Health-related quality of life in obese children and adolescents

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Original article

SUMMARY

Objective

To estimate health-related quality of life (HRQoL) in a group of obese children and adolescents from the city of Hermosillo, Mexico.

Methods

A cross-sectional study was performed using the PedsQL® questionnaire to compare the HRQoL of 200 children and adolescents with obesity and their parents, with two control groups: one from the community (n=400) and another group of service users (n=200) at the Hospital Infantil del Estado de Sonora. The differences in HRQoL were assessed using a Kruskal-Wallis test and their relationship with socio-demographic variables and physical status was examined with logistic regression.

Results

HRQoL was lower in obese subjects. Social and emotional QoL were lower in obese subjects. Parents' perception of HRQoL was lower than that of their children. Some 37.5% of obese subjects perceived their HRQoL as "very bad", which was lower than control groups. The risk of poor HRQoL was 2.2 times higher in the obese group.

Conclusions

Obesity impairs HRQoL in children and adolescents. PedsQL® is a useful tool for the systematic assessment of HRQoL in children with obesity.

Key words: Quality of life related to health, obesity, children, adolescents.

RESUMEN

Objetivo

Estimar la calidad de vida relacionada con la salud (CVRS) en un grupo de niños y adolescentes con obesidad de la ciudad de Hermosillo, Sonora, México.

Métodos

Se realizó un estudio transversal utilizando el cuestionario PedsQL® para comparar la CVRS de 200 niños y adolescentes con obesidad al igual que a sus padres, con dos grupos de control, uno de la comunidad (n=400) y otro grupo de usuarios (n=200) del Hospital Infantil del Estado de Sonora. Las diferencias en la CVRS fueron evaluadas mediante una prueba de Kruskal-Wallis, y su relación con variables sociodemográficas y de estatus corporal se examinó con regresión logística.

Resultados

La CVRS fue menor en los sujetos obesos y las funciones más deterioradas fueron la emocional y la social; la percepción de los padres acerca de la CVRS fue inferior a la de sus hijos. El 37.5% de los sujetos obesos percibe su CVRS como "muy mala", una cifra inferior a los otros grupos. El riesgo de mala CVRS fue 2.2 veces mayor en el grupo de obesos.

Conclusiones

En nuestra población, la obesidad se asoció negativamente con la CVRS de niños y adolescentes. El PedsQL ® es un instrumento útil para la evaluación sistemática de la CVRS en niños con obesidad.

Palabras clave: Calidad de vida relacionada a la salud, obesidad, niños, adolescentes.

Translation of the original version published in spanish in: Salud Mental 2014, Vol. 37 Issue No. 2.

INTRODUCTION

Obesity is a global health problem. In children and adolescents it behaves epidemically; in 2010 more than 43 million children under five were overweight or obese, 35 million of whom lived in developing countries.[1] In adolescents the numbers are less clear, but in some developed countries, prevalence oscillates between 9% and 18%.[2] In Mexico in 2006, 9.4% of boys and 8.7% of girls between 5 and 11 years old were obese. Between 1999 and 2006, there was an alarming increase of 77% (5.3 to 9.4%) in males and 47% (5.9 to 8.7%) in females.[3]

Many factors have been linked to this behavior, for which the design of preventative and integrated solutions has been recommended.[4] Although a large part of the scientific interest in childhood obesity has been centered on its medical effects, an inverse association has been recognized with functional and psychosocial aspects in children and adolescents, which reduces their quality of life.[5,6]

The concept of Health-related Quality of Life (HRQoL) has been coined to examine this relationship. It refers to the way in which a person perceives their physical and mental health. HRQoL has been used to measure the effects of chronic illnesses and the way in which these interfere in the daily life of an individual.[7] Various investigations have documented the relationship between the HRQoL of children and adolescents with conditions such as obesity, cancer, asthma, diabetes, and cystic fibrosis.[7-10]

