and over 69% of 10-year old obese children remain in the same physical condition when grown up.<sup>[12,13]</sup>

The studies conducted in the developing countries as well as in the middle-east including Iran imply an increase and ascending trend for obesity percentage in childhood. The exact reason of this increase in overweight and obesity prevalence is not clearly known yet and the following causes might be involved: Intake of extra calorie, reduced physical activities, rapid changes in life-style resulting from urbanization and improvement of families' economic status, exceeded duration of TV-watching per day, feeding the infants with formula and mother's smoking during pregnancy.<sup>[14]</sup> In general, few studies are available concerning digestive disorders associated with obesity, but some chronic symptoms and their linkage with overweight are reported in adults.<sup>[10]</sup> There are also evidences suggesting the impact of weight loss on stoppage of intestine biological cycles that intensify constipation.<sup>[15]</sup> As mentioned earlier, different complications are reported for obesity among children, but scarce research works have been carried out to demonstrate the relationship between obesity level and BMI and functional constipation in children. These little findings forced the authors of the present paper to design a study for analyzing the relationship between weights in terms of children's BMI admitted in pediatric digestion clinic due to non-organic chronic constipation. The results are then compared with the healthy constipation-free children admitted in the pediatric clinics.

## Methods

The current research was conducted as a case study on 2-14-year-old children admitted in Baqiyatallah University of medical sciences clinic during 2009-2011. The target group consisted of admitted children with constipation complaint for whom organic dysfunction was rejected through complimentary examinations. And, constipation-free children with another disease having no effect on their weight and height in the same age group were incorporated as the control group.

After receiving informed consent forms of their parents, a questionnaire containing demographic specifications and indices of functional constipation were filled for patients based on Rome 2 questionnaire.<sup>[3]</sup> Patients' details were input as codes into the questionnaires and their names were not mentioned. Following calculation of BMI for all patients, these values were compared with children's growth percentiles and their BMI percentiles were evaluated one by one.

The data were introduced to SPSS software, version 17. Continuous variables were reported in mean  $\pm$  standard deviation. First, univariate analyses were performed and then the related tables and diagrams were extracted and descriptive statistics for qualitative variables were expressed in percents (%)

while mean and standard deviation were used for quantitative variables. The correlations between variables were verified by means of Chi-square, *t*-test, and regression logistic.  $P < 0.05$  was considered as the significance level.

## Results

The 259 children participated in the research. Among them, 135 children were in the control group (52.1%) and the rest 124 persons were those suffering from functional constipation. Average age of all children was  $71.96 \pm 37.53$  months and the maximal and minimal ages were 165 and 24 months, respectively.

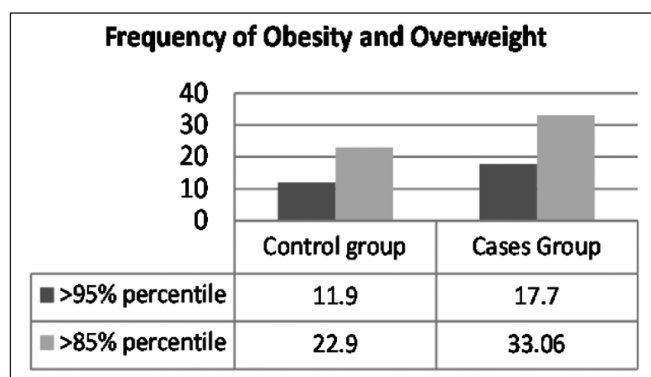
Average age was evaluated equal to  $69.47 \pm 35.03$  months in the constipated children's group (124 persons) while this figure was  $74.15 \pm 39.68$  months for the normal children's group. 135 children (51.7%) were male and the rest 125 persons (48.3%) were female. No significant differences were observed in terms of gender and age between two groups ( $P = 0.969$  for gender, and  $P = 0.317$  for age).

Gender distribution in the constipated group was as follows: 51.9% (64 children) were male and the rest 48.1% (60 children) were female. In the same group, 93 children (75%) did not show encopresis signs and 31 patients (25%) had this problem. Furthermore, among the male patients of this group, 47 children (73.4%) showed no symptoms of encopresis and 17 children (26.6%) had this disorder. Similarly in the female patients of this group, 46 children (76.7%) exhibited no symptom of encopresis and 14 children (23.3%) had this disorder. The difference was not significant between the two groups ( $P = 0.670$ ).

