Acta Pediatr. Port., 1999; N.º 4; Vol. 30: 265-9

Má Nutrição Infantil: Crescimento e Amadurecimento Esquelético

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Summary

Objective: To study longitudinal the growth and skeletal maturation (SM) in undernourished children compared with eutrophic children.

Material and Method: Samples of 68 children ages 0-2 were selected from patients, primary malnourished who attend the Nutritional Rehabilitation Unit of the Children's Hospital «SSM Ludovica» in La Plata. Anthropometric evaluation and a left hand x-ray was performed upon admission and two year follow-up. The experimental population (EP) was paired by sex, age and social economic level with an eutrophic control population (CP). Skeletal maturation (SM) was evaluated with the Greulich and Pyle Atlas (GPA).

Results: First evaluation: A systematic retardation of the SM was detected in relation to the chronological ages (mean deficit 36,3%). The nutritional state was according to weight/age 46% undernourished DCP I degree, 49% DCP II degree and 5% DCP III degree; according to weight/height 13% eutrophic, 84% DCP I degree, 3% DCP II degree; according to heigth/age 14,7% eutrophic, 77,94% DCP I degree, 7,35 DCP II degree. Second evaluation: A significant difference was observed between SM and EP regarding the GPA (mean deficit 31,8%). However it showed a significant improvement between the first evaluation (mean deficit 36,3%) and the last (mean deficit 31,8%) (X2 = 149,422).

The nutritional state according to the weight/height indicator was 46% eutrophic, 40% DCP I degree, 14% DCP II degree. According to the weight/height indicator 95% eutrophic and 5% DCP I degree. According to the height/age indicator 56,9% eutrophic, leaving 37,0% with a I degree deficit, 6,1% with a II degree deficit. The SM of the EP in relation to the CP showed significant differences in the first as well as in the second evaluation (X2 = 573,412 and 323,911 respectively).

Conclusions: The EP presents a deficit in height and systematic retardation of the SM which, in spite improved although significantly, it didn't reach normal levels after two years follow-up. The EP although had recorverd weight for height.

Key-Words: Skeletal malnutrition, growth, pediatrics.

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Subsidized: Comission Scientific Research of Prov. de Buenos Aires.
Presented and approved in the XI Congress of the Latin-American Society of Nutrition (SLAN).
9-15 November 1997, Guatemala.
Entregue para publicação em 15/06/98.
Aceite para publicação em 14/10/98.

Infant Malnutrition: Growth and Skeletal Maturation

Introduction

The retardation in growth descripted in unfavorable environmental conditions is considered by different authors as an adaptive process, interpreted as a real strategy of survival in highly poor environments where there is a high prevalence of malnutrition [1].

The alteration of height is very sensible to malnutrition [2]. Different studies in Latin-America, Africa, The Philippines, New Guinea, India, etc. showed that around 40% of the children younger than five years of age present a retardation in growth in relation to the standards of the National Center for Health Statistics [3] of the United States, caused by malnutrition [4] and it reports an improvement in height in the last decades in European, American and Japanese populations with a better social economic status. A national study performed in emergency neighborhoods in the surroundings of Buenos Aires shows that 36,4% of the children 0-5 years of age present a shortage of eight (CIC-UNICEF 1988) [5]. A follow-up of children with malnutrition in the Nutritional Rehabilitation Unit of the Children's Hospital in La Plata showed a disminution of height for the age [6]. The skeletal maturation is also susceptible to the environmental and genetic factos and presents greater vulnerability and risk in the periods of rapid growth such as are the first year of life and adolescence.

Frisancho [7] in Peru, Dreizen [8] in Mexico, Levine [9], Pretoria Briers [10] and Keat [11] in Africa, Behar and Colb [12] and Garn [13] in Guatemala demonstrate a delay in the skeletal maturation in undernourished children in low

social classes with chronic deficiency of calories for their age group. Zayas [14], Spies and Salomon [15] perform comparative studies of skeletal maturation in undernourished and eutrophic children demonstrating a delay in the skeletal maturation in the undernourished children. These observations suggest that although malnutrition is a factor which particularly aggravates the skeletal maturation process in children who aren't undernourished, a deviation of normality was also observed which may be caused by a negative action of the environment not as critical as malnutrition but equally adverse for growth and maturation.

Objectives

a) To evaluate the effects an growth of a mild malnutrition the outskirts of Buenos Aires state.

b) To compare the levels of skeletal maturation in undernourished children with eutrophic children.