One of the most widely-used instruments to measure HRQoL in children and adolescents with different pathologies, both acute and chronic, is the Pediatric Quality of Life Inventory (PedsQL®).[11] The PedsQL 4.0® has various language adaptations, including one for Mexico. The questionnaire allows for a standardized score of the perception of HRQoL in various illnesses, which can provide information relevant to decision makers in clinics and public health.[11,12]

Although it is recognized that one of the early consequences of obesity in childhood is psychological and social alterations, this has been investigated little in Mexico. The objective of the present study was to document the relationship between obesity and HRQoL in a group of school-aged children in the city of Hermosillo, which may contribute to identifying early effects of obesity on HRQoL, and help in the design of preventative and care strategies for this problem.

METHODS

With the approval of the Secretary of Education and Culture of Sonora State and the Ethics Committee of the Hospital Infantil del Estado de Sonora (HIES), this study was carried out with a transversal design. A probabilistic sample of children and adolescents with obesity were compared with two population groups and their respective parents. The case group was made up of subjects between 8 and 15 years of age and their parents, who attended the HIES Obesity and Nutrition Clinic during 2008. This sample was compared with two other groups matched by age; the first made up of individuals randomly selected from public primary and secondary schools in the city, enrolled during 2008-2009, and the second including children and adolescents who attended HIES outpatients for pathology other than that of interest to this study. In both groups, the father or mother was included. Both the subjects selected and the family member responsible for them signed an informed consent form.

Patients with obesity secondary to another medical condition and those who had received treatment for obesity were excluded from the study. The 4% of patients with incomplete or inadequate information on the questionnaire, and/or those who declined somatometry were also excluded. Once chosen, information on age, sex, level of education, weight, height, marital status, and occupation of the family's primary earner was collected from each father/mother

- child/adolescent pairing. Anthropometry was carried out, consisting of taking the body weight and height of both the child/adolescent and their parent.

Type and size of sample

An estimated 16% of children and adolescents in Sonora are obese,[13] and considering that the HIES sees some 4,000 outpatients annually, a sample size of 200 subjects with obesity was defined with confidence of 95%. To select the school group, a multi-stage sample was used, using the sample framework of public primary and secondary schools in the area of the study. From these, ten primary and secondary schools were randomly selected, stratified by socioeconomic status. Within the schools, the school groups to participate were randomly selected. The final stage included the random selection of 400 participants from among the different groups. The hospital control group (n=200) was randomly chosen from patients who attended HIES outpatients for various reasons other than nutritional problems. In all three groups, the father, mother, or tutor of the selected subject was included.

Measuring instruments

The PedsQL 4.0 questionnaire was used to measure HRQoL in two formats: one for the child or adolescent's answers and one for their parent's, and the pairing's perception was obtained from this. The questions in both formats were the same but they differed in their grammatical construction and were validated for the ages being investigated.[11,12] The basic instruction is to respond to the question: "in the past one month, how much of a problem has this been?" The answer is scored on a scale of five points: 0=never, 1=almost never, 2=sometimes, 3=often, 4=almost always. The responses are inversely coded and transformed linearly on a scale of 0-100 (0=100, 1=75, 2=50, 3=25, 4=0), meaning that a higher score indicates a better HRQoL.[12,13] Five strata of HRQoL were created from the percentile distribution of the score: very poor (lower than the 20th percentile); poor (between the 20th and 40th); regular (between the 40th and 60th), good (between the 60th and 80th), and very good (above the 80th percentile). The questionnaire was applied independently, in a separate cubicle, to both the subject and their tutor. It was applied to the school groups in their classroom.

