

Clinical and Laboratory Pearl

Nutritional Status and Dietary Habits of Indian Children From Alto Xingu (Central Brazil) According to Age

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Key words: Sulamerican Indians, nutritional evaluation, dietary habits

Objective: To evaluate the nutritional status and dietary habits of children of the Alto Xingu, Central Brazil, according to age.

Subjects: 172 Indian children (<10 years of age) of Alto Xingu tribes.

Methods: Date of birth, sex, weight, height (NCHS reference) and questionnaire of dietary habits at the time of field work.

Results: Of the 103 children less than 5 years of age, 34% presented protein-energy malnutrition (PEM), according to Gomez's criteria, of which only 2% with grade II malnutrition and no child presented severe PEM. In relation to the Z scores for the 172 children studied, it was observed that those younger than 1 year (n=25) presented weight for age (median, M=+0.43) and weight for height (M=+1.33) greater ($p<0.05$) than the children with ages between 12 and 60 months (n=78) (weight for age, M=-0.54; weight for height, M=+0.29) and between 60 and 120 months (n=69) (weight for age, M=-0.78; weight for height, M=+0.27). The height for age Z scores for the population studied showed a shift to the left in relation to the reference population in the three age groups (<12 months, M=-0.95; 12 to 60 months, M=-1.22 and 60 to 120 months, M=-1.40). The mothers nursed, without exception, to the age of 24 months, and the frequency of breastfeeding decreased progressively to age 42 months. The introduction of solid foods started at the age of 6 months and after the 10th month all the children ate "beiju" (flat bread), fruit and fish.

Conclusion: The nutritional status of Alto Xingu Indian children, in 1992, is adequate and similar to that previously observed between 1974 and 1980.

INTRODUCTION

During recent decades, many Indian tribes of the Amazon region moved from a situation of semi-isolation or intermittent contact with Brazilian society to a more intense type of contact, motivated by the opening of roads and of farms and by the appearance of cities in the proximities of Indian lands. The introduction of new habits and customs is expected during this process, which may alter the standard of health and disease of these peoples. These alterations may be detected by studies conducted at different times among the same Indian population. Thus, we undertook to study the nutritional conditions and dietary habits of the Indians of the Alto Xingu Basin, in Central Brazil. This population encompasses 10 Indian tribes who belong to different linguistic groups but maintain a common culture, preserving many of their traditional habits and customs.

Another reason for carrying out this study was to compare its results with those previously obtained in the infantile population of the Alto Xingu at the end of the 1970s [1,2]. At that time, anthropometric methods were used independently of age due to the lack of date of birth information. The comparison between the two studies will allow us to determine if modifications in the nutritional status of children of the Alto Xingu have occurred during this period.

MATERIALS AND METHODS

Indians of the Alto Xingu

The region of the Alto Xingu Basin is located in the State of Mato Grosso, in an area of approximately 15,000 km², between

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11° and 13° south latitude and 52° and 54° west longitude. It is a transition zone between the last patches of stunted vegetation “cerrado” of the central plateau and the Amazon forest to the north, having an extensive hydrographical network formed by several rivers, their tributaries, “igarapés” and lakes. The confluence of the Coluene, Ronuro and Batovi Rivers forms the Xingu River (which flows North) and marks the northern limit of the Alto Xingu. The region is inhabited by 10 Indian tribes which belong to the Aruaque, Carib and Tupi linguistic groups, in addition to the isolated language of the Trumai tribe. The Aueti and Camaiurá tribes belong to the Tupi linguistic group, the Iualapiti, Meinaco and Uaurá tribes are part of the Aruaque group, while the Calapalo, Coicuro, Matipu and Nafuquá tribes belong to the Carib linguistic group [3].