Population studied

Experimental group

68 children with moderate malnutrition of low social economic level where studied in a prospective and longitudinal follow-up in the Nutritional Rehabilitation Unit of the Children's Hospital «SSM Ludovica» of city, La Plata, in a 24 month period.

Control group

The control group was made up of two transversal control samples of eutrophic children without malnutrition antecedents, chosen from the Consulting Unit of healthy lactating infants, which were paired by sex, age, social economic level (SEL), with the experimental group, in two times, a control group with an experimental group upon admission, and the second upon discharge or second evaluation.

Methods and Criteria

A clinical – nutritional examination, anthropometric measures, left hand x-ray and monthly nutrition was supply was evaluated in each of the children of the experimental group.

Anthropometric measures

The weight/height was taken and the adequation weight/age, weight/height and height/age was interpreted as well as the velocity of growth according to the anthropometric standards for pediatric evaluation of physical growth recommended by the Committee of Growth and Development of the Argentine Pediatric Society [16, 17, 18].

Radiological Study of the hand and wrist

Two x-rays of the left hand and wrist were obtained of each child in the sample, according to the technique described by Greulich and Pyle [19] one upon admission and other during the evolution, with a 24 month interval.

The classification was performed with the Greulich and Pyle Atlas observing the following requisites: 1) evaluation of the wrist and rest of the bones (radius, large and short bones). 2) when no coincidence existed between the section of the hand evaluated and the standard on the Atlas, the sample was calculated between the three most proximal models. 3) the skeletal age expressed in months was obtained from the mean pondered, between the wrist, which was considered one, and the radius and short bones considered two [20].

Social economic level (SEL)

To measure SEL, the Specific Index was for low income populations [21].

Results

Experimental group

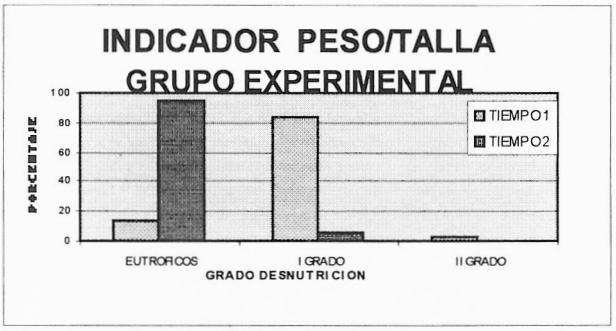
Anthropometric data:

First evaluation: According to the weight/age indicator 46% was found, slightly undernourished, 49% moderate undernourished and 5% seriously undernourished. According to weight/size 84% undernourished I degree, 3% II degree and 13% normal. According to height/age 78% I degree, 7% II degree and 15% normal (graphics 1, 2, 3).

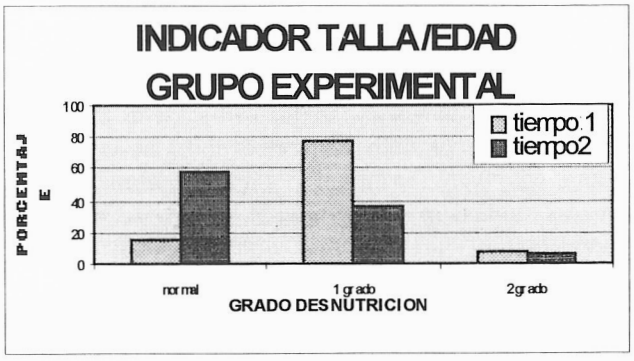
Last evaluation: presented according to the weight/ /size indicator 46% normal, 40% I degree, 14% II degree. According to weight/height 85% normal, 5% I degree. According to size/age 57% normal, 38% I degree and 5% II degree.

Analysis of Anthropometric data: The statistical analysis between the nutritional categorization weight/ /age performed initially differed in a highly significant manner from the posterior categorization: $X2=3380.62P,0,01$. The height/age adequation in the first evaluation (mean deficit = 8,25%) and the second (mean deficit +3,98) shows that improvement is significant. ($X2=74,4062.P<0,001$).

