<div align="center">

anales**de**pediatría

www.analesdepediatria.org

</div>

ORIGINAL ARTICLE

Evaluation of quality of life in schoolchildren with a history of early severe malnutrition[☆]

E.S. De Grandis [a,b,*], P.A. Armelini [b], E. Cuestas [c]

[a] *Hospital de Niños de la Santísima Trinidad, Córdoba, Argentina*
[b] *Facultad de Medicina, Universidad Católica de Córdoba, Córdoba, Argentina*
[c] *Hospital Privado INICSA-CONICET, Cátedra de Estadística Médica, Facultad de Medicina, Universidad Católica de Córdoba, Córdoba, Argentina*

Abstract
Introduction: Severe malnutrition in young children may lead to long-term complications, in particular learning and psychosocial disorders linked to health related quality of life (HRQOL). The aim of this study was to evaluate HRQOL in children whit a history of severe malnutrition before 2 years of life, expecting to find lower scores in these patients.
Materials and methods: A comparative study was performed on schoolchildren between 5 and 12 years with a history of early severe malnutrition, excluding those with chronic diseases. The Controls were healthy siblings of patients. The sample size was estimated as 26 subjects per group (Total = 52). Sociodemographic variables were recorded and the HRQOL was assessed with PedsQL4.0. Chi square and Student *t* test were applied. Significance level: *P* < .05.
Results: A total of 25 patients and 28 controls were studied. The HRQOL scores obtained from PedsQL for children with history of malnutrition, compared with their healthy siblings, were: Total: 80.82 ± 1.94 vs 89.18 ± 1.84 (*P* < .0001), physical health/dimension: 87.75 ± 3.37 vs 94.75 ± 1.87 (*P* < .0001), psychosocial health: 77.77 ± 2.90 vs 86.57 ± 1.42 (*P* < .0001), emotional dimension: 67.80 ± 4.40 vs 78.75 ± 2.96 (*P* < .0001), social dimension: 88.80 ± 3.05 vs 95.71 ± 1.52 (*P* < .0001), and school dimension: 74.58 ± 3.80 vs 85.00 ± 3.51 (*P* < .0001).
Conclusions: Patients with a history of early severe malnutrition, showed significantly lower HRQOL scores compared with controls.
© 2013 Asociación Española de Pediatría. Published by Elsevier España, S.L.U. All rights reserved.

Evaluación de la calidad de vida en escolares con antecedentes de desnutrición temprana severa

Resumen

Introducción: La desnutrición severa en niños pequeños produce secuelas a largo plazo, especialmente trastornos del aprendizaje y de adaptación psicosocial. Dichos aspectos están vinculados con la calidad de vida relacionada a la salud (CVRS). La calidad de vida en niños desnutridos no ha sido suficientemente estudiada. El objetivo fue evaluar CVRS en escolares con antecedentes de desnutrición severa antes de los 2 años de vida, estimando encontrar puntuaciones más bajas en estos pacientes.

Material y método: En un estudio comparativo se incluyeron escolares de 5 a 12 años con antecedentes de desnutrición severa y se excluyeron aquellos con enfermedades crónicas. Los controles fueron los hermanos sanos de los pacientes. Muestreo por conveniencia; tamaño muestral estimado en 26 sujetos por grupo (52 en total). Se midieron CVRS con formulario PedsQL4.0 y variables sociodemográficas. Las diferencias se analizaron con la prueba de la Chi cuadrado y el test de la «t» de Student. El nivel de significación fue: $p < 0,05$.

Resultados: Se estudiaron 25 pacientes y 28 controles. Las puntuaciones de CVRS obtenidas por los niños con antecedentes de desnutrición, en comparación con sus hermanos sanos, fueron: total $80,82 \pm 1,94$ vs $89,18 \pm 1,84$ ($p = < 0,0001$), salud/dimensión física: $87,75 \pm 3,37$ vs $94,75 \pm 1,87$ ($p = < 0,0001$), salud psicosocial: $77,77 \pm 2,90$ vs $86,57 \pm 1,42$ ($p = < 0,0001$), dimensión emocional: $67,80 \pm 4,40$ vs $78,75 \pm 2,96$ ($p = < 0,0001$), dimensión social: $88,80 \pm 3,05$ vs $95,71 \pm 1,52$ ($p = < 0,0001$), dimensión escolar: $74,58 \pm 3,80$ vs $85,00 \pm 3,51$ ($p = < 0,0001$).

