

# Prevalence of overweight and obesity in children of four state schools in Belo Horizonte, Minas Gerais

## *Prevalência de sobrepeso e obesidade em crianças de quatro escolas estaduais de Belo Horizonte, Minas Gerais*

Francisco José Ferreira da Silveira<sup>1</sup>, Julia Carvalho Barbosa<sup>2</sup>, Vanessa Aline Miranda Vieira<sup>2</sup>

DOI: 10.5935/2238-3182.20150035

### ABSTRACT

<sup>1</sup> MD, PhD. in Children and Adolescent Health. Assistant Professor at the Medical Sciences College of Minas Gerais, Belo Horizonte, MG – Brazil.

<sup>2</sup> Medical School student at the Medical Sciences College of Minas Gerais, Belo Horizonte, MG – Brazil.

**Introduction:** obesity is a disorder of nutritional status that is difficult to treat and related to increasing in adipose tissue with consequent elevation of body weight. The population has shown a high prevalence of overweight and among the causes to explain this weight increase are changes in lifestyle and eating habits. **Objectives:** to evaluate the prevalence of overweight and obesity in children of four State schools in Belo Horizonte, Minas Gerais. **Methods:** this was a cross-sectional and observational study consisting of 194 students, aged between seven and nine years, attending four State schools in Belo Horizonte. Anthropometric (height and weight) and some life habits data were obtained. Indicators proposed by the World Health Organization (WHO) were used as a reference for the data analysis to obtain the prevalence of overweight and obesity. **Results:** there was certain homogeneity in the distribution between age groups and female predominance over males. Out of the examined children, 20.1% are in the overweight range, 13.9% are girls and 6.2% are boys. Meanwhile, 16.0% of children were considered obese; 10.8% are girls, and 5.2% are boys. **Conclusion:** the number of overweight children is significant and troubling, which indicates the need for targeted actions to prevent and treat this important public health problem.

**Key words:** Prevalence; Obesity; Overweight; Child.

### RESUMO

**Introdução:** a obesidade é um distúrbio do estado nutricional, de difícil tratamento, relacionado ao aumento do tecido adiposo, com consequente elevação do peso corporal. A população vem apresentando alta prevalência de excesso de peso e entre as causas para explicar esse aumento estão as mudanças no estilo de vida e nos hábitos alimentares. **Objetivos:** avaliar a prevalência de sobrepeso e obesidade em crianças de quatro escolas estaduais de Belo Horizonte, Minas Gerais. **Métodos:** estudo transversal e observacional, constituído por uma amostra de 194 estudantes, com idade entre sete e nove anos, de quatro escolas estaduais de Belo Horizonte. Foram obtidos os dados antropométricos (peso e altura) e alguns dados de hábitos de vida. Como referencial para a análise dos dados foram utilizados os indicadores propostos pela Organização Mundial da Saúde (OMS), a fim de se obter as prevalências de sobrepeso e obesidade. **Resultados:** houve certa homogeneidade na distribuição entre as faixas etárias e predominância do sexo feminino sobre o masculino. Das crianças analisadas, 20,1% estão na faixa de sobrepeso, sendo que 13,9% são meninas e 6,2% são meninos. Enquanto isso, 16,0% das crianças foram considerados obesos, sendo que 10,8% são meninas e 5,2% meninos. **Conclusão:** o número de crianças acima do peso é significativo e preocupante, o que indica a necessidade de ações direcionadas para a prevenção e tratamento desse importante problema de saúde pública.