It is not known when these tribes migrated to the area of the Alto Xingu nor from where these migratory movements originated. There are indications that the occupation of this area occurred in the distant past. The first description of these tribes was made by Karl von den Steinen who traveled the Alto Xingu in 1884 and in 1887, finding the above mentioned tribes in a state of pure culture and complete isolation. The relationship and long coexistence in a single geographic area, and the high frequency of inter-tribal marriages led these tribes to display great similarity in their habits and customs, in their dwellings and dietary standards, so as to be considered as holders of a common culture, known as the Xingu Culture or of the Alto Xingu. Manioc (*Manihot utilissima*) and fish form the dietary base. Other foods are consumed less regularly, such as corn, peanuts and sweet potatoes. Among fruits, the most consumed are bananas and “piqui”, the latter consumed when in season, contains a yellow pulp rich in vitamin A. Generally, wild animals are not consumed due to food taboos. The exceptions are monkeys and some larger birds, such as the jacu and the mutum, which are sporadically used as food. Breast feeding of the young, upon demand, is practiced universally. As exact ages were not available in the past studies, it is not known when the introduction of foods different from maternal milk took place. However, it was noted that breast feeding extended beyond the first year of life [1,2].

It is important to note that, since 1965, the Department of Preventive Medicine of Federal University of São Paulo, has been carrying out a medical health care program with educational, assistance and preventive activities involving the progressive participation of community members as partners in planning and executing health care projects.

Field Work and Case Study

The field work was carried out in villages of the Alto Xingu in September 1992, concomitantly with the immunization and medical activities. In the nutritional inquiry, all children present in the village who were then 10 years old or less were included. Due to the fact that this population is relatively small and, principally, it is the custom of Alto Xingu Indians to leave their

villages to fish and visit other tribes, it was not possible to establish a probabilistic sample.

The study included 172 children, 91 males and 81 females, corresponding to 23.2% of the children in the Alto Xingu aged 10 years or less. No child was omitted due to sickness or parental objection.

Identification of the children was based on individual medical records used by the Environmental and Health Unit of the Department of Preventive Medicine of the Federal University of São Paulo—Escola Paulista de Medicina. These records contain information regarding the overall health and immunizations of each Indian and includes sex, tribe, name(s), date of birth, in addition to a photograph which is periodically updated.

Information was collected directly from the mother or father with all the interviews being carried out jointly by two researchers. Few communications between the Indians and the team required the presence of an Indian health agent as the majority of the adult population of the Alto Xingu is capable of basic communication in Portuguese. The foods that the children were receiving at the time of the study were noted. Questions that required recall were not used for determining the time when various foods were introduced.

Weight was checked with the use of a digital balance with a 150 kg capacity and precision of 100 g, operating with alkaline batteries. The scale was the same model used in the National Health and Nutrition Study carried out in Brazil in 1989 [4]. The children were weighed in the nude. When necessary, the technique of double weighing of child with the mother was used: first weighing the mother and then the mother and child with the desired weight calculated by difference. The height of the children less than 2 years old was obtained by lying them on their backs and measuring them with a wooden anthropometric ruler, 100 cm long, equipped with a movable cursor. The children older than 2 years were measured with a Stanley tape. This inelastic steel tape, rolled and encased, and having a front sight aperture, measures 200 cm. It is equipped with a movable cursor, perpendicular to the ground, which extends the tape for measuring height. The tape is fixed to a smooth wall or similar surface in the villages (wooden board or straight trunk) where the children stood to obtain complete straightening of the legs and spine for measuring. On the ground, a level wooden platform was used to avoid imprecision in the measurements due to surface irregularities.

Complete physical examinations were carried out, with special attention to clinical signs of nutritional disturbances as recommended by Jelliffe [5], and for the detection of enlargement of the spleen.

Analyses of Weight and Height Measurements

The anthropometric indices, percentiles and Z-scores, were calculated with the use of the ANTHRO program which presents these indices in relation to the weight and height of the reference population, National Center for Health Statistics

(NCHS) [6]. Gomez's criteria [7], based on percentages of weight for age, was applied to the children 60 months or younger, according to the following limits: eutrophy >90%; grade I protein-energy malnutrition between 75 to 90%; grade II, between 60 to 74%; and grade III <60%. For the weight for height index, the classification proposed by Macias [8] was considered: eutrophy ≥90%; grade I protein-energy malnutrition, 80 to 89%; grade II, 70 to 79%; and grade III, <70%. The prevalence of malnutrition was also estimated on the basis of the proportion of children with anthropometric indices less than -2 Z-scores, according to present recommendations of the World Health Organization [9].

