

To Peggy and Olive our wives for they shared
the burden and the joy of the book

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Western Diseases:

their emergence and prevention

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Amerindians of Brazil

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Introduction

Since the beginning of the sixteenth century, following the Portuguese discovery of Brazil, it was noted that the indigenous population was composed of heterogeneous groups that have not only differences in language, customs and habits but in some physical aspects. As time went on a new element of diversity was introduced, depending on the extent of contact with the new occupants of the territory. The major concentration of Indians are in the Amazonic region, the most sparsely populated part of Brazil, covering 60 per cent of Brazilian territory and having only 9 per cent of the country's population. The Indian population is estimated to be between 70 and 100 thousand, divided into 143 tribal groups (Melatti, 1970). Depending on the degree of contact with the Brazilian society the Indians can be roughly divided into four groups.

1. Groups of Indians in a state of relative *isolation* inhabit areas as yet untouched by the process of expansion of the Brazilian society; they may have had rare contact.
2. Other tribes are in *intermittent contact* with the civilized but this is almost exclusively restricted to personnel of FUNAI (Fundação Nacional do Índio), a federal government agency, or missionaries.
3. Those in *permanent contact* are tribal groups which are in direct and constant communication with numerous and diverse civilized groups; they have thus suffered modifications in their social structure and have become dependent upon many products of civilization.
4. *Semi-integrated or integrated groups* live in almost the same manner as the back-woodsmen that surround them, but yet continue to consider themselves as Indians (Ribeiro, 1957).

The best opportunity to study the emergence of Western diseases is given by those in intermittent contact. These are estimated to represent 30–40 per cent of the indigenous population. An Indian population representative of those in intermittent contact is found in the Parque Nacional do Xingu (PNX) in Central Brazil.

Parque Nacional do Xingu

The Parque Nacional do Xingu (PNX) is situated in the north of the State of Mato Grosso, Central Brazil. Its area is approximately 22 000 km², extending along the Xingu River. To the south lie the final stretches of 'cerrado', the immense scrubland of the central plateau; the remainder is jungle of the Amazon type with its exuberance and colouring. The existence of rapids along the course of the River Xingu, the presence of hostile tribes and the great distance to be crossed to reach this region, permitted the Indian groups to remain almost isolated until the 1950s. The PNX was created by the Brazilian government in 1961, when the existence of the tribes in the region was threatened because of land speculation.

The Indian tribes inhabiting the PNX, their linguistic groups and the number of individuals in each tribe is shown in Table 10.1.

The Indians of Upper Xingu have inhabited the area of the headwaters of the Xingu River for a long time. They were first described by Steinen (1894), who crossed that region in 1884 and 1887. The tribes of the Upper Xingu

Table 10.1 Indian tribes of the Parque Nacional do Xingu, 1979

Tribe	Linguistic family	Population
Upper Xingu		
1. Aweti	Tupi	39
2. Kamayura	Tupi	168
3. Yawalapiti	Arawak	103
4. Meinaku	Arawak	77
5. Waura	Arawak	106
6. Kalapalo	Carib	166
7. Kuikuro	Carib	169
8–9. Matipu and Nafuqua	Carib	56
10. Trumai	Isolated language	24
	Subtotal	908
Jê		
11–12. Suya and Beijos de Pau	Jê	145
13. Txukahamaye	Jê	245
14. Kren-Akarore	Jê	75
	Subtotal	465
Kayabi		
15. Various groups along the Xingu River	Tupi	330
Other groups		
16. Juruna	Isolated language	75
17. Txikão	Isolated language	102
	Total	1880

have become very similar in their customs and way of life, but each tribe has preserved its own language, which is one element of differentiation. The diet of the Indians of Upper Xingu is principally based on manioc (cassava) and fish. It includes, but to a lesser extent, corn (maize), sweet potatoes, cara, peanuts, bananas, pineapples, water-melons and also piqui – a very much appreciated fruit with a fatty pulp. They do not like game animals, but occasionally eat monkeys and, among birds, mutums (curassows) and jacus.