**Palavras-chave:** Prevalência; Obesidade; Sobrepeso; Criança.

Submitted: 2014/03/26  
Approved: 2015/02/04

Institution:  
Medical Sciences College of Minas Gerais  
Belo Horizonte, MG – Brazil

Corresponding Author:  
Julia Carvalho Barbosa  
E-mail: julia@comexcom.com.br

## INTRODUCTION

Obesity is a disorder in the nutritional status, difficult to treat, related to increased fat tissue, and consequent increase in body weight. It is considered chronic, multifactorial, and caused by overlapping genetic and environmental factors.<sup>1</sup>

In 1997, the World Health Organization (WHO) considered obesity an epidemic, as pointed out in the publication "Obesity: Preventing and Managing the Global Epidemic", as a way to educate public ministries and health professionals about the magnitude and medical and social importance of the problem.<sup>2</sup> The results of the Household Budget Research (POF) 2008-2009<sup>3</sup>, conducted by IBGE in partnership with the Ministry of Health, report that the population has shown a high prevalence of overweight. In 2009, one in three children aged five to nine years old were above the weight recommended by WHO. The POF revealed a significant increase in the number of children aged five to nine years old with excess weight over 34 years: in 2008-2009, 34.8% of boys had weight above the range considered healthy by WHO. In 1989, this index was 15% against 10.9% in 1974-75. A similar pattern was observed in girls, from 8.6% in the 70s, to 11.9% in late 80s, and 32% in 2008-09.

The risk that an obese child remains in this condition in adulthood is linked to the duration and severity of each case. Approximately one-third of obese adults were obese children, and when obesity is severe, this proportion increases to 1/2 to 3/4.<sup>4</sup>

Among the causes explaining this remarkable increase in the number of obese people worldwide are changes in lifestyle and eating habits. The increasing preference for processed and high-fat foods is continuously noticed, and technological advances lead to sedentarism.<sup>5</sup>

The increase in adipose tissue, with a consequent increase in body weight, triggers multiple complications such as increased predisposition to arthritis and osteoarthritis; systemic hypertension; increased surgical risk; early menarche; increased mortality risk; elevated frequency of endometrial, breast, gallbladder, colon/rectum, and prostate cancer as well as respiratory alterations.<sup>6</sup> Data from the Brazilian Society of Endocrinology and Metabolism (SBEM) show that Brazil spends 1.45 billion reais a year in diseases related to obesity.<sup>7</sup>

This study evaluated children aged seven to nine years old, at school age. In this study, the following data were analyzed: body weight, height, and BMI for each age considering the 2006 WHO standard curves.

## METHODS

This was a transversal and observational study conducted in four public schools (State schools) in Belo Horizonte – Minas Gerais.

Among the nine regions of Belo Horizonte, four were chosen (northern, central-south, eastern, and western) in accordance with the study execution. Subsequently, one school per region was selected based on a complete listing of institutions. The study was conducted in the following schools: Professor Alberto Andrade Mazoni State School (northern region); Afonso Pena State School (south-central); Carlos Garcia State School (eastern region); and Professor Magalhães Drumond State School (western region).

In most of the studied literature, the prevalence of overweight and obesity conditions in Brazil is approximately 15%. Therefore, this figure was used for sample calculation. The sample size was calculated to be equal to or greater than 195.92 students, adopting a 95% confidence interval and 5% error.

A total of 194 students were analyzed, according to the estimate obtained from the sample calculation used for this purpose. The inclusion criteria were: school children (seven to nine years old), attending the selected schools, and with a parent or guardian agreeing to participate in the study by signing a Voluntary Informed Consent Form (VICF) after randomization. The exclusion criteria were: children younger than seven years old, children older than nine years old, and children whose parents did not sign the informed consent.

The measurements were taken at the same time in all schools, always between meals. The distribution of students who participated in each school was proportional and in accordance with the total number of students in the age group in each school; the school with most students had proportionally higher number of studied children.

Data collection was performed between August and November of 2012.

Parents were informed about the study and signed the informed consent authorizing the participation of their children before data collection.

A short questionnaire was used to get information about the date of birth and lifestyle habits such as the practice of physical exercises, use of television, use of video games, etc.