As seen in Table 1, the difference was not significant in terms of percentile distribution between two groups ( $P = 0.188$ ). None of differences in the aforementioned values were significant ( $P = 0.060$ ) [Figure 1]. Average BMI for all children was equal to  $16.62 \text{ kg/m}^2$  where maximal and minimal values were  $25.77$  and  $12.41 \text{ kg/m}^2$ , respectively. BMI value was  $16.47 \pm 2.36 \text{ kg/m}^2$  in the control group (the largest and smallest values were reported as  $24.74$  and  $12.41 \text{ kg/m}^2$ , respectively). This value equaled  $16.77 \pm 2.92 \text{ kg/m}^2$  (the maximal and minimal values were  $25.77$  and  $12.58 \text{ kg/m}^2$ , respectively) indicating no significant difference between two groups ( $P = 0.470$ ). Nearly 50% of children in

**Table 1: Percentiles of patients and controls**

Group	Gender	Percentile			Total (%)
		<5 (%)	5-90 (%)	>95 (%)	
Controls	Male	4 (3)	54 (40)	12 (8.9)	70 (51.9)
	Female	8 (5.9)	53 (39.3)	4 (3)	65 (48.1)
	Total	12 (8.9)	107 (79.3)	16 (11.9)	135 (100)
Cases	Male	9 (7.3)	42 (33.9)	13 (10.5)	64 (51.6)
	Female	7 (5.6)	44 (35.5)	9 (7.3)	60 (48.4)
	Total	16 (12.9)	86 (69.4)	22 (17.7)	124 (100)



**Figure 1:** Overweight and obese cases and controls

the percentiles below 5% suffered from constipation and the other half were not constipated; the respective values for the percentiles larger than 85 were 56.9% and 43.1. No significant relationship was observed between the presence or absence of constipation and overweight ( $P = 0.157$ ). Among male children in the percentile below 5, 50% suffered from constipation while 42.2% of male children between 5 and 85 percentiles were constipated and the rest 57.8% were not. In the percentiles over 85, 54.5% suffered from constipation and 45.5% were healthy. No significant correlation was found between gender and obesity (in percentiles over 85) ( $P = 0.098$ ) [Table 1].

In the constipated group, constipation duration was  $27.35 \pm 17.99$  months in the percentiles below 5,  $23.90 \pm 11.26$  months in the weight growth percentiles over 85, and  $43.59 \pm 23.83$  months in the percentiles over 95. A significant difference was observed between obese and normal groups in terms of constipation duration (1413.85 days in the obese group vs. 391.11 days in the normal group ( $P = 0.008$ )). Moreover, the children in the percentiles over 95% (overweight compared with other groups having constipation) suffered from the disease for a longer period of time ( $P = 0.017$ ), whereas no significant difference was observed between other groups. No significant correlation was reported between children's rank (in terms of age) in family and their obesity or overweight ( $P = 0.017$ ). In logistic regression test, having omitted other disrupting factors, age of children was the only factor affecting presence or absence of constipation ( $P = 0.042$  and exponential EXP B: 0.987).

## Discussion

Obesity, whose direct and indirect complications cause many diseases, has remarkably spread during the recent years, in particular among children and adolescents.<sup>[16,17]</sup> Exceeding prevalence of obesity among children and adolescents has compelled the researchers to conduct numerous research works on the factors associated with this disorder in children and adolescents. Findings of these researches suggest determining role of fetal period and also initial years of life in occurrence of obesity among children and adolescents. Fetal age, birth season, birth weight along with other factors such as duration of feeding with mother's milk and start age of eating supplementary foods

are among the factors pertinent to obesity of children and adolescents in a large number of studies. However, many other studies discovered no relationship between these factors.<sup>[17]</sup>

Obesity in children and adolescents is largely dependent upon changes in life-style. In Iran, there are not adequate information concerning obesity and the factors affecting this disease in children. Through a nationwide research in 23 province centers during 2003-2004, overweight and constipation prevalence was respectively reported 4.4% and 8.9%.<sup>[18]</sup> In addition, non-organic constipation (constipation without organic cause) assumes a clearly defined relationship with type and mechanism of nutrition. Hence, there might be a correlation between constipation and obesity.<sup>[3-5]</sup> The study by Inan *et al.* in Turkey demonstrated that birth weight over 2500 grams is associated with more frequent constipation in children; the percentage was not in the significant range. In this study which was conducted on 1900 children, the patients' weights and body mass indices have not been examined during the disease. Yet, factors such as unsuitable training and nutrition diet, record of physical and mental traumas, family constipation record, etc., have been mentioned as major causes of constipation occurrence among children. On the contrary to their study, the current research takes into account constipation duration as well as BMI in both groups. The aforementioned study was a descriptive sectional research dealing with factors affecting constipation in school-age students. Among the 1900 examined children, 73% were reported as constipated and birth weight was analyzed as the only agent involved in growth, which did not exhibit any significant relationship with constipation.<sup>[19]</sup>

It was shown through a study conducted by Fishman *et al.* in US that constipation and encopresis is evidently more prevalent in obese children than normal people.<sup>[20]</sup> In 80% of obese children, around 23% were constipated and 15% also suffered from encopresis. In the aforementioned study, which was carried out in sectional form on 80 children admitted in obesity clinics, it was shown that 30% of these children with average total age of 11 years and average total mass body index of  $33 \text{ kg/m}^2$  suffered from constipation and encopresis; this percentage was higher than the figures reported for non-obese normal population. A remarkable age difference was observed between those suffering from constipation and the normal patients ( $9.3 \pm 3.7$  years vs.  $12 \pm 3.6$  years with  $P = 0.006$ ). Furthermore, Tanner stage growth differed in two groups (1.6 vs. 7 with  $P = 0.016$ ). The abovementioned items were not studied in the current research. Besides, no distinctive age difference was observed between two groups and within the constipated group as well.