Somatometry

The participants were weighed on a Seca brand electronic weight scale, model 813. Height was measured using a Seca brand portable stadiometer, model 214. The measurements were taken at three nutrition appointments; the obese children and the outpatient control group were measured in the office, and the school group was weighed and measured in

school. The somatometry was conducted in the usual way, with everyday clothes and without shoes. The same instruments and procedures were used to measure the parent participants. Body Mass Index (BMI) was used to categorize the bodily status of the participants; obesity was classified as a BMI over 30 kg/m².[14] The BMI percentiles from the World Health Organization were used, also recommended by the Mexican Clinical Practice Guides,[15] to form the strata for obesity (over the 95th percentile), overweight (between the 85th and 95th percentile) and normal weight (between the 5th and 85th percentile).

Statistical analysis

The study subjects were characterized through descriptive statistics. The differences between the different strata of HRQoL were examined through the Kruskal-Wallis test and in order not to over-estimate the value of p due to multiple comparisons, adjustments were made with the Bonferroni method. The response variable (HRQoL) was dichotomized (Poor HRQoL ≤60; Good HRQoL ≥61) to examine its relationship to body weight (1=obese), sex (1=male), level of education (1=primary), and age (1=8 to 10 years), through bivariate logistic and multivariate analysis. The statistical package used was the Number Cruncher Statistical System (NCSS®) 2007, version 7.1.17.

RESULTS

In the population studied, males (n=418) were the greater proportion (52.0%), although there was no difference (p=0.127) in respect to the females. Children from 8 to 10 years made up the greater proportion (44.8%), differences being appreciable (p<0.01) when compared to the 11 to 13 (35%) and 14 to 15 (20%) groups. In terms of level of education, 534 (66.8%) subjects attended primary school and 266 (33.2%) attended secondary school (p<0.01).

The prevalence of obesity in the total of the groups was 40.8%, while that of overweight was 10.8%. Some 20 (2.5%) subjects had low BMI for their age and sex, while another 368 (46.0%) were of a normal height and weight.

Males generally had a greater prevalence of excess weight (33.2%) than females (18.4%) (p<0.001). The average weight of subjects in the group with obesity was 72.2 kg, while it was lower in the hospital control (43.5 kg) and school groups (47.9 kg) (p<0.01). Similarly, greater size and BMI was observed in the obese group (p<0.01). In terms of age, children between 8 and 10 years had a higher prevalence (22.0%) of overweight or obesity. Among the informer group, differences were not apparent in age (median=37.2 years), but BMI (median=32.3) and average weight (82.3 kg) were greater in the group of parents with obese children (p<0.0001) (table 1).

Mothers were the primary informer 83% of the time, while fathers were 7.5% of the time. Parents of the school group had a higher level of education than the other two groups (p=0.0097). In terms of occupation, the parents of the group with obesity worked primarily (40.5%) in skilled jobs, while in both the school and the hospital groups, the parents more frequently reported working in various trades (p<0.001).

In terms of HRQoL, we did not observe differences in accordance with the sex of the subjects (p=0.2579). Subjects with obesity reached a median score of 72.2 out of a maximum of 100, which was lower to that of other groups (p<0.001),

Table 1. Age distribution and somatometry of the study subjects and their parents. Hermosillo, Sonora, Mexico. 2010

Variable	Median (Standard deviation)			
	Obese children	School children	HIES [a]/	P[1]/
Children	(n= 200)	(n = 400)	(n=200)	
• Age in years	11.60 (2.30)	10.80 (2.20)	11.40 (2.30)	0.001
• Weight in kg.	72.20 (20.20)	43.50 (15.70)	47.90 (19.20)	<0.001
• Height in m.	1.52 (0.12)	1.46 (0.14)	1.50 (0.15)	<0.001
• Body mass index*	30.70 (5.20)	20.00 (4.60)	20.80 (5.80)	<0.001
Informers	(n= 200)	(n = 300)	(n=200)	
• Age in years	38.80 (7.00)	37.40 (7.90)	37.50 (8.50)	0.102
• Weight in kg.	82.30 (18.50)	73.70 (16.40)	74.90 (15.60)	0.001
• Height in m.	1.59 (0.07)	1.62 (0.08)	1.61 (0.07)	0.002
• Body mass index*	32.30 (6.30)	29.10 (5.50)	29.00 (5.90)	<0.001