GRAPHIC 1

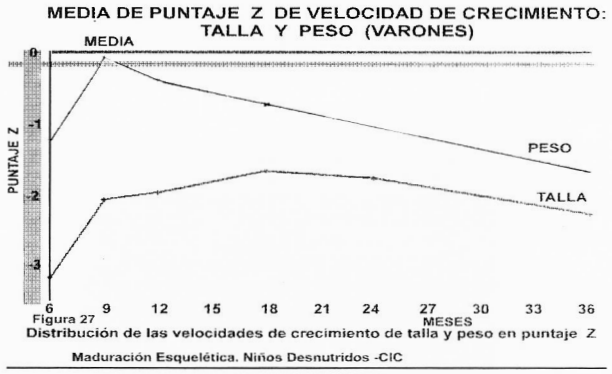


GRAPHIC 2

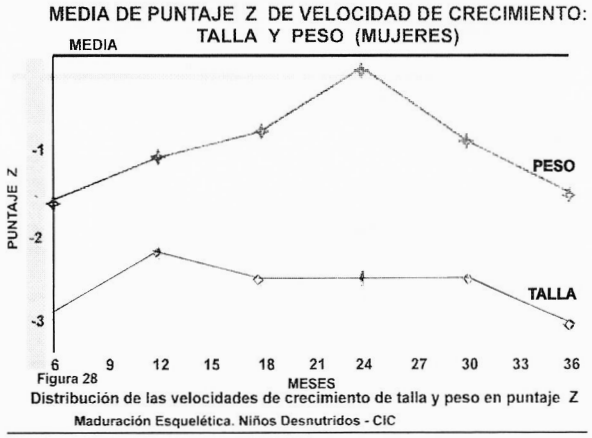


GRAPHIC 3

The growth velocity of the undernourished children studied, [22] in height as well as in weight, the percentiles remained between 3 and 97, when the mean of the variables was graphed over the standard curves a constant tendency of placing itself under 50 percentile was observed, being this tendency most noted for height than for weight. In fact, meanwhile the mean velocity of variation of weight maintains itself between 3 and 10 percentiles of the standard in boys as well as in girls, the velocity of growth in height shows, in constant manner in both sexes, below 3 percentile of the standard. The velocity of increase in heigth and weight is represented in figures 4 and 5, expressed in score Z. An increase in weight and height between six and nine months is visible from the observation of these results with a slow growth, pattern below 0 value – mean value – and a lower increase in height in relation to weight.



GRAPHIC 4



GRAPHIC 5

Skeletal maduration

A delay of skeletal maturation was detected in relation to the chronological ages (SM).

In the second determination of skeletal maturation the majority obtained was below the relation OA/CA (graphic 6, 7). The categorization of the skeletal maturation deficit determined in the first x-ray (mean deficit 36,3%) and of the skeletalmaturation in the second x-ray (mean deficit 31,8%) was statistically significant X2=149,422.

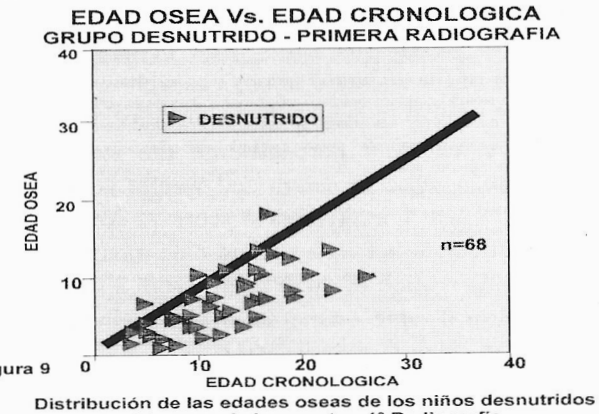


Figura 9

Distribución de las edades oseas de los niños desnutridos al ingreso de la muestra -1ª Radiografia

Maduración Esquelética, Niños desnutridos - CIC

GRAPHIC 6

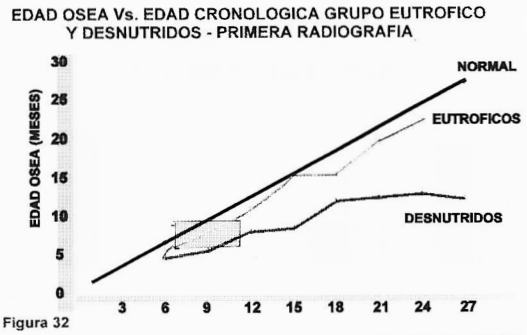


Figura 32

Distribución de las edades óseas de la muestra de niños desnutridos apareados con la muestra de niños eutróficos