WHO indicates anthropometry as the most useful method to identify obese people because it is the cheapest, non-invasive, universally applicable, and well ac-

cepted by the population. Anthropometric indexes are obtained from the combination of two or more basic anthropometric information (weight, sex, age, height).<sup>2</sup> Currently, the most widely used index to identify obese people is the body mass index (BMI), calculated using the formula: squared weight divided by height.<sup>8</sup>

Anthropometric data of weight and height were obtained. In order to avoid errors, standard techniques were used, equipment was calibrated, and students were prepared to carry out anthropometric measurements according to the following procedures:

- body weight was measured using a digital scale, Cadence brand – BAL 150, with capacity of 150 kg and accuracy of 100 g; the student should be in orthostatic position in the center of the scale, bare-foot, and wearing light clothes (school uniform).<sup>9</sup>
- stature was measured using a measuring tape (set on smooth walls). The children were placed in an upright standing position, with parallel feet and heels, shoulders and buttocks leaning against the wall, and hands flat on the thighs.<sup>2,10</sup>

The data was entered and stored in the Epi-Info software, 3.5.2 (2010). The WHO AnthroPlus software was used for the analysis of anthropometric data and calculation of overweight and obesity prevalence. BMI was calculated according to the formula “squared weight divided by height” and interpreted together with the values of weight and height according to z-score values and WHO standard curves. The criteria for defining overweight and obesity were those proposed by WHO as described in Table 1. The chi-square test was used to verify the association between variables considering the level of significance (p) <0.05.

The study was approved by the State Secretary of Education of Minas Gerais and principals from the

four selected schools. The study was also approved by the Ethics Committee of the Medical Sciences College of Minas Gerais/University Hospital São José based on Resolution 196/96 of CNS before the start of data collection.

## RESULTS

A total of 194 children were analyzed and distributed as 84 (43.3%) from the western region; 52 (26.8%) from the south-central region; 34 (17.5%) from the eastern region; and 24 (12.4%) from the northern region. Many of the participants (48.5%) remain at their respective schools in the afternoon, 29.9% in the morning and afternoon shifts while 21.60% were studying only in the morning shift.

Out of the studied children, 30.4% were seven years old; 37.7% were eight years old, and 31.9% were nine years old. Out of this sample, 41.2% were boys, and 58.8% were girls. A certain homogeneity in the distribution among age groups and a larger number of girls compared to boys was noticeable.

Table 2 shows that 114 girls and 80 boys participated in the study, 13.9% and 6.2% were overweight, respectively, totaling 20.1% of children classified in this nutritional status. Among all children, 18.5% were considered overweight, and of these, 2.5% were classified as severe obesity. Therefore, it was considered that 38.6% of children were overweight or obese.

A higher number of girls were overweight than boys; this also occurred, with less intensity, in relation to obesity. However, the association between gender (male and female) and the overweight condition is not statistically significant (p = 0.10), similarly with the association between gender and obesity (p = 0.61).

**Table 1** - Nutritional status classification of children according to the critical values proposed by WHO – Belo Horizonte, 2012

Z-score critical values	Anthropometric indexes for children 5 to 10 years old		
	BMI for age	Weight for age	Stature for age
< -3	Accentuated thinness	Very low weight for age	Very short stature for age
≥ -3 e < -2	Thinness	Low weight for age	Short stature for age
≥ -2 e < -1	Eutrophic	Adequate weight for age	Adequate stature for age
≥ -1 e ≤ +1			
> +1 e ≤ +2	Overweight	Elevated weight for age	
> +2 e ≤ +3	Obesity		
> +3	Severe obesity		

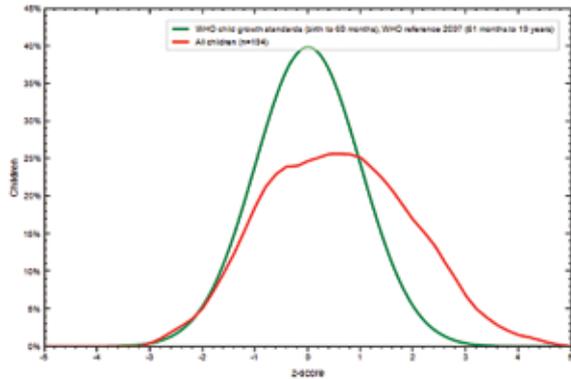
Source: Adapted from the World Health Organization, WHO, 2006.