Fig. 10.1 Upper Xingu Indians, well nourished and with plenty of fish

The Indians belong to the Jê group inhabit the area north of the PNx. The presence of the Suya in this area was reported by Steinen (1894) and the Beißos de Pau (Wooden Muzzles) joined them in 1970, as they were transferred to the Park when their land was being invaded by 'civilized' groups. Both tribes have maintained some characteristics as hunter-gatherers but also cultivate some crops. The Txukahamaye, pacified in 1963, were essentially hunter-gatherers and lived in the area further north of the PNx. Now they have more fixed settlements, larger plantations of corn, manioc, sweet potatoes and bananas. The last group to enter the Park was the Kren-Akarore, in 1975, two years after first being contacted by the Villas-Boas brothers. The breaking of their state of isolation was so abrupt that it caused severe harm to them and resulted in a drastic reduction of their number. Their removal to the PNx was the alternative found to assure the survival of the tribe (Baruzzi *et al.*, 1977).

The Kayabi have entered the PNx in various groups since 1953; they originated from the region of the Rivers Teles Pires and Arinos, about

400 km to the west. They had been contacted in that region in 1926 and later were in conflict with 'civilized' groups. In the PNx they are distributed in various family groups along the course of the Middle Xingu River. Their agriculture is well developed in comparison with the other tribes in the Park and they are good hunters and fishermen.

The Juruna and Txikão are very different groups from the rest of the tribes, not only because of their separate languages but also in their physical characteristics, habits and customs. There are very frequent intratribal marriages among the Juruna, and when an Indian dies, his brother is obliged to wed the widow, even though he may already be married (Villas-Boas and Villas-Boas, 1968). They are the only Indians in the Park to make an alcoholic beverage, the caxiri, prepared through the fermentation of corn, manioc and wild fruits. The Txikão, who entered the PNx in 1967, are shorter and less robust than the rest.

Since 1965, the Escola Paulista de Medicina (one of São Paulo's medical schools) has been developing a programme of preventive medicine in the PNx which includes the determination of health conditions of the population, immunization, local medical care and removal to São Paulo of the Indians needing hospitalization. This medical programme has given us the opportunity to accumulate more experience with respect to the Indians living inside the PNx.

The Indian population of the PNx has increased in the last two decades, not only because of the entrance of new tribes, but also by the natural growth of the population. Available data regarding the Upper Xingu population growth show that in 1963 there were 623 Indians (Galvão and Simões, 1966); in 1970 the number had increased to 704 (Baruzzi and Lunes, 1970) and there were 908 Indians in 1979. These numbers show a tendency to a moderate increase in the Upper Xingu population when compared to the considerable reduction from the estimate of 3000 Indians at the end of the last century (Steinen, 1894).

A brief reference to the infectious diseases is important, since they have been until now the main causes of morbidity and mortality in the PNx.

Infectious disease

These days, among the diseases which attack the population of the PNx, malaria and respiratory infections should receive special mention. A survey made in the Upper Xingu showed the presence of *Plasmodium* in the peripheral blood in 14.3 per cent and serological antibodies against plasmodia in 98.7 per cent of the people examined. In the young children acute attacks by falciparum malaria are more severe, producing a higher mortality than in adults.

A high prevalence of gross splenomegaly was observed in 33 per cent of 730 Indians examined and diagnosed as tropical splenomegaly syndrome (TSS). During the period 1968–73, among the 22 adult deaths, 7 were due to episodes of haematemesis and melaena, probably by rupture of gastro-oesophageal varices, a complication of TSS (Baruzzi *et al.*, 1976).

Respiratory infections are quite frequent in the Indian population of PNX. These infections are sometimes considered to be influenza, but sometimes they result in more severe illness. Mortality caused by respiratory infections is relatively high in the population of the PNX.

In 1954 an epidemic of measles broke out in the Upper Xingu and affected almost the whole population of that area, estimated at 600 Indians; it caused 114 deaths among adults and children. At the beginning of 1979, there was an outbreak of measles among the Kayabi and Jê groups: 128 cases and three deaths were reported. Many of those affected had not been vaccinated, either because they were absent during the various vaccination campaigns, or because it had not been possible to reach the places where they lived. The medical assistance given to the patients during the epidemic was of major importance in reducing the measles fatality rate.

In 1968 the first cases of tuberculosis among the Indians in the Park were reported (Nutels, 1968), but its occurrence did not assume the character of an epidemic, as might have been expected. According to the same author, the cases observed in Suya and Txukahamaye Indians showed a clinical picture similar to that which occurs in civilized groups. Up to now, tuberculosis has not become a grave problem in the PNX, mainly owing to preventive measures based on BCG inoculation, and early diagnosis and treatment of cases.