Conclusiones: Los pacientes con antecedentes de desnutrición severa temprana presentaron puntuaciones significativamente menores de CVRS comparados con los controles.

Introduction

The risk of mortality in severe malnutrition is 5%,[1] and it is estimated that over one third of deaths in children younger than 5 years can be attributed to malnutrition.[2] Cognitive development and learning may be affected beyond the period of acute complications. Severe malnutrition before age 3 years (a critical period in brain development) may have sequelae such as delays in cognitive development and school failure.[1–4] Nutrients modify brain plasticity and function, and nutritional deficiencies produce changes in signalling cascades that delay myelination and result in a reduced number of neurons, altering neural structure and function.[5,6]

Other factors such as poverty, infection, hospitalisation, and parental level of education may have a negative influence on cognitive development and academic performance.[7,8] Early alterations in the mother-infant interaction may cause or exacerbate deficiencies related to malnutrition.[1] These sequence of alterations in severe malnutrition has consequences on the development, learning, and interpersonal relationships of over half of the surviving children.[1–8] The reduced ability of the individual to interact with the environment and with other individuals may limit his or her potential to have a healthy, happy, and productive life.[9,10]

Our working hypothesis was that schoolchildren with a history of early malnutrition have biological, psychological, and psychosocial sequelae, and since quality of life is intimately related to these developments, the evaluation of the different dimensions measured by the health-related quality of life scale (HRQoL) would yield significantly lower values in this group of patients.

It is now recognised that individuals with the same objective health status can report very different subjective quality of life due to differences in resiliency and adjustment skills.[10,11] The HRQoL assesses the impact of health in other dimensions of human experience, such as personal achievement, satisfaction, wellbeing, happiness, and self-esteem.[11,12]

Until recent years, organisation of care was based on mortality rates, population diseases, and the cost-benefit of preventing or curing the latter.[10–13] The World Health Organization (WHO) has acknowledged the critical link between physical and psychosocial health. In recent decades, the assessment of HRQoL has started to consider the individual from an integral perspective, measuring the impact of disease from the perspective of the patient or his or her family.[13,14]

For the above reasons, the aim of this study was to assess the impact on HRQoL in its physical, emotional, social, and school dimensions from the perspective of the parents of children with a history of early severe malnutrition, measured using the Spanish version of the Pediatric Quality of Life Inventory, Version 4.0 Generic Core Scale[15,16] (PedsQL) validated for Argentina.

Patients and methods

We designed a comparative study of a population of children of both sexes aged 5 to 12 years that included 29 patients

with a history of severe malnutrition before age 2 years, and excluded 19 patients with severe malnutrition associated to chronic disease. We defined severe malnutrition[17] as: weight-for-length <−3 SD (or <70% of the ideal weight for length), height-for-age <−3 SD (or <85% of the ideal height for age) or malnutrition with symmetrical oedema. We collected the socioeconomic and anthropometric data retrospectively from the medical records of patients. The sample was obtained by successive sampling based on hospital records from between January 1997 and June 2005, and then we visited the respective families at their homes or contacted them by phone when a visit was not possible. In administering the quality of life questionnaires to the parents, children with a history of early severe malnutrition were considered the study group, and their healthy school-aged siblings the control group. The interviews took place between March 2009 and May 2010. We calculated the minimum sample size for a power of 95%, a 95% confidence interval, and an accuracy of 1% in estimating a difference in the total PedsQL score of at least 2 points (out of a total of 52).

There is evidence that the survey can be administered to low-income populations and can adequately discriminate between healthy and diseased children.[16]

A single researcher performed the interviews in person or by telephone, whichever applied, confirming the data collected from the medical history, obtaining informed consent, and giving the survey to the respondent (father, mother, or caregiver) for its completion.