**Table 2** - Distribution of children, according to gender and nutritional status – Belo Horizonte, 2012

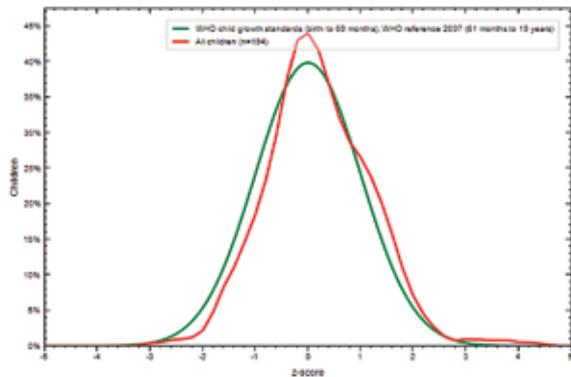
Z-score	BMI (%)			Interpretation
	M	F	Total	
<-3	0.5	–	0.5	Accentuated thinness
≥-3 e <-2	0.5	1.5	2.0	Thinness
≥-2 e ≤+1	27.3	31.4	58.7	Eutrophic
>+1 e ≤+2	6.2	13.9	20.1	Overweight
>+2 e ≤+3	5.2	10.8	16.0	Obesity
>+3	1.5	1.0	2.5	Severe obesity

The percentage of children with severe low weight, i.e., z-score <-3 was 0.5%.

Table 2 and Figures 1, 2, and 3 show the distribution of children according to weight/age, height/age, and BMI indicators, respectively, compared with the WHO standard growth curves.



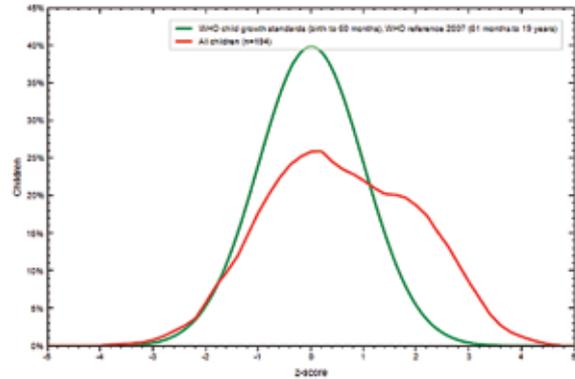
**Figure 1** - Distribution of children according to the weight/age (Z-score) indicator comparing with the WHO standard curve.



**Figure 2** - Distribution of children according to the height/age (Z-score) indicator comparing with the WHO standard curve.

Figures 1 and 3 show a curve deviation to the right and flattening in the central area, evidencing high rates

of overweight and obesity in the studied population compared to the WHO curves. Figure 2 (height age) shows a curve conformation similar to the WHO curves.



**Figure 3** - Distribution of children according to the BMI (Z-score) indicator comparing with the WHO standard curve.

Considering some lifestyle habits, all children watch television; 76.3% reported the daily frequency of this habit and 41.2% remain three to five hours a day watching cartoons, soap opera, movies, and various programs. A total of 57.2% of children have access to electronic games; 37.8% of them play daily. Out of this percentage, 34.2% stated that they play one to two hours a day.

When verifying the frequency with which children watch television in relation to the prevalence of overweight and obesity, it is observed that, out of the 75 children who were overweight, 65 watched television at least three times a week, and 50 of these children spent at least three hours a day watching television. In contrast, out of the 119 children classified in the other nutritional states, 103 watched television at least three times a week, and 63 spent at least three hours a day watching television. The association between the prevalence of overweight and obesity and how often they watch television (less than three times a week and more than three times a week) as well as the time spent in this activity (less than three hours a day and over three hours a day) was not statistically significant ( $p = 0.84$  and  $p = 0.40$ , respectively).