[1]/ Based on an ANOVA test.
[a]/ Hospital Infantil del Estado of Sonora.
* Obesity: body mass index above 30 kg/m²

Table 2. Perception of the study subjects and their parents of Health-related Quality of Life. Hermosillo, Sonora, Mexico, 2010

Variable	Children and adolescents [Median, (Interquartile range)]					Informers [Median, (Interquartile range)]				
	Group with obesity (n=200)	Group of school children (n=400)	HIES* Group (n=200)	P [1/]	Differences between groups**	Group with obesity (n=200)	Group of school children (n=300)	HIES* Group (n=200)	Differences between groups	P [1/]
Health-related Quality of Life [2/]	72.2 (58.2, 80.8)	82.1 (72.3, 89.4)	78.5 (69.8, 87.7)	<0.001	1 < 3 < 2	59.2 (46.2, 73.1)	78.5 (63.8, 88.1)	79.3 (67.8, 88.3)	1 < 2 = 3	<0.001
Psychosocial dimension	68.3 (58.3, 80.0)	80.0 (70.0, 88.3)	76.7 (66.6, 85.0)	<0.001	1 < 3 < 2	60.0 (46.6, 72.0)	77.0 (61.6, 85.0)	77.0 (61.6, 85.0)	1 < 3 = 2	<0.001
• Emotional function	60.0 (50.0, 75.0)	75.0 (65.0, 90.0)	70.0 (60.0, 85.0)	<0.001	1 < 3 < 2	55.0 (43.7, 70.0)	75.0 (60.0, 87.5)	70.0 (55.0, 81.2)	1 < 2 < 3	<0.001
• Social function	80.0 (60.0, 90.0)	90.0 (75.0, 100)	87.5 (75.0, 95.0)	<0.001	1 < 3 = 2	60.0 (45.0, 80.0)	85.0 (65.0, 95.0)	85.0 (70.0, 100)	1 < 2 = 3	<0.001
• School function	70.0 (60.0, 85.0)	80.0 (68.7, 90.0)	75.0 (65.0, 85.0)	<0.001	1 = 3 < 2	60.0 (45.0, 80.0)	70.0 (60.0, 90.0)	75.0 (50.0, 81.2)	1 < 2 = 3	<0.001
Physical dimension	73.5 (62.5, 84.5)	84.4 (75.0, 93.7)	81.3 (68.7, 90.6)	<0.001	1 < 3 < 2	57.9 (43.7, 75.0)	81.3 (59.3, 93.7)	84.4 (68.7, 93.7)	1 < 2 = 3	<0.001

1/ Based on a Kruskal-Wallis test with Bonferroni adjustment**.
2/ Integrates the psychosocial and physical dimensions.
* Controls that attended the outpatients of the Hospital Infantil, State of Sonora, for reasons other than weight control.

both in the psychosocial (median=68.3) and physical dimensions (median=73.5). Similarly, the parents of subjects with obesity perceived a greater deterioration in HRQoL of their children than those of the other two groups (p<0.001). This perception was similar both for psychosocial and physical aspects. The ratings given by the informers for emotional and physical functions were even lower than those of their children (table 2).

When the HRQoL was stratified in accordance with its percentile distribution, 37.5% of the subjects with obesity were classified as having "very poor" HRQoL, constituting the largest proportion of the sample and differing from the control groups: 12% and 19%, respectively (p=0.0021). There were no differences between the three groups for the strata of "poor" and "regular" HRQoL. Furthermore, the stratum of "very good" HRQoL was only reached by 6.5% of the subjects with obesity, compared to 26.2% and 19.0% of the control groups (p=0.0003) (table 3). A similar behavior was observed in the informers. Some 39.5% of parents of the obese group placed their children in the strata of "very poor" HRQoL, in stark contrast to the 14.3% and 9.5% of the other groups (p<0.001). Only 4.5% of parents of the obese group perceived their children's HRQoL as "very good", in contrast to the 24.3% and 26.5% of the other two groups (p<0.001) (table 3).

