



Nutritional status and body composition of two South American native populations – Alto Xingu and Ikpeng

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Abstract

Objectives: To assess the nutritional and body composition of two Brazilian indigenous populations by comparing their nutritional status.

Methods: 95 children from Alto Xingu and 69 from Ikpeng were evaluated, ages ranged from 24 to 117 months. The study was performed in the Xingu Indigenous Park. Data collected were: age, weight, height, skin folds, arm circumference, resistance and reactance. The z-scores were calculated and classified according to the parameters defined by the National Center for Health Statistics (NCHS 2000). Shortness was defined as length or stature below -2, underweight as body mass index below -2, and overweight as body mass index above 2.

Results: Among children from Alto Xingu, the prevalence of shortness was 8.4%, while among Ikpengs the prevalence was 37.7% ($p < 0.001$). Underweight was diagnosed in 12.5% of Ikpeng's children. Values of fat-free mass were greater for children from Alto Xingu and no case of obesity was found.

Conclusion: In this study, Ikpeng's children showed higher incidences of short stature and low weight than the AltoXingu's children. Data regarding body composition have greater values among children from Alto Xingu, thus we conclude that nutritional status among children from Alto Xingu is better than the one found among the Ikpeng's children.

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Introduction

Nutritional status is an important health marker of a given community. It allows determining the frequency and intensity of nutritional disorders in a specific population.^{1,2}

In Brazil, three nationwide nutritional assessments were carried out in the last 30 years, namely: 1) Brazilian National Survey on Household Expenses, in 1975-76; 2) Brazilian National Survey on Health and Nutrition, in 1989, and 3) Brazilian National Survey on Demography and Health, in 1996. However, none of them included indigenous tribes as a specific population segment.^{3,4}

Given the importance of monitoring the nutritional status of a specific population of native Brazilians, researchers of *Universidade Federal de São Paulo* (UNIFESP-EPM), implemented a program, in the early 1970s, for the evaluation of the nutritional status of indigenous children from Alto Xingu. This series of studies has shown a low prevalence of acute malnutrition and obesity in that population in the last 3 decades (Table 1).⁵⁻⁷

The assessment of the nutritional status of indigenous children from the Xingu National Park (XNP), conducted in 2000, confirmed the low rates of malnutrition and obesity and included the estimation of body composition through

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Table 1 - Percentage of well-nourished children found in the studies that assessed the nutritional status of native Brazilians from Alto Xingu for weight/height (W/H)

Authors	Year estudo	Sample size	Percentage of well-nourished children
Fagundes-Neto et al. ⁵	1976	175	96%
Morais et al. ⁶	1980	335	94.3%
Mattos et al. ⁷	1992	172	93.1%

bioelectrical impedance (BI), being the pilot study upon which the present analysis is based. Furthermore, when matched according to height, the indigenous children showed that fat body mass (FM) and lean body mass (LM) percentages were similar to those used as body composition reference values.⁸ The values of BI and weight were strongly correlated.⁹⁻¹¹

The aim of the present study was to: a) assess the nutritional status of indigenous children from Alto Xingu and Ikpeng tribes, comparing the results with the National Center for Health Statistics (NCHS) references;¹² b) compare the nutritional results obtained from Alto Xingu children with those of Ikpeng children; d) estimate and compare the body composition of the analyzed children in terms of LM and FM, using the equations of Slaughter et al.¹³ and De Lorenzo et al.¹⁴

Methods

The XNP is a federal indigenous reserve created by Decree 50.455 on April 14, 1961. Its area amounts to approximately 28,000 km², and it is located in the north of the state of Mato Grosso, extending up to the south of Pará.

The study populations live in different areas of the XNP – the Alto Xingu tribe occupies the southern region of the park, whereas the Ikpeng live in the central area of Xingu. Since the two tribes had a long contact with each other until the early 1970s, both share some similarities in their living habits.¹⁵

Among 768 children (2001 Census of the Health and Environment Unit – Department of Preventive Medicine), 164 (21.3%) who were in the villages during the visits of the research team were included for convenience, due to problems with transportation, accommodation and communication. Of this sample, 95 (57.9%) children belong to the Alto Xingu tribe and 69 (42.1%) to the Ikpeng tribe.

We assessed 83 (50.6%) girls and 81 (49.4%) boys, aged between 24 and 117 months. The median ages of Alto Xingu children was 69 months (IQR25-75% = 48.25-94.75), and the median ages of Ikpeng children was 68 months (IQR25-75% = 48.00-90.00). No statistical difference was noted between the studied populations (Mann Whitney – $p = 0.443$).