Furthermore, 38.74% of the children who play video games are overweight (overweight and obesity), and 34.88% play at least three times a week. The association between the variables obesity and time spent playing video games showed that among the children who play video games more than three hours a day, 30.77% were obese, and 69.23% were in the z-score <2 BMI. Among the children who play for less than three

hours a day, 13.56% were obese, and 86.44% were in the z-score < 2 BMI. This association was statistically significant ( $p = 0.049$ ).

Considering a diet for weight loss, 22.70% of children reported following a diet. Out of these, only 15.9% followed a diet according to the recommendations of a health professional. The association of the variables diet and prevalence of overweight and obesity showed that among children who do not diet, 34.67% were overweight, while 65.33% were in the z-score < 1 BMI. Among the children who dieted, 52.27% were overweight, and 47.73% were in the z-score < 1 BMI. These data showed statistical significance ( $p = 0.043$ ).

Regarding the practice of physical activities, 55.70% of participants practiced some physical exercise that require respiratory effort and/or cause sweating once or twice a week, while 13.4% of them performed these activities more than five times a week. Out of those who performed physical activities, 83 spent 30 minutes to one hour in each practice. The association between variables overweight and obesity and physical activity showed that 34.97% of children who did not exercise or practice less than twice a week were overweight, and 65.03% were in z-score < 1 BMI. Among children who practiced physical activities more than three times a week, 49.02% were overweight, while 50.98% were allocated to the other classifications of nutritional status. The association between the prevalence of overweight and obesity, and the frequency of physical activities (less than twice a week and more than twice a week) was not statistically significant ( $p = 0.10$ ).

## DISCUSSION

The percentage of overweight children is high and should be considered worrisome. However, similar values are observed in other studies in several Brazilian regions. In a research conducted with schoolchildren in Bahia, the percentage of the overall prevalence of obesity was 15.8%.<sup>11</sup> In another study of the prevalence of overweight and obesity among schoolchildren in Brasilia (DF), the indexes were, together, 18.8% in boys and 21.2% in girls.<sup>6,9</sup>

The data are also similar to a study in schoolchildren in Paraná, which found a prevalence of 20% overweight and 7% obesity; the majority of students (72%) did not practice physical activities outside the school, and just over half of them (53%) spent more than four hours a day in sedentary activities.<sup>12</sup> Other studies showed simi-

lar results.<sup>13,14</sup> Significantly lower prevalence rates are found in some studies (6.7% and 11.2%).<sup>15,16</sup>

In relation to gender and overweight condition, the prevalence in girls is not constantly observed, and in some studies it was statistically significant in boys.<sup>13,14</sup> However, variability in the various studies is observed regarding the prevalence of gender and the overweight condition; males predominate in some studies and females in others. The differences are not significant in most cases.

The result of the association between frequency of children watching television and the prevalence of overweight and obesity could have been statistically significant because the present study did not analyze other variables that can interfere with these disorders. Multiple risk factors can be considered for the development of overweight and obesity including family genetics, low birth weight, gestational diabetes in the mother, smoking during pregnancy, and ethnicity. Inadequate eating habits can be important elements of environmental factors.<sup>17</sup>

Fiates et al.<sup>17</sup> demonstrated that overweight and obesity in children have been traditionally associated with the habit of watching TV because this habit promotes a sedentary lifestyle. In addition, it is known that food advertisements aired on TV have the power to promote effectively consumption, directly influencing the eating habits of children.