We collected data on age; sex; socioeconomic status (SES) described according to the index defined by the Centro de Estudios sobre Nutrición Infantil (Centre for the Study of Child Nutrition [CESNI]),[18] modified in the Córdoba, lactancia, crecimiento y desarrollo (CLACyD) study and summarised into 3 strata: (1) High and middle, (2) low and (3) Very low[19]; maternal level of education, single- or two-parent household; the child's school level; and current anthropometric measurements (weight and height recorded in the charts of the health care centre that provided care for the child).

We assessed the HRQoL using the PedsQL, considering all 23 items for the global score, arranged in four multidimensional scales – physical, emotional, social, and school – and two summary scores – for psychosocial health (the average of the last three dimensions) and for physical health (which corresponded to the physical dimension). Due to the poor cognition characteristics expected in our patients and to the difficulties that children aged 5–7 years have in understanding and completing the questionnaire, described by Roizen et al.,[16] we used the parent-proxy version for parents of children 5–7 years and children 8–12 años,[15,16,20] with 5-point Likert scales (from 0: never a problem to 4: always a problem). The parent responses had to refer to the month preceding the administration of the survey (one month recall period). Subsequently, the items were reverse-scored and transformed to a 0–100 scale (lower to higher HRQoL).

We described continuous variables with normal distributions as mean ± standard deviation, and those with non-normal distributions as medians and ranges. Discrete variables were expressed as percentages for a 95% CI. We used Student's t-test or the Kruskall–Wallis test, when applicable, to compare continuous variables, and the chi squared test to compare discrete variables. The level of statistical significance was set at $P < .05$.

The study was assessed and approved by the Comité Institucional de Ética de Investigación en Salud (Institutional Ethics Committee for Health Research [CIEIS]) of the Polo Sanitario area and the Consejo de Evaluación Ética de Investigación en Salud (Ethical Evaluation Board for Health Research [CoEIS]), of the Ministerio de Salud (Health Ministry) of the government of Córdoba (Argentina). It has been entered in the Registro Provincial de Investigaciones en Salud (Provincial Registry of Health Studies [REPIS]), of the Ministerio de Salud of the government of the province of Cordoba (Argentina).

We obtained the informed consent of the parents who responded to the survey, explaining the objective of the study, the possible link between malnutrition and quality of life, and underscoring the confidentiality of the data.

Results

We reviewed 357 medical histories with a diagnostic code of malnutrition or severe malnutrition, and identified 48 patients that met the inclusion criteria based on admissions data. After applying the exclusion criteria, we obtained a sample of 29 eligible patients. Two of the home addresses were not correct, and two families refused to participate: four families out of 29 (13/8%; 95% CI, 3.8–31.6). We included 25 patients in the study group and 28 healthy school-aged siblings.

The HRQoL assessment was performed in 53 school-aged children from 25 families (25 children in the study group [47.2%; 95% CI, 33.5–62.6] and 28 children in the control group [52.8; 95% CI, 52.8–67.2]). The time that had elapsed since the diagnosis of malnutrition ranged from 3.5 to 9.9 years.

The data of the sociodemographic and baseline characteristics of the sample are shown in Tables 1 and 2.

The current anthropometric measurements showed a mean weight z score of −1.36 (±0.17) in the study group and −0.49 (±0.20) in the control group ($P < .0500$). In the study group, the mean height z score was −1.44 (±1.50) vs. −1.33 (±0.90) in the control group ($P = .0600$).

The HRQoL scores obtained with the PedsQL scale in children with a history of malnutrition, compared to their healthy siblings, were: global score 80.82 ± 1.94 vs 89.18 ± 1.84 ($P = .0001$), physical health dimension 87.75 ± 3.37 vs 94.75 ± 1.87 ($P = .0001$), psychosocial health 77.77 ± 2.90 vs 86.57 ± 1.42 ($P = .0001$), emotional dimension 67.80 ± 4.40 vs 78.75 ± 2.96 ($P = .0001$), social dimension 88.80 ± 3.05 vs 95.71 ± 1.52 ($P = .0001$), and school dimension 74.58 ± 3.80 vs 85.00 ± 3.51 ($P = .0001$) (Table 3).