On examining the bivariate relationship of HRQoL with the variables studied, it was observed that the subjects with "poor" HRQoL were 2.1 times more exposed to obesity (OR=2.13, CI95% [1.57, 2.91]). It was not found that HRQoL was linearly associated with the age, sex, or level of education of the children or adolescents (table 4), nor with the occupation or level of education of their parents (data not shown). When adjusted to a multivariate model, the effect of obesity on HRQoL was maintained (OR=2.24, CI95% [1.64, 3.06]), but this was not the case with overweight (OR=0.85, CI95% [0.51, 1.41]) (table 5).

DISCUSSION

Our findings show that the HRQoL of children and adolescents with obesity is found to be more reduced than that of their non-obese counterparts. This is consistent with previous reports[6,8,16] and suggests the pertinence of assessing additional areas when obesity is studied. Even if there is a global reduction of HRQoL of children and adolescents with obesity, the psychosocial aspect is more affected and this would indicate the need to add multidisciplinary care to the medical management of obese patients; something that has already been indicated in previous reports which included gravely obese children without medical attention.[8,17] It has also been documented that the deterioration in the psychosocial aspect particularly affects the self-esteem of minors and how they relate to their peers, independently of their socioeconomic stratum and racial or ethnic background.[18]

Table 3. Perception of Health-related Quality of Life (HRQoL) of study subjects and their parents, in accordance with categories based on the PedsQL® questionnaire. Hermosillo, Sonora, Mexico. 2010

HRQoL Stratum	Children and adolescents [No. (%)]				Informers [No. (%)]			
	Group with obesity (n=200)	Group of school children (n=400)	HIES* Group (n=200)	P [1/]	Group with obesity (n=200)	Group of school children (n=300)	HIES* Group (n=200)	P [1/]
Very poor	75 (37.5)	48 (12.0)	38 (19.0)	0.0021	79 (39.5)	43 (14.3)	19 (9.5)	0.0000
Poor	47 (23.5)	75 (18.8)	40 (20.0)	NS	53 (26.5)	54 (18.0)	34 (17.0)	0.0308
Regular	39 (19.5)	81 (20.2)	38 (19.0)	NS	37 (18.5)	54 (18.0)	43 (21.5)	NS
Good	26 (13.0)	91 (22.8)	46 (23.0)	0.0134	22 (11.0)	73 (24.3)	51 (25.5)	0.0003
Very good	13 (6.5)	105 (26.2)	38 (19.0)	0.0003	9 (4.5)	76 (24.3)	53 (26.5)	0.0000

[1/] Based on a multinomial Chi-squared test for difference of proportions.
NS = Not significant. HRQoL = Health-related Quality of Life.
* Controls that attended the outpatients of the Hospital Infantil, State of Sonora, for reasons other than weight control.

Furthermore, in our study some 60% of the parents with obesity gave a lower score to HRQoL than their children, particularly in the emotional and physical aspects; something that has been documented before.[8,19] One explanation that has been offered for this fact is that parents' own excess of weight leads them to minimize the effect that being overweight can have on the health of their children.[16,20,21] Other reports[22] have suggested that even the psychopathologies of the parents can confuse or modify the perception they have of the HRQoL of their children and consequently affect compliance with medical, nutritional, and psychological advice to resolve the problem.

Due to the discrepancies observed between the scores of parents and children in the HRQoL, strategies have been proposed to improve the reliability of the questionnaires that measure them, whether by self-assessment procedures or by "*proxies*", usually the parents. The results are still uncertain, and while some studies report low concordance between children and their parents,[23] others indicate an agreement that oscillates between moderate and substantial.[8,24] Future studies in Mexico that incorporate the geographical and cultural diversity of the country could examine the potential differences in the perception of HRQoL between parents and children, controlling the effect of sociocultural variables.