A Kraus-Cas microelectronic scale, with capacity for 150 kg and an accuracy of 100 g, was used for weight

measurement. This scale resets automatically after each measurement. Length or height were measured using two anthropometers: a wooden stadiometer with a movable headpiece, manufactured in Brazil, with a 100-cm extension and a 3-mm accuracy, for children of up three years old, and an inelastic metal tape (Raven Minimetre) for older children. Arm circumference (AC) was measured while the children were standing in an upright position, at the midpoint between the elbow and the shoulder, to the nearest 0.1 cm. Skinfolds (SKF) were measured by only one observer with a Lange caliper.^{16,17} BI values were obtained through an RJL Quantum instrument, using four self-adhesive metal electrodes attached to the children's skin, following the manufacturer's recommendations.

The following variables were used to determine the nutritional status: weight, height, age and sex. The following indicators for the assessment of nutritional status were used: weight/age (W/A), body mass index (BMI), height/age (H/A) and body mass index/age (BMI/A). The results were compared to the NCHS 2000 reference values,¹² by means of the *Nutrition* program, which is part of Epi-Info 2002, launched by the Center for Disease Control (CDC).

We used W/A and BMI/A for low weight and obesity, and H/A for short stature. The cutoff points used were -2 and +2 z-scores from the reference mean, following CDC 2000 recommendations.¹⁶

The body fat percentage (%BF) was calculated using the following equations of Slaughter et al.:¹³

- Boys: %BF = 1.21 x (triceps x subscapular) – 0.008 x (triceps x subscapular)² – 1.7;
- Girls: %BF = 1.33 x (triceps x subscapular) – 0.013 x (triceps x subscapular)² – 2.5.

We used De Lorenzo's equation [LM (kg) = 2.33 + 0.588 (H²/Z) + 0.211 x weight (kg)].¹⁴ In order to estimate LM through BI, the fat mass was obtained by subtracting the LM from the body weight of the analyzed children.

The resultant values for the two populations, according to age and sex, were compared with each other using Student's t test and Mann-Whitney test. The chi-square test (χ^2) was used to compare the proportions obtained for the two populations. The significance level was established as being less than or equal to 0.05. The study protocol was approved by the Ethics Committee of UNIFESP-EPM and by the Brazilian National Research and Ethics Council

Results

Anthropometry

The body weight of the analyzed children ranged from 10.2 kg to 30.3 kg, mean of 18.8±4.8 kg and median of 17.5 kg (IQR25-75% = 15.1-22.2 kg). After comparing the measures of central tendency, we verified no significant differences in weight between boys and girls belonging to the same population. However, by comparing both populations, we observed that Alto Xingu children had relatively higher values than those obtained for Ikpeng children (Table 2).

Height ranged from 78 to 132.9 cm, mean of 106.5±12.9 cm and median of 105.7 cm (IQR25-75% = 97.3-117.3). No significant differences in height were observed between sexes or between the assessed populations.

The minimum BMI value was 13.4 and the maximum value was 19.5, mean of 16.3±1.2 and median of 16.3 (IQR25-75% = 15.6-17.1). Remarkable differences were observed between the two tribes regarding both boys and girls (Table 2).

The mean z-score values for W/A, H/A and BMI/A are shown in Table 3. After comparing the results obtained for boys and girls in the same population, we did not find any differences for any of the indicators. However, when we compared both populations, we observed that the mean z-score values were significantly higher for Alto Xingu children, with regard to all indicators.

In Alto Xingu, eight (8.4%) children had short stature, which was detected in 26 (37.7%) Ikpeng children, a prevalence rate that is significantly higher ($p < 0.001$). Among Alto Xingu children, we did not find any cases of underweight, however 12.5% of Ikpeng children had their weight below the minimum reference value for age and sex (Table 4).

Body composition

Anthropometry

The values of central tendency of the sums of SKF, upper arm fat area (AFA) and arm muscle area (AMA) and AC are shown in Table 5. The sum of the skinfold measurements was significantly different between boys and girls in both populations. In AFA, the difference was only observed among Alto Xingu children. AMA and AC were different between the studied populations.

BI values

The results obtained for BI are shown in Table 6. There was a significant difference between the two populations for H²/R values. For H²/Z, which considers reactance in its calculation, there were differences between boys and girls within the samples and between the two tribes.

