THE RELATIONSHIPS BETWEEN SELECTED ANTHROPOMETRIC AND SOCIO-ECONOMIC DATA IN SCHOOLCHILDREN FROM DIFFERENT SOCIAL STRATA IN RIO DE JANEIRO, BRAZIL*

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ABSTRACT: The nutritional status according to anthropometric data was assessed in 756 school-children from 5 low-income state schools and in one private school in the same part of Rio de Janeiro, Brazil. The prevalence of stunting and wasting (cut-off point: <90% ht/age and <80% wt/ht) ranged in the public schools from 6.2 to 15.2% and 3.3 to 24.0%, respectively, whereas the figures for the private school were 2.3 and 3.5%, respectively. Much more obesity was found in the private school (18.0%) than in the state schools (0.8 - 6.2%). Nutritional problems seem to develop more severely in accordance with the increasing age of the children. Therefore it appears advisable to assess schoolchildren within the context of a nutritional surveillance system.

KEYWORDS: Nutritional status. Anthropometry. Socioeconomic factors.

INTRODUCTION

Since the recommendation to use anthropometric data as an indicator for the nutritional status of children, a fair amount of data has been collected on the anthropometric characteristics of pre-school children in different parts of Brazil. In contrast to the rural areas and the northeastern and northern parts of the country, wasting and stunting of children aged up to six years is far less widespread in the southern and southeastern regions and in the urban areas [4, 7, 9, 11, 12, 13, 14, 16].

However, little information is available on the nutritional status of schoolchildren in Brazil [2, 5, 10]. The present study has the following objectives:

1. The assessment of the nutritional status of schoolchildren for the identification of possible interventions.

2. The identification of possible statistical relationships between anthropometric and socio-economic data as nutritional indicators.

3. To determine whether measurement of the anthropometric characteristics of schoolchildren should be used for nutritional surveillance in Brazil.

METHODS

Population Studied

In order to limit as much as possible ecological and sociogeographical conditions, pupils of six schools in the geographically isolated city quarters "Ilha do Governador" and "Ilha do Fundão" of Rio de Janeiro, Brazil, were studied. "Ilha do Governador" and "Ilha do Fundão" are islands in the bay of Guanabara (Figure 1). "Ilha do Governador" is the biggest island (32 km²) in the bay. Both islands are well connected by two bridges which lead to the center of the city, for "Ilha do Governador" is the site of the International Airport of Rio de Janeiro and "Ilha do Fundão" has the biggest university in the city (Universidade Federal do Rio de Janeiro). The state schools (nº 1 - 5) are attended by 2,127 children from low-income groups and were surveyed in 1985 (Table 1). The private school (nº 6) is attended by 1,254 children from middle-income families and was studied in 1986 (Table 1). In all schools pupils