Discussion

The main finding of this study was that early severe malnutrition was significantly associated with a considerable reduction in quality of life during school-age years in all areas studied (physical dimension/health and psychosocial health scores, and emotional, social, and school dimensions). To the best of our knowledge, this is the first report of this kind.

Table 1 Baseline sociodemographic characteristics of our sample for the study and control groups.

Variable	Study group N (% [95% CI])		Control group N (% [95% CI])		P-value
Number of participants					
Participants	25/53 (47.2 [32.8–61.5])		28/53 (52.8 [38.4–67.2])		0.4334

Variable	Study group		Control group		
	N	Mean (range) SD	N	Mean (range) SD	
Age of participant					
5–7 years	9/25	5.30 (4.93–5.90) 0.12	4/28	5.88 (5.18–6.66) 0.31	
8–12 years	16/25	8.74 (7.05–10.77) 0.4	24/28	10.01 (7.03–12.99) 0.32	

Variable	Study group	Control group N (% [95% CI])	P-value
Sex			
Male	9/25 (36 [15.2–56.8])	12/28 (43 [22.7–62.9])	0.4706

Variable	Study group N (% [95% CI])	Control group N (% [95% CI])	P-value
Schooling			
Age-appropriate level of schooling	20 (80 [59.2–93.3])	21 (72 [57.2–92.8])	0.5210

Table 2 Sociodemographic characteristics of the 25 families in the sample.

Variable	N (% [95% CI])
Description of parents' marital status	
Married or two-parent family	13 (52 [30.4–73.5])
Other: single, separated	12 (48 [26.4–69.5])
Mothers' level of education	
Illiterate	1 (4 [0.1–20.3])
Did not complete elementary school	2 (8 [0.9–26.1])
Completed elementary school	21 (84 [69.9–95.4])
Completed secondary school	0 (0 [0–13.7])
Completed college or tertiary degree	1 (4 [0.1–20.3])
SES score	
Stratum I	2 (8 [0.9–26.1])
Stratum II	3 (12 [2.5–31.2])
Stratum III	20 (80 [59.2–93.2])

Malnutrition in young children continues to be a serious public health problem in our country and across the world. Globally, there are 165 million children stunted by malnutrition, and the prevalence of wasting is 8%, according to a report published by the WHO in 2012.[2] In Argentina, the prevalence of severe malnutrition ranges from 1.9%[21] to 3.9%.[22] Sequelae of the central nervous system contribute to delays in skill development, learning disabilities, impaired adjustment skills, and loss of educational and occupational opportunities. In the long term, malnourished children will not have the same professional opportunities; human capital and productivity are affected in adulthood.[23,24] In 1973, Cravioto described the worst consequence of early malnutrition, its spiral effect: survivors of malnutrition will raise children under conditions that will give rise, almost inevitably, to a new generation of malnourished individuals.[8] The demographic data of the families in our sample revealed that they belonged to a socially disadvantaged group, with households typically sustained by informal employment. Most mothers had only completed elementary education. These sociodemographic circumstances in our patients, which predated participation in the study, carry a risk of non-organic malnutrition.[25,26]

Other family and social factors present among the respondents and associated with nutritional neglect and risk were, among others, employment instability,[27] poverty,[19–29] single-parent household,[27] and degree of overcrowding. Kleinman described children with insufficient nutrition and

Table 3 Description of the Spanish version of the PedsQL 4.0 scale for Argentina.

Scale	Study group Mean ± SD	Control group Mean ± SD	P
Global score	80.82 ± 1.94	89.18 ± 1.84	<.0001
Health/physical dimension	87.75 ± 3.37	94.75 ± 1.87	<.0001
Psychosocial health	77.77 ± 2.90	86.57 ± 1.42	<.0001
Emotional dimension	67.80 ± 4.40	78.75 ± 2.96	<.0001
Social dimension	88.80 ± 3.05	95.71 ± 1.52	<.0001
School dimension	74.58 ± 3.80	85.00 ± 3.51	<.0001

hunger who showed psychosocial dysfunction more frequently than those of the same communities that did not report similar experiences.[30]

Our patients were severely malnourished at an early age, with risk of serious sequelae in the mid- and long-term. In current anthropometric measurements, the mean z score for weight and height in cases and controls shows deviations lower than ≤ 2, and while height is multifactorial, the finding of a lower height z score in cases compared to their control siblings seemed to suggest a chronic evolution.