LM and FM calculated through the equations of Slaughter et al.¹³ and De Lorenzo et al.¹⁴

Girls had higher FM mean values when compared to boys, for both equations and in both populations. However, significant differences between boys and girls only occurred

Table 2 - Weight and height values of native Brazilian children from XNP according to population and sex

Variables	Population from Alto Xingu		Ikpeng population	
	Male X±SD (Md)	Female X±SD (Md)	Male X±SD (Md)	Female X±SD (Md)
Weight (kg)	20.3±5 (19) * †	19.4±5 (19) * † ‡	17.8±4.6 (17) † ‡ §	16.8±3.5 (16) ‡ §
Height (cm)	109.1±12.6 (107) † ¶	107.3±14 (105) † ¶ **	104.8±13.5 (103) ¶ ** ††	103.5±10.9 (105) ** ††
BMI (kg/m ²)	16.8±1.1 (16.8) †† §§	16.6±0.9 (16.6) †† §§ ¶¶	16.0±1 (16) §§ ¶¶ ¶¶	15.6±1.3 (15.7) ¶¶ ¶¶ ¶¶

SD = standard deviation; Md = median; BMI = body mass index; XNP = Xingu National Park.

* Alto Xingu: male x female; Mann-Whitney's test; T = 2,055.5; $p > 0.05$.

† Male: Alto Xingu x Ikpeng; Mann-Whitney's test; T = 1,043.5; $p < 0.05$.

‡ Female: Alto Xingu x Ikpeng; Mann-Whitney's; T = 1,334.5; $p < 0.05$.

§ Ikpeng: male x female; t test; T = -1,069; $p > 0.05$.

¶ Alto Xingu: male x female; t test; T = -0,658; $p > 0.05$.

¶¶ Male: Alto Xingu x Ikpeng; t test; T = 1,473; $p > 0.05$.

** Female: Alto Xingu x Ikpeng; Mann-Whitney's; T = 1,456.0; $p > 0.05$.

†† Ikpeng: male x female; t test; T = 0,438; $p > 0.05$.

‡‡ Alto Xingu: male x female; t test; T = 1,0054; $p > 0.05$.

§§ Male: Alto Xingu x Ikpeng; t test; T = 3,4889; $p < 0.01$.

¶¶¶ Female: Alto Xingu x Ikpeng; Mann-Whitney's test; T = 16,5434; $p < 0.01$.

¶¶¶¶ Ikpeng: male x female; t test; T = 1,4486; $p > 0.05$.

Table 3 - Z-score values for W/A, H/A and BMI/A according to population and sex

Variables	Alto Xingu population		Ikpeng population	
	Male X±SD (Md)	Female X±SD (Md)	Male X±SD (Md)	Female X±SD (Md)
W/A	-0.26±0.77 (-0.21) * †	-0.39±0.68 (-0.46) * † ‡	-1.12±0.75 (-1) † ‡ §	-1.42±0.98 (-1.43) ‡ §
H/A	-1.11±0.77 (-1.15) † ¶	-1.15±0.71 (-1.28) † ¶ **	-1.69±0.66 (-1.72) ¶ ** ††	-2±1.03 (-1.9) ** ††
BMI/A	-0.67±0.64 (0.71) †† §§	0.55±0.6 (0.67) †† §§ ¶¶	0.09±0.8 (0.27) §§ ¶¶ ¶¶	-0.03±0.9 (0.19) ¶¶ ¶¶

SD = standard deviation; Md = median; W/A = weight/age; H/A = height/age; BMI/A = body mass index/age.

* Alto Xingu: male x female; *t* test; T = -0.8501; *p* > 0.05.

† Male: Alto Xingu x Ikpeng; *t* test; T = 4.9183; *p* < 0.001.

‡ Female: Alto Xingu x Ikpeng; Mann-Whitney's test; T = 24.0509; *p* < 0.001.

§ Ikpeng: male x female; *t* test; T = 1.4225; *p* > 0.05.

¶ Alto Xingu: male x female; *t* test; T = 0.3168; *p* > 0.05.

¶¶ Male: Alto Xingu x Ikpeng; *t* test; T = 3.5287; *p* < 0.001.

** Female: Alto Xingu x Ikpeng; Mann-Whitney's test; T = 19.3329; *p* < 0.001.

†† Ikpeng: male x female; Mann-Whitney's test; T = 1.4556; *p* > 0.05.

‡‡ Alto Xingu: male x female; *t* test; T = -0.9797; *p* > 0.05.