Although we did not observe that age modified the relationship between obesity and HRQoL, it is possible that the risk of poor HRQoL occurs from an early age; something that has been raised in previous reports.[24,25] It was particularly interesting that there was no difference in HRQoL between children of 8 to 10 years and young people of 14 to 15 years, given that it has been proposed that in some groups of adolescents, there is certain psychosocial instability that could reduce HRQoL.[26]

Similar to previous reports,[18] we found no association with other socioeconomic variables that merit more specific study, such as civil status, mother's level of education, socioeconomic status, and occupation of the parents. This does

Table 4. Risk factors for poor Health-related Quality of Life in children and adolescents of Hermosillo, Sonora, Mexico. 2010. Results of bivariate logistic regression

Variable	Coefficient β	Standard error	Odds Ratio [1/]	95% CI OR
Body weight (1 = Normal)				
• Obesity	0.758	0.157	2.13	(1.57, 2.91)
• Overweight	-0.163	0.258	0.85	(0.51, 1.41)
Sex (1 = Male)				
• Female	0.182	0.144	1.20	(0.90, 1.59)
School level (1 = Primary)				
• Secondary	0.222	0.154	1.25	(0.92, 1.69)
Age (1 = 8 to 10 años)				
• 11 to 13 years	0.429	0.164	1.54	(1.11, 2.12)
• 14 to 15 years	0.236	0.193	1.27	(0.87, 1.85)

[1/] Odds Ratio without adjustment.
95% CI OR = Confidence Interval at 95% for Odds Ratio without adjustment.

Table 5. Risk factors for poor Health-related Quality of Life in children and adolescents of Hermosillo, Sonora, Mexico. 2010. Results of multivariate logistic regression

Variable	Coefficiente β	Standard error	Adjusted Odds Rattio [1/]	95% CI OR
Body weight (1.0 = Normal weight)				
• Obesity	0.805	0.159	2.24	(1.64, 3.06)
• Overweight	-0.168	0.260	0.85	(0.51, 1.41)
• Low weight	1.103	0.459	3.01	(1.23, 7.41)
Obesity x age 1	0.108	0.306	1.11	(0.55, 2.25)
Obesity x age 2	-0.738	0.630	0.48	(0.14, 1.64)
Obesity x age 3	0.623	0.434	1.86	(0.25, 14.1)

[1/] Odds Ration adjusted by age, sex, occupation of the head of the family and the socio-economic status of the family.
Age 1 = subjects from 8 to 10 years. Age 2 = subjects from 11 to 13 years. Age 3 = subjects from 14 to 15 years.
* The significance of the final model was assessed by a χ^2 [Log likelihood] = 41.27 (value of p <0.001).

not mean that an association does not exist; indeed, it has already been documented[27] that such a relationship is not only possible, but that selection biases could conceal or mitigate potential relationships. For example, we only included a population from a relatively low socioeconomic level, the same geographic region, and from a public hospital, among other factors. New regional studies are appropriate because the relationship between HRQoL and childhood obesity could be measured by paternal social class. This has been observed in some groups such as African-Americans and Mexican-Americans,[26,28] proving that even in some affluent regions, the poor strata of the population are the most affected.[27] The effect of social class could be measured both by environmental and behavioral factors as well as by psychosocial variables.