Maduración Esquelética, Niños Desnutridos - CIC

GRAPHIC 8

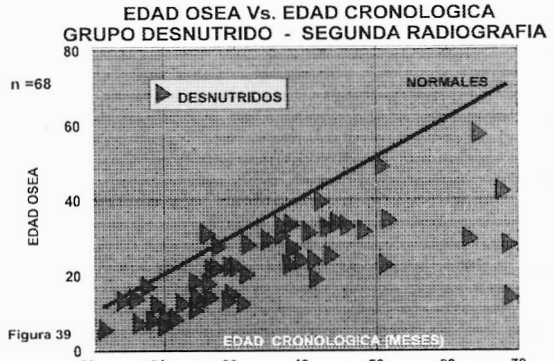


Figura 39

Distribución de las edades óseas de los niños desnutridos en la segunda evaluación

Maduración Esquelética, Niños Desnutridos - CIC

GRAPHIC 7

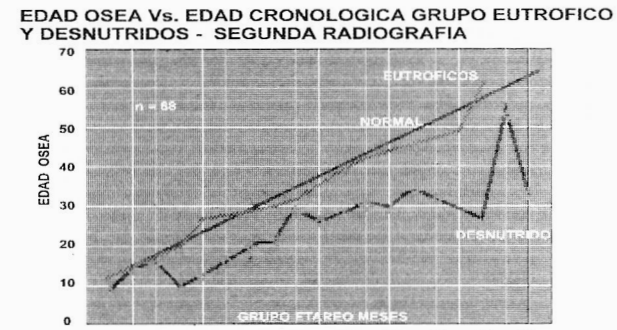


FIGURA 30 Curva de distribución de las edades oseas de los niños desnutridos, apareados con la muestra de niños eutróficos. 2ª Radiografia.

Maduración Esquelética. Niños Desnutridos - CIC

GRAPHIC 9

Analysis of Skeletal Maturation Data

The process of recuperation of skeletal maturation in the experimental group shows a significant improvement between the evaluation performed upon admission to the study and the last two years later. However, the proven improvement didn't allow to reach the required levels by the standard for the normal diagnosis.

Comparison between the experimental group and the control group

The differences were reflected between both samples from the analysis of the skeletal maturation of the control group paired by sex and age with the experimental group, that analyzed statistically were highly significant for the first x-ray (X=573,412) as for the second (X2=323,911).

The differences in the means of the skeletal maturation from the samples of undernourished children, in the first and second x-rays and the samples of eutrophic children, are shown in figure 8.

Conclusions

The growth in weight/height and skeletal maturation in a population of undernourished children, selected at random, who were submitted to a nutritional recuperation plan was studied in a longitudinal survey; such samples were paired by sex and age with a control group of eutrophic children.

We to observe, in the experimental group, a significant difference between the skeletal maturation with respect to standard (Greulich and Pyle Atlas). The recuperation process showed a significant improvement without reaching normality.

In the evolution, it could be observed that differences between groups occurred in the ages were ossification centers appeared. The skeletal maduration of both groups shows significant differences between them upon admission as well as at the end of the evaluation. The osseous age of the control group, although approximate to the mean standard of Greulich and Pyle, practically never overpassed it.

When analyzing the anthropometric indicators the majority presented recuperation weight/height in a short period of time. On the contrary, it was verified that only half of the samples presented recuperation weight/age and the samples height/age showed significant modifications between the beginning and the end of the study, being this improvement less than to the improvement of weight/age.

This results agrees with others, in a sense that weight improves faster than size which needs more time to recuperate.

The analysis of Z in velocity of growth reaffirmed what was point out first. It allowed to observe in both sexes, in the period between the second and third trimester of age, an increase in weight and size followed by a progressive deceleration without reaching normality at the end of the observation.

This alteration in velocity and growth was more evident in height than in weight, which results in low stature and a proportionate weight.

Discussion

The conclusions reached allowed to formulate some interrogatives. First, it could be pointed out that once installed the process of undernourishment affected the weight, height, relation between both and skeletal maturation, altering in this manner, growth and development in the child, which was substitued by a phenomenon of homeotthesis adaptive type. Its' consequence was an initial flattening of the growth curve with a posterior increase of its rhythm but without recuperation of the body height, phenomenon described by Ramos Galvan [(1)].

Growth in children of poor communities, with unsatisfied basic necessities, shows a weight and height velocity with good improvement in the firsts months, beginin them a decrease below the reference curves [(23)].

The longitudinal follow up of the skeletal maturation demonstrated offered a dynamic perspective, that to with the anthropometric measurements, allowed us a to better understanding malnutrition and the magnitude of its consequences in the process of growth and development of the child.

Acknowledgments: To the doctors of the Nutritional Rehabilitation Unit and the healthy Infants Consulting Office, Luis Gobelian for the realization of the graphics.

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