Intestinal infections are not an important cause of mortality in infancy because of prolonged breast-feeding and the good nutritional state of the infant population. Intestinal parasites are common, especially in children, among whom *Ancylostoma* 67 per cent and *Ascaris* 15 per cent have been reported (Dias and Ribeiro, 1977).

Western diseases

Hypertension

For the study of blood pressure the Indians of the PNX were divided into three groups: each group includes tribes having similarity of habits, customs and dietary pattern. The first group contains the 10 tribes of the Upper Xingu, the second the Indians of the Jê group (Suya, Beijos de Pau, Txukahamaye and Kren-Akarore), and the third the Kayabi Indians. The Juruna and Txikão tribes were not included because of their small number and diversity in physical and cultural aspects in relation to the Indian groups mentioned above.

The blood pressure levels were determined during the general medical examination of the population made in the period 1966-71, when we tried to establish the medical priorities for the preventive programme to be followed. The Kren-Akarore were examined at the beginning of 1975 when they entered the PNX. The study of the blood pressure was made in 282 males and 245 females of 15 years of age and over.

Levels of systolic pressure ≥ 140 mmHg were found in 14 males (4.9 per cent), and among them only 4 reached 150 mmHg. There were no cases of systolic pressure ≥ 140 mmHg among the females. Diastolic pressure levels

Table 10.2 Blood pressure levels (mmHg) in Upper Xingu, Jê and Kayabi Indians, 1966-71

Age group ¹ (years)	Males				Females					
	No.	Systolic		Diastolic		No.	Systolic		Diastolic	
		Mean \pm s.d.	mean \pm s.d.	mean \pm s.d.	mean \pm s.d.		mean \pm s.d.	mean \pm s.d.		
Upper Xingu										
15-19	27	109.6	14.6	68.0	10.4	27	102.0	10.7	60.4	8.7
20-29	58	96.9	34.9	69.4	9.6	45	100.0	10.8	64.8	8.2
30-39	40	101.2	30.9	70.0	8.1	37	103.4	10.4	60.2	16.5
40-49	20	104.7	28.3	65.5	12.7	15	97.3	30.3	66.0	9.9
≥ 50	7	108.6	12.1	70.7	9.3	8	106.2	16.6	60.0	12.0
Jê										
15-19	17	117.4	14.6	69.7	9.8	12	108.7	10.5	66.2	6.4
20-29	25	117.2	11.3	73.4	10.4	32	109.4	10.1	69.4	9.0
30-39	9	111.1	8.2	69.4	7.7	14	105.0	10.7	66.4	7.7
40-49	8	108.7	14.6	65.7	7.3	8	110.0	10.7	68.7	6.4
≥ 50	3	120.0	10.0	76.7	5.8	2	110.0	—	70.0	—
Kayabi										
15-19	6	108.3	20.4	63.3	13.7	11	108.6	7.8	70.9	7.0
20-29	29	115.7	13.2	73.8	10.1	13	108.5	9.9	68.5	6.9
30-39	11	102.7	32.0	75.0	7.4	14	113.6	9.3	73.6	8.4
40-49	10	105.1	34.1	75.0	8.5	7	118.6	12.1	78.6	14.6
≥ 50	12	116.7	20.1	76.7	11.5	0	—	—	—	—

¹ Estimated age

≥90 mmHg were observed in 17 Indians, 13 males (4.6 per cent) and 4 females (1.6 per cent); in only one case the diastolic pressure reached 100 mmHg. When the systolic and diastolic blood pressure were considered together, levels ≥140/90 mmHg were observed only in 8 Indians, i.e. in 1.5 per cent of the total number of Indians examined, males and females (Table 10.2). In the statistical analysis of the data, the 50 years and over age group were not included, as they were few.

Age and sex

Significant differences were not observed between the mean values of the systolic and diastolic blood pressure levels of the age groups in any of the indigenous groups, either in males or females.

The mean values of the systolic and diastolic blood pressure levels were significantly higher in males than in females in the following age groups: 15–19, 20–29 and 30–39 years in each indigenous group ($P < 0.05$). In the 40–49 age group no significant differences between sexes were observed.

Various Indian groups

Comparing the Jê and Kayabi groups no significant differences were observed in the mean values of systolic and diastolic blood pressure levels within each age group in either males or females. When the Jê group was compared with the Upper Xingu, significant difference was found only in systolic blood pressure, being higher in Jê females aged 20–29 years. Between Kayabi and Upper Xingu the mean systolic blood pressure levels were significantly higher in the Kayabi group, for males in the 20–29 and for females in the 30–39 years age groups. Mean diastolic blood pressures were significantly higher in the Kayabi group only in females in the 15–19 and 30–39 age groups.