§§ Male: Alto Xingu x Ikpeng; Mann-Whitney's test; T = 9.5197; *p* < 0.01.

¶¶ Female: Alto Xingu x Ikpeng; Mann-Whitney's test; T = 8.6631; *p* < 0.005.

¶¶¶ Ikpeng: male x female; *t* test; T = 0.5681; *p* > 0.05.

Table 4 - Percentage of children with z-scores < -2 standard deviations for the W/A, H/A and W/H values according to population and sex

Index	Population from Alto Xingu n (%)	Ikpeng population n (%)	Total n (%)
H/A	8 * (8.4)	26 * (37.7)	34 (20.73)
W/A	0 † (0)	8 † (12.5)	8 (4.9)
BMI/A	0	0	0

H/A = height/age; W/A = weight/age; BMI/A = body mass index/age.

* Chi-square test = 19.081; *p* < 0.001.

† Chi-square test = 9.215; *p* < 0.001.

for values obtained through the equation of Slaughter *et al.*¹³ We also observed a significant difference between Alto Xingu and Ikpeng girls in the same equation (Table 7). As for LM values, regardless of the equation used, significant differences occurred between the two populations (Table 8).

Discussion

The mean weight and height values obtained for the analyzed children were lower than those expected for age, in relation to the NCHS 2000 reference values. This result was already expected, since the same growth pattern was observed in underdeveloped regions around the globe and

in the Alto Xingu population, according to previous studies.^{5-7,18,19} The authors of the assessment conducted in Alto Xingu in 1991 found an overall 19.8% incidence of short stature among children, who were in the same age group as the population assessed in the present study.⁷

Malnutrition rates observed among Alto Xingu children were low. For H/A, which indicates previous malnutrition, we found eight (8.4%) children below -2 z-scores. However, there was a slight decrease in the prevalence of short stature if we compare current data with those obtained in 1991. At that time, short stature was detected in 20.4% of the children,^{4,7} and none of the assessed children had a weight lower than -2 SD from the reference value, which indicates an improvement in the last decade, as in the previous study⁷ 2% of the children were underweight. No children with a BMI/A lower than -2 SD (indicator that replaces W/H) or acute malnutrition were observed.^{4,7}

On the other hand, although we did not find any children with a BMI/A lower than -2 z-scores among Ikpeng children, we found eight (12.5%) children with underweight and 26 (37.7%) with short stature.

Ikpeng children had lower anthropometric values than Alto Xingu children. The parameters used to indicate nutritional status in the present study show that Alto Xingu children have a better nutritional status than do the Ikpeng. Curiously enough, there are highly significant differences between the two populations, especially if we consider the mean values of the evaluation criteria adopted herein, which may reflect the better living conditions of the Alto Xingu tribe.

Obesity, whose morbidity has been increasing on a worldwide basis, was not observed in any of the analyzed children. This was already expected, since no authors had described such problem among indigenous children from the XNP.⁵⁻⁸ Very likely, this is due to the living and eating habits of these children, who spend the day in playful activities outside their home, apparently without any

restriction on energetic expenditure, maintaining the traditional dietary habits of their tribes.^{7,8}

Nevertheless, due to the growing availability of industrialized products and to the occurrence of obesity among adult indians of the XNP (unpublished data), the concern with the possible presence of obesity among children of these tribes is totally justifiable.

Table 5 - Values of central tendency of the sums of skinfold, AFA, AMA, and AC in native Brazilian children from XNP according to population and sex

Variables	Population from Alto Xingu		Ikpeng population	
	Male X±SD (Md)	Female X±SD (Md)	Male X±SD (Md)	Female X±SD (Md)
Skinfolds Σ (mm)	21.1±3.5 (21.5) * †	25.5±4.3 (25) * † ‡	21.7±3.5 (21.5) † ‡ §	24.6±5.3 (23) ‡ §
AFA (cm ²)	54.8±11.9 (53.1) † ¶	69.6±17.7 (65.8) † ¶ **	52.2±12.5 (51.1) ¶ ** † †	59.8±16 (55.8) ** † †
AMA (cm ²)	193.1±38.3 (185.9) † † §§	187.4±31.7 (185.4) † † §§ † †	162.6±32.2 (155.6) §§ † † ¶ ¶	156.9±22 (152.9) † † ¶ ¶
AC (mm)	176±14.2 (175) *** † † †	179.2±14.1 (180) *** † † † † †	163.8±13.6 (165) † † † † † §§§	164.7±10.3 (163) † † † §§§

SD = standard deviation; Md = median; AFA = upper arm fat area; AMA = arm muscle area; AC = arm circumference.