On the other hand, the majority of studies that have utilized PedsQL® categorize HRQoL in a binary fashion –eg., as having a condition or a lower HRQoL– the latter when the score reached moves away from standard deviation.[12,29] We propose that stratifying the scores through quartiles can provide a qualitative grade to the perception of HRQoL. This stratification seems appropriate given that the PedsQL® score derives from a discrete numeric scale.[11] We therefore suggest that the results of the questionnaire are analyzed through non-parametric statistical techniques; something that we have observed is used little in the published reports.[24,29]

As such, it was noted that one in three subjects with obesity has a very poor HRQoL, while a very low percentage (6.5%) could be classified as having very good HRQoL. This behavior was different to that of the other two groups, inasmuch as the HRQoL decreases as body weight increases, especially in subjects who already presented with the problem of obesity. Further to this, HRQoL at different levels of obesity remains to be analyzed by a future report. Notwithstanding the above, we recommend caution in the interpretation of these findings, due to the characteristics of the sample and the design of the study. Because of this, it would be appropriate to investigate HRQoL at a community level, which would not only contribute to estimating the effect of certain pediatric illnesses, both acute and chronic, but also to the construction of positive indicators of health.[18,30,31]

Finally, despite the possible bias due to the selection of a hospital group of obese patients, the results are consistent with other reports and corroborate findings that obesity reduces the HRQoL of children and adolescents, particularly in the emotional aspect, and that obesity duplicates the risk of having a poor HRQoL in schoolchildren of the city of Hermosillo, Sonora. In this sense, the Mexican version of the PedsQL® is a valid and easily-applied instrument to examine the relationship between obesity and HRQoL. The results indicate that that HRQoL can be systematically assessed in children and adolescents with obesity, and that new studies would contribute to broadening the knowledge of researchers, healthcare staff, and managers around the priorities for regional public health problems.

REFERENCES

1. World Health Organization. Population-based prevention strategies for childhood obesity. Report of the WHO Forum and Technical Meeting. Ginebra: 2009.
2. Ogden CL, Yanovsky SZ, Carroll MD, Flegal KM. The epidemiology of obesity. Gastroenterol 2007;132:2087-2102.
3. Olaiz-Fernández G, Rivera-Dommarco J, Shamah-Levy T, Rojas R et al. Encuesta Nacional de Salud y Nutrición 2006. Cuernavaca, México: Instituto Nacional de Salud Pública; 2006.
4. Gordon-Larsen P, Nelson MC, Page P, Popkin BM. Inequality in the built environment underlies key health disparities in physical activity and obesity. Pediatr 2006;117(2):417-424.
5. Fallon EM, Tanofsky-Kraff M, Norman AC, McDuffe JR et al. Health-related quality of life in overweight and nonoverweight black and white adolescents. J Pediatr 2005;147:443-450.
6. Tsiros MD, Olds T, Buckley JD, Grimshaw P et al. Health-related quality of life in obese children and adolescents. Int J Obes 2009;33:387-400.

7. Sawyer MG, Reynolds KE, Couper JJ, French DJ et al. Health-related quality of life of children and adolescents with chronic illness –a two year prospective study. Qual Life Res 2004;13:1309-1319.

8. Pinhas-Hamiel O, Singer S, Pilpel N, Fradkin A et al. Health-related quality of life among children and adolescents: associations with obesity. Int J Obes 2005;30(2):267-72.

9. Matziou V, Perdikaris P, Feloni D, Moshovi C et al. Cancer in childhood: Children's and parent's aspects for quality of life. European J Oncology Nursing 2008;12:209–216.

10. Van Gent R, Van der Ent CK, Rovers MM, Kimpen JL et al. Excessive body weight is associated with additional loss of quality of life in children with asthma. J Allergy Clin Immunol 2007;119(3):591-596.

11. Varni JW, Seid M, Kurtin PS. PedsQL® 4.0 Reliability and validity of the pediatric Quality of Life Inventory Version 4.0 Generic Core Scales in Healthy and Patients Populations. Med Care 2001;39:800-812.

12. Varni JW, Burwinkle TM, Seid M, Skarr D. The PedsQL® 4.0 as a pediatric population health measure: Feasibility, reliability, and validity. Ambul Pediatr 2003;3:329-341.