Salt intake

The PNX Indians do not use salt (sodium chloride) in their food; they do prepare a type of 'salt' obtained from plants, but use it only sporadically. This 'salt' is rich in potassium, the composition of a sample analysed was 74 g/100 g potassium chloride and 0.2 g/100 g sodium chloride. The urinary 24-hour sodium excretion was measured in 7 Indians and the levels varied from 1.8 to 16.8 mmol/l, with urinary volumes between 400 and 1800 ml. The low urinary excretion is indicative of the low intake of sodium.

Obesity

Most of the Indians included in the hypertension study had their weight and height measured at the same medical examination. There were available data for 392 Indians aged 20 years and over, 212 males and 180 females, belonging to the Upper Xingu, Jê and Kayabi groups. The means and standard deviations of the weight and height, and the percentages to 'desirable' weight standard, for the age groups 20–29, 30–39 and 40 or more years, are presented in Table 10.3 for males and Table 10.4 for females. The reference standard used was the ICNND Table (1963), which established for each height a

Table 10.3 Upper Xingu, Jê and Kayabi Indian male height, weight and percentage of 'desirable weight',¹ 1966–71

Age group (years)	No.	Height (cm)		Weight (kg)		Percentage of 'desirable weight'				
		mean	± s.d.	mean	± s.d.	<90	90–99	100–109	≥110	
Upper Xingu										
20–29	56	161.6	6.2	62.9	5.2	1.8	30.3	51.8	16.1	
30–39	44	160.8	5.3	62.6	7.9	6.8	31.8	38.6	22.7	
≥40	26	160.1	5.2	63.8	7.7	15.3	15.3	38.7	30.7	
Jê										
20–29	20	164.1	3.7	62.3	6.9	20.0	30.0	40.0	10.0	
30–39	8	164.5	7.9	65.6	10.2	12.5	37.5	25.0	25.0	
≥40	9	168.5	5.9	67.8	4.8	0.0	11.1	77.8	11.1	
Kayabi										
20–29	20	155.5	4.6	55.8	5.9	20.0	45.0	30.0	5.0	
30–39	10	155.3	3.3	56.3	4.5	10.0	70.0	10.0	10.0	
≥40	19	158.0	4.3	54.3	5.0	52.6	21.0	26.3	0.0	

¹ Jelliffe (1966)

Table 10.4 Upper Xingu, Jê and Kayabi Indian female height, weight and percentage of 'desirable weight', 1966-71

Age group (years)	No.	Height (cm)		Weight (kg)		Percentage of 'desirable weight'						
		mean	± s.d.	mean	± s.d.	<90	90-99	100-109	≥110			
Upper Xingu												
20-29	44	149.5	5.2	49.8	5.2	9.1	45.5	31.8	13.6			
30-39	37	149.4	7.9	49.2	5.7	21.6	37.8	35.1	5.4			
≥40	23	149.3	4.7	49.6	5.0	13.0	34.8	39.1	13.0			
Jê												
20-29	23	152.7	8.5	55.7	7.6	0.0	26.1	47.8	26.1			
30-39	14	155.1	7.2	57.5	6.3	14.3	7.1	35.7	42.9			
≥40	9	152.4	5.6	53.5	4.7	0.0	44.4	44.4	11.1			
Kayabi												
20-29	10	143.6	3.5	46.2	5.0	30.0	30.0	40.0	0.0			
30-39	13	144.2	4.5	46.5	7.5	23.1	46.1	15.4	15.4			
≥40	7	145.5	3.8	52.1	8.5	14.3	0.0	28.6	57.1			

¹ Jelliffe (1966)

'desirable' weight standard considered as 100 per cent (Jelliffe, 1966). From this table individuals having percentages between 90 and 109 can be accepted as *normal*, from 110 to 119 as *overweight*, and 120 or more as *obese*.

In PNX males percentages of weight for height between 110 and 119 were found in 16.0 per cent, and equal to or above 120 on 0.9 per cent. In females the percentages were 16.7 and 5.0 respectively.