The statistical analyses were carried out with the use of the programs EPI INFO 5.0 [10] and SIGMA STAT FOR WINDOWS [11].

RESULTS

During the physical examinations, no signs that suggested severe protein-energy malnutrition were observed in any child. Signs suggestive of vitamin deficiencies or specific nutritional deficiencies were not observed. During the field work, there was no clinical indication of any acute case of malaria, neither in the children participating in the study nor in other members of the community. Slight enlargement of the spleen was observed in three children (2.3%).

No significant statistical differences were noted in nutritional indicators according to sex. Therefore, the results for male and female children are presented together.

Table 1 presents the nutritional condition according to Gomez's criteria for the children with ages <60 months.

Table 2 presents the weight for height index for three age groups: 0 to 12 months, 12 to 60 months and 60 to 120 months.

Table 3 shows the number of children with Z-scores <-2 for the indices weight for age, weight for height, and height for age.

Table 4 presents the medians and 25 and 75 percentiles of the Z scores for weight for age, weight for height, and height for age, and the corresponding statistical study comparing these parameters in the 0 to 12 months, 12 to 60 months, and 60 to 120 months age groups.

Fig. 1 shows Z score distribution of weight for age, weight

Table 2. Nutritional Status of the Indian Children from Alto Xingu, Central Brazil, According to the Index Weight for Height, in 1992

%	Age group (months)		
	0-12 (n=25)	12-60 (n=78)	60-120 (n=69)
Weight-height			
80-90	0 (0%)	3 (3.9%)	0 (0.0%)
90-100	1 (4.0%)	24 (30.8%)	23 (33.3%)
100-110	3 (12.0%)	40 (51.3%)	40 (58.0%)
110-120	14 (56.0%)	10 (12.8%)	5 (7.3%)
>120	7 (28.0%)	1 (1.2%)	1 (1.4%)

Table 3. Number and Percentual of Indian Children from Alto Xingu, Central Brazil, Presenting Z-score <-2 for the Indices Weight for Height, Height for Age and Weight for Age, According to the Age Group

Z-score (< -2)	Age group (months)		
	0-12 (n=25)	12-60 (n=78)	60-120 (n=69)
Weight for age	1 (4.0%)	1 (1.3%)	2 (2.9%)
Weight for height	0 (0%)	0 (0%)	0 (0%)
Height for age	4 (16.0%)	17 (21.8%)	13 (18.8%)

for height and height for age, relative to the expected distribution for the NCHS reference population.

Table 5 presents the distribution of breast feeding children according to age. Table 6 shows the consumption frequency of basic foods in the Alto Xingu diet according to age.

DISCUSSION

In this study, the selection of the anthropometric criteria, Z scores with cutoff limit of -2.0, was based on the international recommendations of the World Health Organization [9]. Gomez's criteria was used because it had also been used in the last study of the prevalence of malnutrition in Brazilian children carried out by INAN in 1989 [4]. The weight for height index was used because it was the principal nutritional indicator in previous studies in the Alto Xingu [1,2].

Table 1. Nutritional Status of the Indian Children from Alto Xingu, Central Brazil, According to Gomez Criteria, in 1992

Gomez Criteria	Age group (months)			Total (n=103)
	0-6 (n=13)	6-12 (n=12)	12-60 (n=78)	
Eutrophy	12 (92.3%)	8 (66.7%)	48 (61.5%)	68 (66.0%)
PEM I	1 (7.7%)	3 (25.0%)	29 (37.2%)	33 (32.0%)
PEM II	—	1 (8.3%)	1 (1.3%)	2 (2.0%)

PEM=protein-energy malnutrition.