- * Alto Xingu: male x female; *t* test; T = 5.4401; p < 0.01.
- † Male: Alto Xingu x Ikpeng; *t* test; T = 0.7025; p > 0.05.
- ‡ Female: Alto Xingu x Ikpeng; *t* test; T = 0.7717; p > 0.05.
- § Ikpeng: male x female; Mann-Whitney's test; T = 6.1926; p < 0.05.
- ¶ Alto Xingu: male x female; Mann-Whitney's test; T = 19.8051; p < 0.01.
- ** Male: Alto Xingu x Ikpeng; *t* test; T = 1.473; p > 0.05.
- ** Female: Alto Xingu x Ikpeng; *t* test; T = 2.6223; p > 0.05.
- †† Ikpeng: male x female; *t* test; T = 2.1611; p > 0.05.
- ‡‡ Alto Xingu: male x female; Mann-Whitney's test; T = 0.4602; p > 0.05.
- §§ Male: Alto Xingu x Ikpeng; *t* test; T = 3.6914; p < 0.01.
- †† Female: Alto Xingu x Ikpeng; Mann-Whitney's test; T = 18.3413; p < 0.01.
- ¶¶ Ikpeng: male x female; Mann-Whitney's test; T = 0.3712; p = 0.05423.
- *** Alto Xingu: male x female; *t* test; T = 1.118; p > 0.05.
- ††† Male: Alto Xingu x Ikpeng; *t* test; T = 3.807; p < 0.01.
- ††† Female: Alto Xingu x Ikpeng; Mann-Whitney's test; T = 1092.5; p < 0.01.
- §§§ Ikpeng: male x female; Mann-Whitney's test; T = 1088.0; p > 0.05.

Table 6 - Mean values of H²/R and E²/Z of the children studied according to population and sex

Variables	Population from Alto Xingu		Ikpeng population	
	Male X±SD (Md)	Female X±SD (Md)	Male X±SD (Md)	Female X±SD (Md)
E ² /R (cm ² /Ω)	20.1±5.5 (18.5) * †	18±5 (16.9) * † ‡	16.7±4.7 (16.1) † ‡ §	15.4±5.4 (14.8) ‡ §
E ² /Z (cm ² /Ω)	19.8±5.6 (18.4) † ¶	17.9±4.9 (16.7) † ¶ **	16.6±4.6 (16) ¶ ** † †	15±3.9 (14.8) ** † †

SD = standard deviation; Md = median.

- * Alto Xingu: male x female; Mann-Whitney's test; T = 1938; p > 0.05.
- † Male: Alto Xingu x Ikpeng; Mann-Whitney's test; T = 1004; p = 0.01.
- ‡ Female: Alto Xingu x Ikpeng; *t* test; T = 2.261; p < 0.05.
- § Ikpeng: male x female; *t* test; T = -1.043; p > 0.05.
- ¶ Alto Xingu: male x female; *t* test; T = 3.3261; p < 0.01.
- ** Male: Alto Xingu x Ikpeng; *t* test; T = 2.6617; p < 0.01.
- ** Female: Alto Xingu x Ikpeng; *t* test; T = 2.8931; p < 0.01.
- †† Ikpeng: male x female; *t* test; T = 3.3539; p < 0.01.

Arm circumference measurements, which allow determining fat and protein stores, were significantly higher among Alto Xingu indians.¹⁶⁻²⁷

When SKF values were considered, the differences occurred mainly between sexes and not between the tribes, which means that girls have more FM if compared to their male counterparts, a characteristic that has been described in the literature, even among preadolescents, as in the case of the analyzed children.²⁶

Based on these two measurements, noting that SKF measurements are similar between the tribes and that AC is larger among Alto Xingu indians, there is strong evidence that this population is well-nourished, especially in terms of protein intake, comparatively to Ikpeng children, even though such difference is not easy to quantify using only these measurements.

Alto Xingu children showed higher AMA and AFA values than Ikpeng children. This corroborates that the nutritional status of Alto Xingu indians is better than that of the Ikpeng, as confirmed by the W/A, H/A and BMI/A indicators.