Falling behind in school occurred in one fifth of participants, including cases and controls. The regression analysis performed by Alaimo on 3286 children and 2063 adolescents with insufficient nutrition revealed that they had lower arithmetic scores and were more likely to have repeated a grade, have seen a psychologist, and have had difficulty getting along with their peers.[31] Sameroff studied the intelligence scores of a group of children aged 4 to 13 years in relation to family and social risk factors, and found that the lowest intelligence coefficients were associated with a collection of factors rather than to isolated ones.[32] The low level of maternal educational attainment and unskilled labour as the source of income may have contributed to malnutrition in our sample, and therefore to poor academic achievement in study participants. Cases and controls in our study share the same risk factors for falling behind in school, yet children with a history of malnutrition scored lower on the school dimension. From the perspective of parents, this finding could be explained by combined emotional and social integration challenges that would add to the barriers to academic achievement.

The results obtained by applying the PedsQL 4.0 scale to 25 patients with a history of severe malnutrition and 28 controls showed differences between the groups that may be related to the effect of early malnutrition on HRQoL in patients that had been affected by the condition.

The work of Roizen, carried out in Argentina with patients of sociodemographic characteristics similar to those of our patients, allows for comparisons based on belonging to a low stratum of SES and maternal educational level.[16] The study analysed 287 families with children and adolescents that had chronic diseases, comparing the perceived HRQoL as reported by children and adolescents, parents, and the treating physicians. There was agreement between the HRQoL reports of parents and children, and lower scores in the reports by physicians.[16]

When we analysed the four dimensions and the physical and psychosocial health scores for the HRQoL reports by the parents, we found differences between malnourished and healthy children. This was the main finding of our study.

Since there are no previous studies on HRQoL in malnourished children, comparisons may be made with other research on chronic conditions associated with malnutrition: cystic fibrosis, gastrointestinal diseases,[33] cerebral palsy,[33] cancer[16] and AIDS.[16]

The global HRQoL score, and the physical and psychosocial health scores in healthy children were similar to those reported by Varni for children in developed countries,[15-33] and higher than those reported by Roizen for Argentina[16].

In all our comparisons with other studies, the physical health score in the malnourished children was higher, an unexpected result given that the motor sequelae of malnutrition mainly affect fine motor skills,[1-3] while in the conditions they are compared to, physical deterioration is often associated with the chronic diseases mentioned above.[16-33]

The dimensions that we considered most important in the context of our study were the emotional, social and school dimensions, which may be affected in malnourished children.

The psychosocial health scores in healthy children were similar to those reported in studies by Varni[15-33] in other countries, and higher than those reported by Roizen for Argentina.[16] The scores of malnourished children in our sample were similar to those reported for children with chronic conditions.[15,16]

Our working hypothesis was confirmed: early malnutrition can affect HRQoL in children due to its impact on wellbeing, happiness, and self-esteem. Galler reported that in the absence of appropriate interventions to manage malnutrition, compromised behavioural function may persist long beyond the episode, have a lasting impact on survivors, and increase the cost to society.[23] The comparison of HRQoL in children with a history of severe malnutrition and their healthy siblings can contribute to elucidating the consequences of nutrient deficiencies during critical periods of development.

Even in extreme poverty, there can be protective factors such as a mother's care, social support networks, and the skill to adapt to unfavourable environments.[26] It was the parents of the patients and the healthy siblings of those patients that filled out the questionnaires, so the social, economic, and cultural conditions are the same, and intrafamilial differences in HRQoL cannot be accounted for.

Were there early problems in attachment in malnourished children that influenced the care that they received? Did malnourished children have physiological or psychological characteristics that stunted their growth? If so, could this fact have affected their HRQoL? Research on the psychological and sociological features of these families could provide answers to these questions.