13. Hurtado-Valenzuela JG, Sotelo-Cruz N, Avilés-Rodríguez M, Peñuelas-Beltrán CI. Aumento en la prevalencia de obesidad en niños y adolescentes de la consulta ambulatoria. Bol Clin Hosp Infant Edo Sonora 2005;22(2): 81-86.

14. Cole TJ, Bellizi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ 2000;320:1240-1243.

15. Prevención y Diagnóstico de Sobrepeso y Obesidad en Niños y Adolescentes en el Primer Nivel de Atención. Guía de Práctica Clínica. Consejo de Salubridad General 2012. México. Available at: http://www.cenetec.salud.gob.mx/ (Access date: October 2013).

16. Kim D, Kawachi I. Obesity and health-related quality of life. Chapter 12. Part II. Epidemiologic studies of consequences of obesity. En: Hu FB (ed.). Obesity epidemiology. Cambridge: Oxford Press; 2008; pp 234-260.

17. Schwimmer JB, Burwinkle TM, Varni JW. Health-related quality of life of severely obese children and adolescents. JAMA 2003;289(14):1813-1819.

18. Wallander JL, Kerbawy S, Toomey S, Lowry R et al. Is obesity associated with reduced health-related quality of life in Latino, black and white children in the community? Int J Obes 2013 doi:10.1038/ijo.2013.31.

19. Wake M, Salmon L, Waters E, Wright M et al. Parent-reported health status of overweight and obese Australian primary school children: a cross-sectional population survey. Int J Obesity 2002;26:717-724.

20. Baughcum AE, Chamberlain LA, Deeks CM, Powers SW et al. Maternal perceptions of overweight preschool children. Pediatrics 2000;106(6):1380-1386.

21. Strauss RS. Childhood obesity. Pediatr Clin North Am 2002;49:175-201.

22. Steinsbekk S, Josefiak T, Ødegård R, Wichstrøm L. Impaired parent-reported quality of life in treatment-seeking children with obesity is mediated by high levels of psychopathology. Qual Life Res 2009;18:1159-1167.

23. Theunissen NCM, Vogels TGC, Koopman HM. The proxy problem: Child report versus parent report in health-related quality of life research. Qual Life Res 1998;7:387-397.

24. Hughes AR, Farewell K, Harris D, Reilly JJ. Quality of life in a clinical simple of obese children. Int J Obes 2007;31(1):39-44.

25. Sato H, Nakamura M, Sasaki N. Effects of bodyweight on health-related quality of life in school-aged children and adolescents. Pediatr Int 2008;50:552-556.

26. Tyler Ch, Johnston CA, Fullerton G, Foreyt JP. Reduced quality of life in very overweight Mexican-American adolescents. J Adolesc Health 2007;40:366-368.

27. Gearhart RF, Gruber DM, Vanata DF. Obesity in the lower socioeconomic status segments of the American society. Forum in public policy. Ashland University, Ohio USA. Serie en internet 2008. Available at: http://www.forumonpublicpolicy.com/archivespring08/gearhart.pdf. (Access date: October 23, 2011).

28. Zeller MH, Modi AC. Predictors of health quality of life in obese youth. Obesity 2006;14(1):122-130.

29. Varni JW, Limbers CA, Burwinkle TM. Impaired health-related quality of life in children and adolescents with chronic conditions: a comparative analysis of 10 disease clusters and 33 disease categories/severities utilizing the PedsQL 4.0 Generic Core Scales. Health Quality Life Outcomes 2007, doi:10.1186/1477/7525-5-43.

30. Simon AE, Chan KS, Forrest CB. Assessment of Children's Health-Related Quality of Life in the United States with a Multidimensional Index. Pediatrics 2008;121(1):118-126.

31. Strauss RS, Knight J. Influence of the home environment on the development of obesity in children. Pediatrics 1999;103(6):e85.

Declaration of conflict interest: None