

# Some Observations on the Nutritional Status of Medical Students in the Brazilian Amazon

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No serious work has been published on the nutritional status of various population groups in the Brazilian Amazon area (an area which comprises 60 per cent of the national territory of Brazil). Within the period of 1955-1958 I had the opportunity to examine thousands of people in this area regarding their health and nutritional status. This is a report of my observations of 133 medical students in the capital city of Belem made during a study of blood pressure<sup>1</sup> between September 1955 and August 1956.

## SUBJECTS AND METHODS

The subjects in this study represented the student body of the Medical Faculty of the University of Para in Belem, Brazil, exclusive of the last year students. All were natives of the Amazon valley, with the exception of one girl who was born in Germany. They belonged overwhelmingly to the white upper class of this area with a few mixed groups among them (16 per cent). Most of their forefathers had come from Portugal; a few from Spain, France and Germany. There were 102 men and thirty-one women with a mean age of  $23.5 \pm 3.4$  years (men) and  $22.3 \pm 2.6$  years (women).

## Dietary Data

Seventy-six men and twenty-eight women kept a seven day individual diet record between September and November 1955 at their home after receiving careful instruction from me. Most of the students used ordinary household measures; a few, however, recorded the

amounts eaten in grams after actual weighing of the portions. A small number (15 per cent) kept a second seven day diet record in April 1956 during the winter (season of heavy rains).

After conversion of all quantities into grams the mean daily consumption per student was calculated based on raw food values as given in the only Brazilian food tables<sup>2</sup> available.

## Physical Data

The physical data were obtained during an examination by me between September and October 1955. They were recorded on a special form and included the following information: (1) data on the family and personal history; (2) measurements of height and weight; and (3) results of the physical examination of various systems with particular attention to the skin, eyes, mouth, neck and cardiovascular system.

## RESULTS

### Dietary Findings

Table I gives an idea of the dietary pattern of the students. From the table it becomes apparent that bread, rice and beans were the main sources of carbohydrates, the bread being white wheat with 10 per cent manioc flour (cassava). The main source of protein was beef; main fats used were butter and vegetable oils. The men drank an average of four cups of coffee a day, whereas the women drank only about one to one and a half cups a day.

The calcium to phosphorus ratio was 1:2 in the men and 1:1.7 in the women (Table II). The protein intake in the women was significantly lower than in the men; no other differences were significant. Compared to the National Research Council's (N.R.C.) recommended dietary allowances, the dietary intake

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TABLE I  
Mean Weekly Consumption of Main Foods—Raw Values (gm./student)

Subjects	No.	Milk (ml.)	Bread	Beef	Chicken	Pork	Beans	Rice	Butter and Oil	Coffee (ml.)
Men	76	1,793	1,153	941	68	60	327	671	410	1,361
Women	28	1,729	806	970	106	21	144	480	354	548

TABLE II  
Mean Daily Intake per Student of Various Essential Nutrients; Percentage in Relation to National Research Council Allowances<sup>3</sup>

Nutrient	Men (76)			Women (28)		
	Mean Daily Intake	% of N.R.C.	Range	Mean Daily Intake	% of N.R.C.	Range
Calories	2,620.0	87.3	1,194.1-4,190.8	1,990.0	86.5	812.8-3,205.7
Protein (gm.)	72.0	110.8	53.7-255.3	39.0	70.9	47.0-130.4
Calcium (gm.)	0.75	93.7	0.23-1.77	0.72	90.0	0.14-2.22
Iron (mg.)	15.0	125.0	5.91-20.79	11.3	94.2	3.74-17.89
Vitamin A (I.U.)	4,366	87.3	813-19,656	3,928	78.6	702-18,568
Thiamine (mg.)	1.9	118.9	1.01-3.39	1.3	108.3	0.50-3.23
Riboflavin (mg.)	3.2	200.0	1.31-7.36	2.6	185.7	0.72-4.32
Niacin (mg.)	23.8	148.7	12.6-45.5	17.0	141.7	8.3-43.0
Ascorbic acid (mg.)	84.9	113.2	23.9-208.1	76.1	108.7	23.4-185.3

of the male students exceeded these allowances in all instances except calories and vitamin A which were 7 to 13 per cent lower; in the women the intake of calories, protein, calcium, iron and vitamin A was 6 to 29 per cent below N.R.C. allowances. There were no major differences in the dietary intake of twelve male students and eight female students who filled a second weekly record in April 1956 for the two seasons. In April 1956 the twelve men ate slightly more than they had in September 1955, which was manifest in higher mean quotas of calories, proteins, fats, calcium and ascorbic acid. The eight women did not demonstrate the same tendency; in fact, their mean intake of proteins, fats, iron and ascorbic acid diminished as compared to September 1955.

#### Physical Findings

The range of heights and weights of the subjects are presented in Table III.