No child with PEM III.

Table 4. Medians and Percentiles 25 and 75 (P25 P75) of the Z-Scores for Weight for Age, Weight for Height and Height for Age for the Indian Children of Alto Xingu, Central Brazil, According to the Age Group, in 1992

Z-Score	Age group (months)			Kruskal-Wallis
	0-12 m (n=25)	12-60 m (n=78)	60-120 m (n=69)	
Weight for age				
Median	+0,43	-0,54	-0,78	p≤0,0001*
(P25 75)	(-0.31 +1.07)	(-1.22 +0.02)	(-1.35 -0.22)	p≤0,0001*
Weight for height				
Median	+1,33	+0,29	+0,27	p≤0,0001*
(P25 75)	(+1.05 +1.98)	(-0.22 +0.78)	(-0.21 +0.61)	
Height for age				
Median	-0,95	-1,22	-1,40	p=0,465
(P25 P75)	(-1.84 -0.53)	(-1.91 -0.57)	(-1.79 -0.79)	

Dunn Test

Weight for age

0-12×12-60⇒p<0,05*

0-12×60-120⇒p<0,05*

12-60×60-120⇒p>0,05

Weight for height

0-12×12-60⇒p<0,05*

0-12×60-120⇒p<0,05*

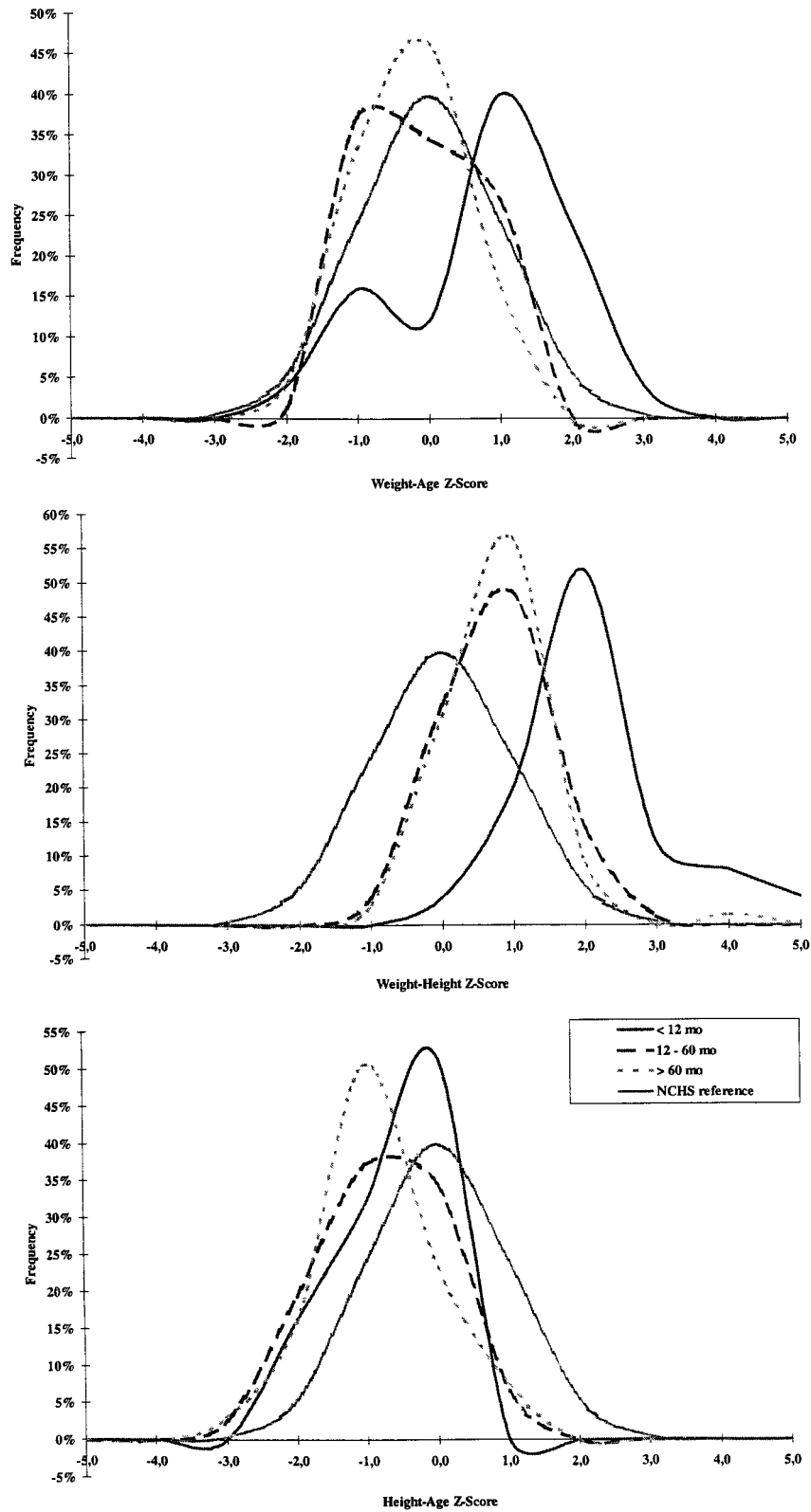
12-60×60-120⇒p>0,05.