As for diets for weight loss, it is observed that 34.67% of children who do not diet are overweight. This fact leads to thinking about the possible lack of knowledge about overweight and obesity in those responsible for these children. Many of the parents who do not impose diets to their children are unaware of the importance of such practice or even of the fact that his child is not at the proper weight. The recognition of the overweight condition by parents is a remarkable step in the process of preventing, diagnosis, and treating childhood obesity. Because many parents may not realize the overweight condition in their children or even associate it with a good health condition, the search for healthcare professionals might be late or, they do not adequately participate in the prescribed treatment when the overweight condition is diagnosed.<sup>18</sup>

Most children present adequate height for their age, which is expected if there is no evidence that they had been submitted to inadequate diseases and conditions that could interfere with normal growth.

Given the high rates of overweight and obesity found in children of school age and the significant likelihood that they might be obese adults, there is a

need for decisions and actions to take effect by public agencies and health services. There is also a need for intersectoral action with the participation of agencies linked to education. The growing overweight and obesity prevalence should be considered as one of the major public health problems; some attitudes and interventions such as awareness of children, parents, family members, and the population on the importance of changes in lifestyle and other preventive and care measures could minimize their harmful effects on children and in their adult lives.

## CONCLUSION

Overweight and obesity can be considered major public health problems. This study identified indexes that suggest high prevalence rates of these nutritional disorders in children at school age. Because obesity is a chronic disease, it requires constant attention in relation to the life habits of this population.