Another study completely analogous to the present research was conducted in USA by Pashankar and Loening-Baucke on two groups of children admitted in IOWA's academic hospitals. The study encompassed 719 children at the age of 4-18 years referring to pediatric gastroenterology clinic and 930 children of the control group having no constipation who referred

to other medical centers. The results indicated that obesity percentage is significantly higher in children suffering from constipation; the prevalence is 22.4% compared with 17% in the control group.<sup>[10]</sup> This research was also a retrospective study in which obesity percentage for the male constipated children was higher than the female constipated group (25% vs. 19%). This finding is not in accordance with results of the current research in which no significant difference was observed in terms of gender. In addition, there is a significant difference between ages of children with and without constipation and encopresis ( $8.5 \pm 3$  and  $9.1 \pm 4$ , respectively). In all three aforementioned studies, standard obesity percentage was proportional to increase in children's weight percentile above 95% weight percentile in terms of age.

In another study by Misra *et al.* in USA, prevalence of chronic functional constipation for obese 5-18-years-old children was reported significantly higher compared with the control group. Note that obesity level in this study was assumed equal to incremental BMI value from the 85% percentile. There is also a clear correlation between obesity and chronic functional constipation in the male participants. Their findings are therefore in disagreement with the current research results in which no clear relationship was found between these two variables in terms of both 85 and 95%. In the former research conducted as a retrospective study on two groups of 100 and 101-member groups of children, overweight was observed in 44% and 30% of the constipated and control groups, respectively suggesting a significant difference.

Furthermore, unlike the current research, no significant correlation was observed in Misra's study between overweight and constipation duration.<sup>[21]</sup> Ultimately, the study by Aydođdu *et al.* in Turkey demonstrated that percentage of chronic functional constipation for children in developing countries is barely related to obesity. Through this retrospective study conducted during 6 years on the medical files of 485 constipated children, it was revealed that 92.3% of these patients having an age average of 6.4 years suffer from functional constipation. The prevalence was slightly higher in males and their disease averagely lasted for 42 months. Only 5.1% of children suffering from functional constipation in the former study were obese; this value is by far lower than the figures in the other research works and those conducted in developed countries as well as the value in the current research (15.1%).<sup>[22]</sup> According to the above mentioned

studies, a crucial relationship holds between constipation and overweight. Further research works are required for consistency, determining the level of correlation and especially assessment of factors involved in this relationship like disease duration [Table 2]. Although absolutely clear results were not observed concerning negative effect of obesity or positive effect of weight loss on reduction of constipation prevalence in the current research unlike the former studies, but altogether, the individuals are logically recommended to remain in the normal weight range due to positive effects of weight loss and adverse impacts of obesity either in childhood or even in adult ages.

Furthermore, according to the research results that imply relation of constipation duration to exceeded obesity prevalence in constipated children, such patients are recommended to immediately refer to a pediatric specialist for further examinations. Constipation and obesity are two chronic processes, which could lead to different biological and psychological consequences<sup>[23]</sup> including lack of confidence as well as impaired life quality, particularly during childhood. On the other hand, both complications are closely linked to children's and families' nutritional styles. Needed instructions shall be provided to families in this regard. Since most of the former works have been sectional and/or retrospective studies and taking into account diverse growth and nutrition styles in different regions, more extensive researches (clinical trial or retrospective) are recommended to be carried out on effects of weight loss or weight gain and their correlations to the excretory system and vice-versa.

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## Implications for family medicine

Both constipation and obesity are very common among adults and children in developed and developing countries. The role of family in prevention and management of these diseases, especially with changing the life-style, is significant and both of them can be treated by changing in life-style and life habits. In this study, we investigated on a probable relationship between obesity and constipation in children.

**Table 2: Brief review on the similar studies**

Study	Year	Nationality	Number	Age (years)	Constipation frequency	Other
Fishman <i>et al.</i>	2004	U.S.	80	11	23% of obese cases	Tuner score in constipated cases was different
Pashankar and Baucke	2005	U.S.	1649	18-4	22.4% of obese versus 17% of normal	It was prominent in male gender
Misra <i>et al.</i>	2006	U.S.	201	5-18	44% in obese cases versus 30% in normal	It was prominent in male gender
Aydođdu <i>et al.</i>	2009	Turkey	485	6.4	5.1% in obese cases	It was prominent in male gender
Kavehmanesh <i>et al.</i>	2012	Iran	259	6	57.9% in obese cases versus 46.2% of controls	Age and the duration of disease can affect the results



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