Between 1974 and 1980, the prevalence of current malnutrition (weight for height <90%, according to the NCHS) in the Alto Xingu was 1.0% in children younger than 1 year, 2.8% for those between 1 and 5 years and 1.1% in those older than 5 years [2]. The results of the present study, carried out in 1992, are very similar (Table 2), showing that the nutritional condition of the Alto Xingu Indian children has not changed in this 12-year interval.

Considering Gomez's criteria, the prevalence of malnutrition in 1992 was 34.0%, with absolute predominance of grade I malnutrition (32.0%), corresponding to a weight for age deficit in the standard deviation range of -1.0 and -2.0 relative to the NCHS. Recent estimates referring to the prevalence of malnutrition among Brazilian children, showed similar rates based on the occurrence of overall malnutrition in Brazil which was of 30.7% with 5% of moderate to severe malnutrition [4]. When considering only the children residing in the rural areas of Brazil who, theoretically, live in conditions more similar to those of the Alto Xingu population, a higher prevalence of overall malnutrition is noted, 41.6%, of which 7.8% is in the moderate to severe range [4]. The study carried out by INAN shows the early installation of malnutrition in 21.8% of children less than 6 months old, 6.0% of these with moderate to severe malnutrition, with breast feeding continuing through the sixth month occurring in only one-half of the children [4]. This situation is diametrically opposed to that observed in the Alto Xingu where prolonged breast feeding throughout the first years is the rule and may explain why the malnutrition rate three times lower, according to Gomez's criteria, during the first 6 months of life (one case in 13 children: 7.7%) and the absence of cases of moderate to severe malnutrition.

The Z score analyses presented in Table 4 and in the Fig. 1 clearly show that the children of the Alto Xingu younger than 12 months present weight for age and weight for height scores statistically greater than the children older than 1 year. On the other hand, the Z scores for height for age do not indicate variations among the three age groups considered, with the median situated at approximately -1.0 standard deviation from the NCHS reference population. Considering the classic affirmation that with the development of malnutrition, the first anthropometric variable to be compromised is weight, and that height is affected with the continuation of the process [12], our results show that the Indian children present height below the NCHS reference, starting in the first year of life, while the weight distribution to age is practically identical to that expected by the NCHS reference and weight for height distribution presents a positive shift of approximately +1.0 standard deviation. The interpretation of this finding leads to two considerations. Analyzing the population studied as a whole: 1) if a weight deficit does not occur in the first year when, in fact, a tendency for greater weight is observed relative to height, the negative deviation of -1.0 standard deviation of height for age must not be a result of malnutrition; and 2) if the negative deviation of height for age is not a consequence of malnutrition, it could be a genetic expression of the growth potential of the Alto Xingu population, already manifest in the first year of life, contrary to what is affirmed that growth differences dependent on genetic factors only express themselves starting with the fourth year of life.