Our patients may not have reached their developmental potential due to malnutrition. The care received by children with a history of malnutrition has an impact on their personal futures and also on society, where the spiral effect will propagate the consequences of the nutritional deficiencies they experienced for generations. The assessment of HRQoL should be part of the holistic care of these patients, in order to adjust treatment as needed and promote parent involvement in care.

In describing HRQoL in children with severe malnutrition, this study suggests a way to make a more thorough follow up of the evolution of sequelae. It would also be possible to study whether the malnutrition associated to chronic conditions can contribute to a reduction in the quality of life in the children who suffer them.

Some strengths of this study are that it is the first study that describes the association between malnutrition and a reduction in quality of life, with few losses to follow-up and recovery, resulting in a strong statistical significance.

There are limitations to this study, as the initial data were collected retrospectively, which could lead to missing data bias, recall bias, and selection bias.

The results of this study show that patients with a history of early severe malnutrition had a significant reduction in HRQoL compared to their healthy siblings in the areas of physical, psychosocial, emotional, social, and school functioning.

Funding

Conflicts of interest

The authors have no conflicts of interest to declare.

References

1. Galler JR, Shumsky JS, Morgane PJ. Malnutrition and brain development. In: Walker WA, Watkins JB, editors. Nutrition in pediatrics. London: BC Publisher; 1997. p. 196–212.
2. United Nations Children's Fund, World Health Organization, The World Bank. UNICEFWHO-World Bank. Joint child malnutrition estimates. New York/Geneva/Washington, DC: UNICEF/WHO/The World Bank; 2012. Available from: www.who.int/entity/nutgrowthdb/estimates2012/en/-24k [accessed 25.03.06].
3. Galler JR, Ramsey F, Salt P, Archer E. Long-term effects of early kwashiorkor compared with marasmus: III. Fine motor skills. J Pediatr Gastroenterol Nutr. 1987;6:855–959.
4. Gorman K, Pollitt E. Does schooling buffer the effects of early risk. Child Dev. 1996;67:314–26.
5. Isaacs E, Gadian D, Sabatini S, Chong W, Quinn B, Fischl B, et al. The effect of human diet on caudate volumes and IQ. Pediatr Res. 2008;63:308–14.
6. Williams C. Food for thought: brain, genes and nutrition. Brain Res. 2008;1237:1–4. Available from: www.elsevier.com/locate/brainres
7. Waterlow JC. Malnutrición proteico energética. Washington, DC: OPS; 1996.
8. Cravioto J, DeLicardie E. Nutrition and behavior and learning. In: Basel K, editor. Food nutrition and health: world review of nutrition and dietetics. Washington: Rechcigl Ed; 1973. p. 80–96.
9. OĎonnell A. Una visión de la problemática nutricional de los niños argentinos. In: OĎonnell A, Carmuega E, editors. Salud y calidad de vida de los niños argentinos. Buenos Aires: Publicación CESNI; 1999. p. 119–52.
10. Cravioto J, Cravioto P. Algunas consecuencias psico biológicas a largo plazo de la malnutrición. Anales Nestlé. 1993;48:55–66.
11. Brock D. Medidas de la calidad de vida en el cuidado de la salud y la ética médica. In: Nussbaum M, Sen A, editors. La calidad de vida. México, DF: Editorial Fondo de cultura económica; 1996. p. 135–81.
12. Gill TM, Feinstein ARA. Critical appraisal of the quality of life measurements. J Am Med Assoc. 1994;272:619–26.
13. Eiser C, Morse R. A review of measures of quality of life for children with chronic illness. Arch Dis Child. 2001;84:205–11.
14. Sanders C, Egger M, Donovan J, Tallon D, Frankel S. Reporting on quality of life in randomized controlled trials: bibliographic study. Br Med J. 1998;317:1191–4.