It is common knowledge that LM is directly related to impedance indices, which in their turn should be used for body composition measurements, when no validation through a direct equation exists that allows for LM calculation.²⁷ In the present study, we noted that BI values of the Alto Xingu population were higher than those of the Ikpeng population, a fact that became quite evident when we considered reactance for the calculation of LM. Also, the difference between boys and girls was significant for the BI values. These results were as expected, as the LM of Alto Xingu children for other estimates used herein was always higher. The same

Table 7 - Lean body mass and fat body mass calculated through the equations of Slaughter et al.¹³ and De Lorenzo et al.¹⁴ according to population and sex

Variables	Population from Alto Xingu		Ikpeng population	
	Male X±SD (Md)	Female X±SD (Md)	Male X±SD (Md)	Female X±SD (Md)
De Lorenzo et al. (kg)	2.1±1 (1.8) * †	2.5±1.4 (2.3) * † ‡	2±1.2 (1.8) † ‡ §	2.1±0.9 (1.9) ‡ §
Slaughter et al. (kg)	3.1±0.8 (3) † ¶	3.8±1.7 (3.6) † ¶ **	2.8±0.7 (2.6) ¶ ** ††	3.1±0.9 (3) ** ††

SD = standard deviation; Md = median.
 * Alto Xingu: male x female; Mann-Whitney's test; T = 2.0694; p > 0.05.
 † Male: Alto Xingu x Ikpeng; t test; T = 0.5229; p > 0.05.
 ‡ Female: Alto Xingu x Ikpeng; Mann-Whitney's; T = 1.5910; p > 0.05.
 § Ikpeng: male x female; t test; T = 0.4821; p > 0.05.
 † Alto Xingu: male x female; t test; T = 8.1992; p < 0.01.
 ¶ Male: Alto Xingu x Ikpeng; t test; T = 1.7763; p > 0.05.
 ** Female: Alto Xingu x Ikpeng; t test; T = 2.8306; p < 0.01.
 †† Ikpeng: male x female; t test; T = 4.7387; p < 0.01.

Table 8 - Mean values of lean body mass calculated through the equations of Slaughter et al.¹³ and De Lorenzo et al.¹⁴ according to population and sex

Variables	Population from Alto Xingu		Ikpeng population	
	Male X±SD (Md)	Female X±SD (Md)	Male X±SD (Md)	Female X±SD (Md)
De Lorenzo et al. (kg)	18.3±4.3 (17.1) * †	16.9±3.9 (16.1) * † ‡	15.8±3.7 (15.5) † ‡ §	14.7±3 (14.5) ‡ §
Slaughter et al. (kg)	17.2±4.3 (15.8) † ¶	15.7±4 (15) † ¶ **	15±3.9 (14.1) ¶ ** ††	13.6±2.8 (13.6) ** ††

SD = standard deviation; Md = median.
 * Alto Xingu: male x female; t test; T = 1.5401; p < 0.05.
 † Male: Alto Xingu x Ikpeng; t test; T = 2.5822; p < 0.05.
 ‡ Female: Alto Xingu x Ikpeng; t test; T = 2.8876; p < 0.05.
 § Ikpeng: male x female; t test; T = 1.4385; p > 0.05.
 † Alto Xingu: male x female; t test; T = 1.8079; p > 0.05.
 ¶ Male: Alto Xingu x Ikpeng; t test; T = 2.3150; p < 0.05.
 ** Female: Alto Xingu x Ikpeng; Mann-Whitney's test; T = 5.475; p < 0.05.
 †† Ikpeng: male x female; t test; T = 1.7334; p > 0.05.

occurred among boys, when compared to girls in the same tribe.

This is an interesting finding, as it shows that data from BI were consistent with the ones obtained from anthropometry, which allows the inclusion of BI for nutritional assessment in field trials.

The results obtained through different equations were inconsistent regarding the absolute values for body composition, which was also observed in a very similar study carried out with German children.²⁷

When we used the equation of Slaughter *et al.*,¹³ which employs anthropometric data, LM values were lower than those obtained through the equation of De Lorenzo *et al.*,¹⁴ which is based on BI. The opposite was observed for fat body mass.

By analyzing the set of results, despite the expected inconsistencies, we note that all results point to the same direction, indicating the same differences between the assessed populations, always showing that the best nutritional status is that of Alto Xingu children.

We cannot deny that such differences may be merely attributable to ethnical aspects. However, the anthropometric data of Asian populations, which migrate to the USA, suggest that by sharing the same habits and environment, ethnical characteristics do not remarkably influence nutritional status.²⁸

In the present study, no factor that may explain the better nutritional status of Alto Xingu children could be identified.

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