It should be noted that the excess weight relative to height during the first year of life in Alto Xingu children is not a factor observed only in 1992. In the previous study from 1974 and



Distribution of Z-Scores of Weight for Age, Weight for Height and Height for Age according age groups and NCHS reference

Table 5. Distribution of Indian Children from Alto Xingu, Central Brazil, According to the Practice of Breast Feeding and the Age Group, in 1992

Age group (months)	Breast feeding		Total
	Yes	No	
0-6	13 (100%)	0 (0%)	13
6-12	12 (100%)	0 (0%)	12
12-18	13 (100%)	0 (0%)	13
18-24	10 (100%)	0 (0%)	10
24-30	8 (66.7%)	4 (33.3%)	12
30-36	4 (36.4%)	7 (63.6%)	11
36-42	2 (14.3%)	12 (85.7%)	14
>42	0 (0%)	87 (100%)	87

Table 6. Frequency of Consumption of Basic Food in the Alto Xingu, Central Brazil, According to the Age Group, in 1992

Basic food	Age group (months)		
	0-6 (n=13)	6-10 (n=10)	>10 (n=149)
Mingau (manioc porridge)	6 (46.2%)	10 (100%)	149 (100%)
Water	2 (5.4%)	10 (100%)	149 (100%)
Beiju (flat bread)	0 (0%)	8 (80.0%)	149 (100%)
Fruits	0 (0%)	6 (60.0%)	149 (100%)
Fish	0 (0%)	6 (60.0%)	149 (100%)

1980 [2], 37.4% of the 195 children less than 1 year of age presented a weight for height index greater or equal to 120% and in 26.2% this parameter was between 110 and 119%. For those older than 1 year, 1,083 measurements yielded values of approximately 1.5% and 16%, respectively.

With reference to Alto Xingu adult Indians, the median height is 161.0 cm for males and 149.2 cm for females [13], values very similar to the -2.0 standard deviation of the NCHS at 18 years of age (163.6 cm for males and 151.8 cm for females). Therefore, the shorter final height of Alto Xingu adult Indians may begin to express itself from the first year of life. This deviation to the left of the distribution of height to age, in relation to the NCHS data, determines the overall rate of 19.8% of children with height for age Z scores below -2.0 standard deviation. This information should be compared with other studies undertaken to evaluate Indian nutrition. Santos and Coimbra [14] studied Tupi-Mondê children belonging to three tribes that live in Rondônia and Mato Grosso and found, according to the Z scores (<-2.0 standard deviation of the NCHS table), deficits in height for age in 55.8% of the children and deficits in weight to height in 0.8%. Accentuated rates of height to age deficits were observed in other Indian populations in Latin America, 43% in the Shipibo tribe of Peru [15] and 75.0% in the Chaci tribe of Ecuador [16].

With relation to dietary habits, our data confirm the prolonged duration of maternal breastfeeding previously found [1].

In the population studied, all children up to 2 years of age were still nursing and up to 3.5 years of age some children continued this feeding habit. With relation to nursing, it was noted that one-half of the 13 children who were less than 6 months old received other types of food, particularly manioc porridge, a part of the traditional diet of Alto Xingu Indians. Our results also show that foods of greater physical consistency are introduced in the second 6 months of life. Notably, although they do not receive specific alimentary orientation, the Alto Xingu Indian children are fed according to the current pediatric recommendations for feeding during the first year of life, with reference to the age when solid foods are introduced.

Finally, we conclude that the nutritional status of Alto Xingu children has continued to be adequate in 1992, as was initially observed between 1974 and 1980. We recommend periodic reevaluations to detect negative repercussions in the health and nutrition of the infant population as a result of the current acculturation process.

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