Comparing the Upper Xingu, Jê and Kayabi groups, significant differences were observed in the proportion of individuals with percentages of weight for height ≥110. In the Upper Xingu and Jê groups, males had rates of percentages ≥110 significantly higher than the Kayabi, while between the Upper Xingu and Jê no significant difference was found. Females of the Jê and Kayabi groups had significantly higher rates than those of the Upper Xingu, but there was no significant difference between Jê and Kayabi in this sex.

Skinfold and arm circumference measurements were made in 106 Indians from the Upper Xingu (Table 10.5).

Table 10.5 Anthropometric measurements of adult Indians of the Upper Xingu, 1979

Anthropometric data	Males (No. 59)		Females (No. 47)	
	mean	± s.d.	mean	± s.d.
Skinfold:				
triceps (mm)	7.9	2.2	13.6	3.6
biceps (mm)	4.9	1.3	6.0	1.9
subscapular (mm)	10.4	2.5	13.0	4.7
suprailiac (mm)	7.3	3.1	11.3	3.3
Arm circumference (cm)	31.2	1.8	27.4	1.7
Arm-muscle circumference (cm)	28.8	1.6	23.1	1.4

Table 10.6 Arm-muscle circumference of adult Indians of the Upper Xingu, 1979

Sex	Percentage of normality					No.
	<90	90-99	100-109	110-119	≥120	
Male	0	0	15	32	12	59
Female	1	24	19	2	1	47

From Jelliffe (1966)

The results of the arm-muscle circumference are presented in percentages of normality (Table 10.6), considering 25.3 cm for males and 23.2 cm for females as 100 per cent of normality (Jelliffe, 1966).

In males the skinfold thickness and the percentages of normality for the arm-muscle circumference give strong evidence that they have low subcutaneous fat and well developed musculature. Thus the values of 110 per cent or more, found in the weight for height (Table 10.3), should not be considered as representative of overweight or obesity, but as resulting from their athletic condition.

The children in the Upper Xingu are well nourished; this is being shown in a longitudinal study in progress among them. When they reach puberty, boys and girls remain in seclusion inside the hut for prolonged periods, which can amount to one or two years for males. During the periods of seclusion they are confined to a small and dimly lit place in the interior of the hut, receiving a lot of food and being introduced to the handicrafts and oral traditions of the tribe. At the end of this period, when the adolescent comes back to the community life, his physical and muscular condition are remarkably improved. He then starts to participate in corporal fights, which are very important in the Upper Xingu culture and give considerable prestige to the winners. The ritual of seclusion is a cultural characteristic trait of the Upper Xingu and it is not observed among the Jê and Kayabi groups. But all the Indians of the PNx get plenty of physical exercise in hunting, gathering, fishing, canoeing, walking long distances, and ceremonial dancing for hours.

The Indian woman does hard physical work. She prepares food, fetches water from the river and helps in the harvest. When coming back from field work, it is the woman who carries the product of the day, while the man, with his bow and arrows, must be ready to face the dangers of the forest.

Diabetes mellitus

During the 14 years of participation in medical activities in the PNx, symptoms suggestive of diabetes were not observed in the indigenous population. Among those Indians brought to São Paulo for hospitalization, the blood glucose levels were always in the range of normality.

In January 1979, a survey based on the glucose tolerance test was made on 106 Upper Xingu Indians, adults of both sexes. The Indians were submitted to a standard load of 100 g carbohydrate equivalent (Dexpak—Ames Company). Due to difficulties in assuring the fasting stage of the Indians, and for convenience in the field work, venous blood samples were taken one hour after the carbohydrate load. The plasma glucose was determined on the Auto-Analyzer using the modified Hoffman method: the results are shown in Table 10.7.

Diabetes was not shown in this investigation in the Upper Xingu, considering 10.83 mmol/l (195 mg/dl) as the critical point for normality to the plasma glucose levels one hour after 100 g of carbohydrate load, according to the United States Public Health Service (O'Sullivan and Mahan, 1968). The mean and standard deviation of the plasma glucose was $5.21 \pm$

1.12 mmol/l (93.7 ± 20.1 mg/dl) for males, and 5.31 ± 1.79 mmol/l (95.6 ± 32.3 mg/dl) for females.