15. Varni J, Limbers C, Burwinkle T. Parent proxy-report of their children' health related quality of life. Health Qual Life Outcomes. 2007;5:2. Available from: http://www.hqlo.com/content/5/1/2
16. Roizen M, Rodriguez S, Bauer G, Medin G, Bevilacqua S, Varni J, et al. Initial validation of the Argentinean Spanish version of the PedsQL 4.0 Generic Core Scale in children and adolescents with chronic diseases: acceptability and comprehensibility in low income settings. Health Qual Life Outcomes. 2008;6:59.
17. Van den Broeck J, Willie D, Younger N. The World Health Organization child growth standards: expected implications for clinical and epidemiological research. Eur J Pediatr. 2009;168:247–51, http://dx.doi.org/10.1007/s00431-008-0796-9.
18. CESNI. Proyecto Tierra del Fuego. Diagnóstico basal de salud y nutrición. Buenos Aires: Edición Fundación Jorge Macri; 1995. p. 28–34.
19. Chesta M, Lobo B, Agrelo F, Carmuega E, Sabulski J, Durán P, et al. Evaluación antropométrica en niños de la ciudad de Córdoba. Año 2000. Arch Arg Pediatr. 2007;105:101–8.
20. Varni JW, Seid M, Kurtin P. The PedsQL™ 4.0: reliability and validity of the Pediatric Quality of Life Inventory™ Version 4.0 Generic Core Scales in healthy and patient populations. Med Care. 2001;39:800–12.
21. Gomila AA, De Grandis ES, Visconti G, Montero S, Bertero M, Marietti G, et al. Estado nutricional en niños internados en salas de cuidados mínimos. Hospital de Niños de la Santísima Trinidad. Córdoba. Arch Argent Pediatr. 2009;107:37–42.
22. Encuesta nacional de Nutrición y Salud (ENNyS). Available from: http://www.msal.org.ar [accessed 25.03.06].
23. Galler JR, Barret LR. Children and famine: long-term impact on development. Ambul Child Health. 2001;7:85–95.
24. Behrman J, Hoddinott J, Maluccio J, Soler Hampejsck E, Behrmen E, Martorell R, et al. What determines adult cognitive skills? Experiences in Guatemala. PARC working paper series. IFPRI discussion paper 00826; 2008.
25. Cravioto J, DeLicardie E, Birch H. Nutrition, growth and neurointegrative development: an experimental and ecologic study. Pediatrics. 1966;38:319–20.
26. Reyes H, Perez Cuevas R, Sandoval A, Castillo R, Santos J, Doubova S, et al. The family as a determinant of stunting in children living in conditions of extreme poverty: a case control study. BMC Public Health. 2004;4:57, http://dx.doi.org/10.1186/1471-2458-4-57.
27. Block R, Krebs N, The Committee on Child Abuse and Neglect and the Committee on Nutrition. Failure to thrive as a manifestation of child neglect. Pediatrics. 2005;116:1234–7.
28. Varni JW, Seid M, Rode C. The PedsQL™: measurement model for the Pediatric Quality of Life Inventory. Med Care. 1999;37:126–39.
29. Mohsena M, Mascie-Taylor CG, Goto R. Association between socio-economic status and childhood under nutrition in Bangladesh; a comparison of possession score and poverty index. Public Health Nutr. 2010;13:1498–504.
30. Kleinman R, Murphy M, Little M, Pagano M, Wehler C, Regal K, et al. Hunger in children in the United States: potential behavioral and emotional correlates. Pediatrics. 1998;101:E3. Available from: http://www.pediatrics.org/cgi/content/full/101/1/e3
31. Alaimo K, Olson C, Frongillo E. Food insufficiency and American school-aged children's cognitive, academic, and psychosocial development. Pediatrics. 2001;108:44–53.
32. Sameroff AJ, Seifer R, Baldwin A, Baldwin C. Stability of intelligence from preschool to adolescence: the influence of social and family risk factors. Child Dev. 1993;64:80–97, http://dx.doi.org/10.1111/j.1467-8624.1993.tb02896.
33. Varni JW, Limbers C, Burwinkle T. 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 Qual Life Outcomes. 2007;5:43, http://dx.doi.org/10.1186/1477-7525-5-43. Available from: http://www.hqlo.com/content/5/1/43