The results of the physical inspection of various systems in regard to the presence of signs of possible nutritional deficiencies are presented in Table IV.

It is obvious that the percentage of students who presented various signs frequently associated with nutritional deficiencies was low, with the exception of seborrhea and hypertrophy of the filiform papillae of the tongue in both sexes and circumcorneal congestion of the conjunctiva in the men only. Whereas the examination of the women showed the complete absence of eleven signs of nutritional deficiency, the men showed such absence only in five instances.

Gross evidence of dental caries was high in both sexes (Table V).

The incidence of dental caries was higher and more severe in the men. All subjects had their carious teeth filled with the exception of six men. Two men and two women had partial dentures. The percentage of dental deformities was relatively low (14.7 per cent in the men and 9.7 per cent in the women).

#### COMMENTS

The adequacy of the diet of the Brazilian students was measured in Table II by comparing their mean intake of various essential

TABLE III  
Range of Heights and Weights in Brazilian Students

No.	Subjects	Height (cm.)	Weight (kg.)
102	Men	154-178	42.0-80.5
31	Women	148-169	34.0-67.5

TABLE IV  
Percentage of Students Presenting Signs of Possible Nutritional Deficiency in September-October 1955

Sign	Men (102)	Women (31)
Skin		
Xerosis	0	0
Follicular hyperkeratosis	12.8	25.8
Seborrhea	27.5*	58.1*
Eyes		
Blepharitis	3.0	0
Thickening of conjunctiva	19.6	9.7
Spots of conjunctiva	17.6	6.5
Follicular conjunctivitis	2.0	3.3
Circumcorneal congestion	45.1*	12.9*
Mouth		
Angular stomatitis	1.0	3.3
Cheilosis	0	0
Redness of tongue	0	0
Edema of tongue	18.6	12.9
Fissures of tongue	5.9	9.7
Atrophy of filiform papillae	2.0	0
Hypertrophy of filiform papillae	44.9	38.7
Atrophy of fungiform papillae	14.7	9.7
Hypertrophy of fungiform papillae	10.8	19.4
Redness of gums	9.8	0
Edema of gums	4.9	0
Bleeding of gums	1.0	0
Recession of gums	13.7	3.3
Neck		
Enlargement of thyroid	5.9	12.9
Skeleton		
Curvature of spine	0	3.3
Curved legs	8.8	0
Nervous system		
Diminished knee jerks	2.0	0
Exaggerated knee jerks	0	6.5
Muscular system		
Calf tenderness	2.0	0

\* Differences statistically significant at 5 per cent level ( $\chi^2$  test used).

nutrients with N.R.C. recommended daily allowances for these same nutrients. N.R.C. allowances are intended for use in North Americans who are of larger average size than the Brazilians and live in a temperate climate.

TABLE V  
Incidence of Dental Caries in 133 Students

Subjects	Absent (%)	Grade I (%)	Grade II (%)
Men	1.0	76.5	22.5
Women	22.6	67.7	9.7

TABLE VI  
Comparison of Height and Weight of Brazilian and North American Students

Sub-jects	No.	Mean Height (cm.)	Standard Devia-tion (cm.)	Mean Weight (kg.)	Standard Devia-tion (kg.)
<i>Brazilian Students (Belem)</i>					
Men	102	167	5.4	60.7	9.7
Women	31	154	5.7	49.1	7.6
<i>North American Students (New York)</i>					
Men	70	172	6.8	74.5	8.6
Women	30	160	5.5	56.8	5.0

Physiologic requirements for these nutrients diminish in persons with decreased body size.

That the Brazilian students were considerably shorter and lighter than comparable North American students<sup>4</sup> can be seen from Table VI, presenting mean heights and weights for the two groups.

From this it follows that the metabolic needs of the Brazilians are lower than those of the North Americans. Therefore, North American standards such as the N.R.C. allowances are actually too high for Brazilian requirements—as they are for most of Latin America. However, because we do not have any standards for tropical Brazil as yet, these standard allowances have to serve with the aforementioned reservations. The intake of all nutrients presented in Table II must be considered adequate or better in both sexes.

The diet pattern of the Brazilian student may be considered typical for the upper class in Belem. It is similar in various aspects to the diet pattern of a group of Chinese students in New York studied by me in 1952-1953.<sup>4</sup>

TABLE VII  
Comparison of Brazilian and Chinese Diet Patterns

Nutrient	Percentage of Total Calories	
	Brazilians (133)	Chinese (57)
Protein	9	16
Fat	22	38
Carbohydrate	69	46

This group of Chinese had adopted a diet pattern which was primarily American. The Brazilians, in comparison, ate more rice and beans and drank more coffee.