Table 10.7 Plasma glucose levels one hour after oral carbohydrate 100 g of Indians of the Upper Xingu, 1979

Age group (years)	Plasma glucose levels (mmol/l)				No.
	2-22-4-43	4-44-6-66	6-67-8-88	8-89-10-56	
Males					
20-29	11	14	1	0	26
30-39	4	4	1	0	9
40-49	0	12	0	0	12
≥50	2	7	3	0	12
Subtotal	17	37	5	0	59
Females					
20-29	8	10	0	0	18
30-39	5	4	1	1	11
40-49	3	2	3	1	9
≥50	1	7	1	0	9
Subtotal	17	23	5	2	47
Total	34	60	10	2	106

Conversion: SI to traditional units—blood glucose: 1 mmol/l \approx 18 mg/dl

Hyperlipidaemia

In the 106 Indians from the Upper Xingu, already mentioned, the serum cholesterol levels were determined by the Huang modified method, in which the normal values range from 3.88 to 6.47 mmol/l (150 to 250 mg/dl).

The mean and standard deviation of the serum cholesterol levels were 3.99 ± 0.62 mmol/l (154 ± 24 mg/dl) for males, and 4.40 ± 0.67 mmol/l (170 ± 26 mg/dl) for females.

The serum triglyceride determination was made in the 106 blood samples. The mean and standard deviation were 1.03 ± 0.41 mmol/l (91.4 ± 36.4 mg/dl) for males and 1.04 ± 0.42 mmol/l (92.1 ± 37.4 mg/dl) for females. According to the method employed, the normal values are below 1.97 mmol/l (175 mg/dl) (Bucolo and David, 1973).

Cardiovascular disease

Until now the presence of symptoms or signs suggestive of cardiomegaly, arrhythmia or congestive heart failure has not been observed at the general medical examination of the indigenous population, nor during the medical care delivered periodically since 1965 by medical teams.

Ischaemic heart disease

Complaints suggestive of angina have not been reported, nor has the occurrence of myocardial infarction been detected among the Upper Xingu, Jê and Kayabi Indians. Electrocardiographic evidence of cardiac hypertrophy, conduction disturbance and ischaemic heart disease was not found by Pazzanese *et al.* (1964).

Stroke

The occurrence of stroke was not observed and we did not find people with its sequelae, but it should be noted that there are very few Indians in the age group in which the risk of stroke is greater.

Peripheral vascular disease

Circulatory failure manifested by intermittent claudication or gangrene has not been observed in Indians from the PNx. There is a remarkable absence of varicose veins, although some tribes have the habit of tying cotton thread tightly around the upper parts of their arms and round their legs just below the knee, to show up the muscles. Varicocele, a relatively frequent finding in 'civilized' people, has not been observed among the Indians.

Gastrointestinal disorders

Complaints related to the digestive tract are uncommon among the Indians of the PNx, apart from episodes of diarrhoea which are sometimes related to the ingestion of some food such as the piqui, largely consumed from August to November. Up to date no cases of gastroduodenal ulcer, hiatus hernia, appendicitis and diverticular disease have been diagnosed. Constipation is a rare complaint, although there is a possibility that the Indians do not seek the health team for this, and use their own medicine. Haemorrhoids have not been reported or observed up to now.

Neoplastic disease

Among the Indians of the PNx, five cases of neoplasia were observed from 1965 to 1979, as follows:

1. squamous cell carcinoma of the penis of a 50-year-old patient;
2. basal cell carcinoma on the face of a 46-year-old woman;
3. carcinoma indifferiate of the testis of a 4-year-old child;
4. gynaecological cancer with disseminated metastases in two patients, one aged 45 and the other 48 years, both of whom died.

General considerations

Tribes or tribal groups in *intermittent contact* with the Brazilian society can be found in the PNx and several other areas of Brazil. The preventive medical programme which has been carried out in the PNx from 1965 until the

current year (1979) has enabled us to be in touch with all the tribes living there and to accumulate a great deal of data about the health conditions of this indigenous population. Thus it has been possible to minimize two problems involving medical research in tribal societies—the small size of the tribes and their sparse distribution in a large territory. As the age of the Indians had to be estimated because of the lack of information, there could be some margin of error, mainly for females over 30 years and for the oldest of both sexes. Three large groups can be recognized in the indigenous population of the PNx: the Upper Xingu, Jê and Kayabi groups. The pattern of Western diseases in these groups was very similar, in spite of some diversity among them.

High blood pressure was very rare among the Indians, and the blood pressure did not rise with age. The assumption that the low levels of blood pressure found in many individuals living in tribal societies in the tropics could be related to the high prevalence of malaria, or more specifically to the presence of tropical splenomegaly syndrome, has often been questioned. This association was not confirmed in the PNx when two groups of Indians, with and without gross splenomegaly, were compared (Baruzzi *et al.*, 1976). To explain the rarity of hypertension in the PNx some factors should be considered as relevant:

1. constant physical activity;
2. preservation of their traditional diet;
3. lower levels of stress.