## REFERENCES

- Sorensen TIA. The genetics of obesity. *Metabolism*. 1995; 44(3):4-6. [Cited 2011 Oct 18]. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/7674914>.
- World Health Organization. Physical Status: the use and interpretation of anthropometry. Report of a WHO Expert Committee, Geneva: WHO; 1995. WHO Technical Report Series, 854.
- Instituto Brasileiro de Geografia e Estatística-IBGE. Coordenação de Trabalho e Rendimento. Pesquisa de Orçamentos Familiares 2008-2009: Análise do consumo alimentar pessoal no Brasil. [Internet] Rio de Janeiro: IBGE; 2011. [Cited 2011 Oct 4]. Available from: [http://www.ibge.gov.br/home/estatistica/populacao/condicaoodevida/pof/2008\\_2009\\_analise\\_consumo/pofanalise\\_2008\\_2009.pdf](http://www.ibge.gov.br/home/estatistica/populacao/condicaoodevida/pof/2008_2009_analise_consumo/pofanalise_2008_2009.pdf).
- Serdula MK, Ivery D, Coates RJ, Freedman DS, William DF, Byers T. Do obese children become obese adults? A review of the Literature. *Prev Med*. 1993; 22:167-77. [Cited 2011 Oct 20]. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/8483856>.
- Dietz WH. Prevention of childhood obesity: individual, environmental, and policy issues. In: *ILSI Childhood Obesity: partnerships research and prevention*. Washington: ILSE; 2002. Cap.4, p.41-55.
- Mello ED, Luft VC, Meyer F. Obesidade infantil: como podemos ser eficazes? *J. Pediatr (Rio J)*. 2004; 80(3):173-82. [Cited 2011 Oct 19]. Available from: <http://www.scielo.br/pdf/jped/v80n3/v80n3a04.pdf>.
- Ilsi International Life Sciences. Obesidade traz riscos para à saúde. Especialistas discutem ações para promover estilos de vida saudáveis. São Paulo: ILSI Brasil; dez. 2003.
- Lamounier JÁ, Abrantes MM, Colosimo EA. Prevalência de sobrepeso e obesidade nas regiões nordeste e sudeste do Brasil. *Rev Assoc Med Bras*. 2003; 49:162-6. [Cited 2011 Nov 2]. Available from: <http://www.scielo.br/pdf/jped/v78n4/v78n4a14>.
- Giugliano R, Melo ALP. Diagnóstico de sobrepeso e obesidade em escolares: utilização do índice de massa corporal segundo padrão internacional. *J Pediatr (Rio J)*. 2004; 80:129-34. [Cited 2011 Oct 25]. Available from: [http://www.scielo.br/scielo.php?pid=S0021-75572004000200010&script=sci\\_abstract&tlng=pt](http://www.scielo.br/scielo.php?pid=S0021-75572004000200010&script=sci_abstract&tlng=pt).
- Jelliffe DB. Evaluación del estado de nutrición de la comunidad (con especial referencia a las encuestas en las regiones en desarrollo). Ginebra, Organización Mundial de la Salud; 1968. Serie de Monografías No 53.
- Leão LSCS; Araujo LMB; Moraes LTL; Assis AM. Prevalência de obesidade em escolares de Salvador, Bahia. *Arq Bras Endocrinol Metab*. 2003; 47(2):151-7. [Cited 2011 Oct 5]. Available from: [http://www.scielo.br/scielo.php?pid=S0004-27302003000200007&script=sci\\_arttext](http://www.scielo.br/scielo.php?pid=S0004-27302003000200007&script=sci_arttext)
- Mello ADM; Marcon SS; Hulsmeyer APC; Cattai GBP; Ayres CSL; Santana RG. Prevalência de sobrepeso e obesidade em crianças de seis a dez anos de escolas municipais de área urbana. *Rev Paul Pediatr*. 2010; 28(1):48-54. [Cited 2011 Oct 18]. Available from: [http://www.spsp.org.br/spsp\\_2008/revista/rpp\\_v28n1\\_p48-54.pdf](http://www.spsp.org.br/spsp_2008/revista/rpp_v28n1_p48-54.pdf)
- Rosaneli CF, Auler F, Manfrinato CB, Rosaneli CF, Sganzerla C, Bonatto MG, et al. Avaliação da prevalência e de determinantes nutricionais e sociais do excesso de peso em uma população de escolares: análise transversal em 5.037 crianças. *Rev Assoc Med Bras*. 2012; 58(4):472-6. [Cited 2011 Oct 3]. Available from: [http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0104-42302012000400019](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-42302012000400019)
- Bernardo CO, Fernandes OS, Campos RMMB, Adami F, Vasconcelos FAG. Associação entre o índice de massa corporal de pais e de escolares de 7 a 14 anos de Florianópolis, SC, Brasil. *Rev Bras Saúde Matern Infant*. 2010; 10(2):183-90. [Cited 2011 Oct 15]. Available from: [http://www.scielo.br/scielo.php?pid=S1519-38292010000200005&script=sci\\_abstract&tlng=pt](http://www.scielo.br/scielo.php?pid=S1519-38292010000200005&script=sci_abstract&tlng=pt).
- Felisbino-Mendes MS, Campos MD, Lana FCF. Avaliação do estado nutricional de crianças menores de 10 anos no município de Ferros, Minas Gerais. *Rev Esc Enferm USP*. 2010; 44(2):257-65. [Cited 2011 Oct 22]. Available from: [http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0080-62342010000200003&lng=en](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0080-62342010000200003&lng=en).
- Pelegriani A, Silva DAS, Petroski EL, Glaner MF. Estado nutricional e fatores associados em escolares domiciliados na área rural e urbana. *Rev Nutr*. 2010; 23(5): 839-46. [Cited 2011 Oct 21]. Available from: [http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S1415-52732010000500014](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1415-52732010000500014).
- Fiates GMR, Amboni RDMC, Teixeira E. Comportamento consumidor, hábitos alimentares e consumo de televisão por escolares de Florianópolis. *Rev Nutr*. 2008; 21(1):105-14. [Cited 2011 Oct 21]. Available from: [http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S1415-52732008000100011](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1415-52732008000100011).
- Boa-Sorte N, Neri LA, Leite MEQ, Brito SM, Meirelles AR, Ludovice FBS, et al. Percepção materna e autopercepção do estado nutricional de crianças e adolescentes de escolas privadas. *J. Pediatr (Rio J)*. 2007; 83(4):349-56. [Cited 2011 Nov 1]. Available from: [http://www.scielo.br/scielo.php?pid=S0021-75572007000500011&script=sci\\_arttext](http://www.scielo.br/scielo.php?pid=S0021-75572007000500011&script=sci_arttext).