A comparison of the relative proportions of protein, fat and carbohydrate in the diets is made between the Brazilians and the Chinese<sup>7</sup> of both sexes in Table VII. In this comparison the fact that the Brazilians were eating considerably less protein and fat and correspondingly more carbohydrates becomes of great importance. This may be considered an advantage in the tropical heat because of the known specific dynamic increase of the basal metabolism caused by protein and the higher caloric value of fats. A mean daily protein intake of 54 gm. is to be considered adequate in the tropics, with 50 per cent derived from animal sources according to Brazilian authors.<sup>5</sup> The fact that the Brazilian intake of fats was only 22 per cent as compared to 38 per cent for the Chinese consuming an American-type diet (Table VII) becomes of particular interest in relation to the problem of atherosclerosis. There are no data available on the incidence of atherosclerosis in Brazil. However, some indication that it probably presents a serious problem can be gained from the data<sup>1</sup> on the high incidence of cardiovascular diseases among the parents of these students, which was about as high as in a comparable group of North American students.<sup>4</sup>

In view of the apparent adequacy of the diet in regard to various essential nutrients, a low incidence of physical signs associated with nutritional deficiencies could be expected in the Brazilian students. This was true in the majority of cases; however, the fact that such

signs as follicular hyperkeratosis, thickening and spots of the bulbar conjunctiva were found in a fair percentage of both men and women indicates that the intake of vitamin A was inadequate. I found a much higher incidence of the same eye signs in a low economic group on a much lower vitamin A intake<sup>6</sup> and an equally high incidence, however, of these eye signs and of follicular hyperkeratosis and xerosis of the skin in the Chinese and North American students in New York,<sup>7</sup> whose vitamin A intake was between 50 and 150 per cent higher than that of the Brazilian students. Such findings could indicate that these signs either are not pathognomic for vitamin A deficiency or that requirements for vitamin A are much higher than the N.R.C. allowances in certain groups. The high percentage of men with circumcorneal congestion of the eyes and hypertrophy of the filiform papillae of the tongue (the latter was also high in the women) cannot be explained on the basis of a low intake of riboflavin and niacin because the intake of these, even if one considers cooking losses, was more than adequate (Table II). The fact that circumcorneal congestion was significantly more frequent in men (as I have found in other groups) suggests that such factors as exposure to dust, wind and sun may be responsible.

Whereas conditions of the gums were generally satisfactory, the teeth showed evidence of a high rate of caries attack. Comparable groups of Chinese and North American students were found to have lower rates of caries than the Brazilians,<sup>7</sup> the Chinese showing the lowest rates. The mean daily sugar consumption per Brazilian student was 73 gm. in the men and 46 gm. in the women; this is lower than the national average given as 88 gm. per day.<sup>8</sup> It is also lower than the average for four North American cities in 1949, which was 96 gm. per person per day.<sup>9</sup> The percentage of sugar in the total calories was about 10 per cent among the Brazilians and the North Americans but less among the Chinese. It is clear that sugar consumption is high in Brazil as well as in the United States if compared with such countries as Haiti with 27 gm. per day per person<sup>10</sup> or Turkey with

25 gm. per day per person.<sup>10</sup> If it were still higher in Brazil, one would be justified in ascribing the higher caries rates to this higher intake of sugar; however, since this is not the case, other factors must be responsible for the higher and more severe incidence of caries among the Brazilians. That the total carbohydrate content of the diet is not a factor has been shown by such studies as that of Schour and Massler<sup>11</sup> in Italy where the total carbohydrate intake was high, but the sugar consumption low (during the years 1930-1934 the per capita daily consumption of sugar in Italy was 23 gm. as compared with 126 gm. in the United States).

The incidence of simple goiter was low in the Brazilian students with a higher incidence among women.

#### SUMMARY AND CONCLUSIONS

A total of 133 Brazilian medical students in the Amazon city of Belem have been examined in regard to their nutritional status between September 1955 and August 1956.

Dietary informations obtained from 104 students during one week showed a satisfactory to high mean intake of essential nutrients such as calories, proteins, calcium, iron, vitamins A and C, thiamine, riboflavin and niacin. The adequacy of these nutrients in the Brazilian diet was compared with N.R.C. recommended daily allowances. However, it must be remembered that the Brazilians have lower requirements as they are shorter in stature and lighter in weight than the North Americans.

The incidence of physical signs frequently associated with nutritional deficiencies was generally low, with the exception of such signs as hypertrophy of the filiform papillae of the tongue, circumcorneal congestion of the eyes (in men only) and follicular hyperkeratosis of the skin (in women only). Possible

factors other than nutritional in the genesis of some of these signs have been discussed.

A high incidence of dental caries has been found in the Brazilian students, which was more severe among the men. Although sugar consumption is high, it does not explain the severe caries picture satisfactorily, since comparative groups of North American students with an equally high intake of sugar have a lower and less severe incidence of dental caries.

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