The findings in the Upper Xingu demonstrate that the males have little subcutaneous fat but well developed musculature. Their athletic condition explains the values equal or above 110 per cent of the 'desirable' weight, found in this group, and this observation can also be extended to the Jê and Kayabi males. Among females, those from the Jê are distinguished by their athletic aspect.

Within the aetiology of hypertension it is more difficult to evaluate the importance of stress, although it has been regarded as a relevant factor to explain the increasing prevalence of high blood pressure in Western society. All the Indians participate in activities relevant to their sex. The power to make decisions is equally divided among the members of the indigenous community, without responsibility falling on a few people. Competition and strife to achieve greater socioeconomic status are not factors which influence the Indians living in the PNx.

The style of life and pattern of nutrition of these Indians also seem to protect them from the occurrence of cardiovascular disease and from some disorders of the digestive tract, which have been considered as Western diseases.

The question now is, how long can the Indians in intermittent contact preserve their present state in the face of the process of acculturation, which tends to accelerate as time goes on?

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References

- Baruzzi, R. G., Franco, L. J., Jardim, J. R., Masuda, A., Naspitz, C., Paiva, E. R. and Ferreira-Novo, N. (1976). The association between splenomegaly and malaria in Indians from the Alto Xingu, Brasil Central. *Revista do Instituto de Medicina Tropical de São Paulo*, **18**, 322-348
- Baruzzi, R. G. and Iunes, M. (1970). *Survey of the state of health of the native tribes of the Upper Xingu River. Application of medicoprophyllactic measures for their conservation*. Parque Nacional do Xingu, Central Brazil. Escola Paulista de Medicina, São Paulo, Brasil
- Baruzzi, R. G., Marcopito, L. F., Serra, M. L. C., Souza, F. A. A. and Stabile, C. (1977). The Kren-Akarore: a recently contacted indigenous tribe. In: *Health and Disease in Tribal Societies*, 179-211. Elsevier, Amsterdam, Oxford, New York. Excerpta Medica, North Holland
- Bucolo, G. and David, H. (1973). Quantitative determination of serum triglycerides by the use of enzymes. *Clinical Chemistry*, **19**, 476-482
- Dias, L. C. S. and Ribeiro, O. B. (1977). Prevalência de parasitas intestinais em Índios do Alto Xingu, Parque Nacional do Xingu, Brasil Central. Presented in the XIX Congresso Brasileiro de Higiene, São Paulo, Brasil
- Galvão, E. and Simões, M. F. (1966). Mudança e sobrevivência no Alto Xingu, Brasil Central. *Revista de Antropologia da Universidade de São Paulo*, **14**, 37-52
- Jelliffe, D. B. (1966). *The Assessment of the Nutritional Status of the Community*, 271. World Health Organization, Geneva
- Melatti, J. C. (1970). *Índios do Brasil*, 208. Brasília, Coordenadora-Editora de Brasília, Brasil
- Nutels, N. (1968). Medical problems of newly contacted Indian groups. In: *Biomedical Challenges Presented by the American Indians* (Publication No. 165), 68-76. Pan American Health Organization, Washington, DC
- O'Sullivan, J. B. and Mahan, C. M. (1968). Prospective study of 352 young patients with chemical diabetes. *New England Journal of Medicine*, **278**, 1038-1041
- Pazzanese, D., Ramos, O. L., Lanfranchi, W., Portugal, O. P., Finatti, A. A. C., Barreto, H. P. C. and Sustovich, D. R. (1964). Serum-lipid levels in a Brazilian Indian population. *Lancet*, **ii**, 615-617
- Ribeiro, D. (1957). Culturas e línguas indígenas do Brasil. *Educação e Ciências Sociais*, **2**, 1-102. Rio de Janeiro, Brasil
- Steinen, K. von den (1894). *Unter den Zentral-Brasiliens*, Berlin. Title of the Portuguese Edition: *Entre os Arbores do Brasil Central* (1940). Departamento de Cultura, São Paulo
- Villas-Boas, O. and Villas-Boas, C. (1968). Os Juruna no Alto Xingu. *Revista Reflexão de Instituto Ciências Humanas e Letras, Universidade Federal de Goiás, Brasil*, **1**, 61-87