ILHA do Governador

ILHA do Fundão

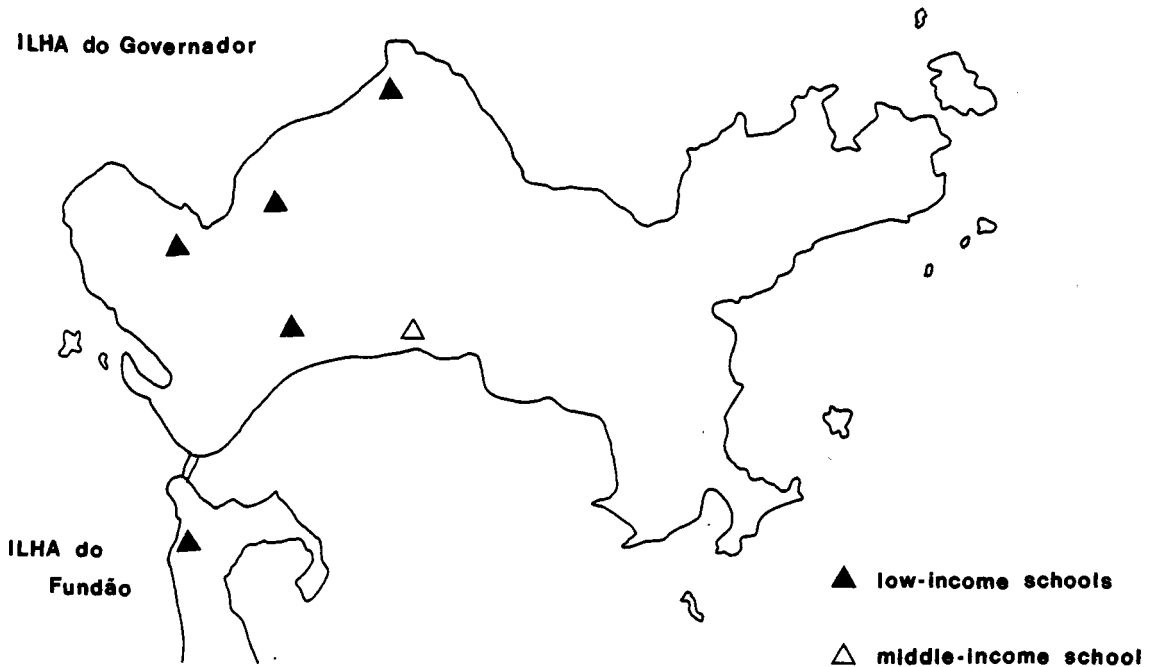▲ low-income schools

△ middle-income school

Fig. 1. Geographical location of the six surveyed schools in Rio de Janeiro.

from the 2nd, 3rd and 4th years were assessed. Classes were randomly selected.

Anthropometric Characteristics

All anthropometric data were taken in accordance with the WHO recommendation [20]. Children were weighed on an electronic personal scale (SECA 770) graded in divisions of 100 g. Children were weighed lightly clothed and without shoes. The height of the children was recorded using a metal tape measure fixed on an aluminum bar, on which a square can be moved up and down the bar to the top of the child's head.

Questionnaire

All questions on demographic, socio-economic and environmental characteristics were put by the same nutritionists to reduce interobserver bias. The answers were given by the mothers of the children.

Data Processing

All data were processed using the SPSS package on a Burroughs Large Systems Computer, Version H, at the University of São Paulo. The anthropometric data were calculated using the Anthropometric Software Package[8], which is based on the reference standard of the United States Center of Health Statistics (NCHS) in accordance with the recommendation of the WHO Working Group[21]. In case that the Anthropometric

Software Package could not be used for calculation due to increased age of schoolchildren all calculation of anthropometric indicators were made by hand according to NCHS reference population. The data were converted into height-for-age (ht/age) and weight-for-height (wt/ht) indices (% of NCHS standard) to discriminate between stunting and wasting[19] and obesity.

Tests of specific derived subhypotheses were carried out using a series of variance analyses with unequal sample size (one-factor ANOVA). These tests avoid the exaggerated overestimation of smaller-sized sample groups which might occur in field studies. Furthermore, it allows the statistical differentiation not only of continuous variables, such as age groups, but also of discontinuous variables, such as the origin of parents.

RESULTS

Population studied

According to Table 1 the surveyed schoolchildren of low income groups are in average more than one year older than their counterparts of middle income households. Further the age distribution is more heterogenic in the public schools than in the private school. Sex distribution does not differ between both school types.

Socio-economic and Socio-cultural Data

Table 2 describes the socio-economic and socio-

cultural data of the families of the schoolchildren. There are considerable differences between the observed socio-economic indicators of the middle-income households of school 6 and the low income households of schools 1 to 5. Significantly fewer persons (4.6) live in the middle-income households and fewer of them (0.8 per household) work than in the low-income households (p<0.01). All data confirm that the housing conditions (such as number of bedrooms, running water, flush toilet and electricity) of the middle-income families surveyed are better than the average of the households of the five low-income schools. Many more families of school 6 children own their houses 81% than do families of children from the other five schools (10 - 57%). The dwelling area of the middle-income households of children from school 6 is equipped with a complete network of street lighting whereas lighting is incomplete in the living areas of the households with children from the other five schools (48 - 88%).

School education of the parents, which is shown in Table 3, is another indicator for the socio-economic situation of the families. The parents of the children from school 6 had a significantly longer school education than those of children from schools 1 - 5. 51% of the fathers of children from school 6 had more than 12 years formal education, whereas, with the exception of school 5, most fathers of children from the other schools had only 5 years school education. Regardless of socio-economic background (with the exception of school 2), in all other groups mothers had on average less school education than fathers.

The distribution of the origin of the parents may provide an indicator for the socio-cultural background of the communities attending the schools observed (Table 4). There are considerable differences as regards the origin of the parents within the communities. In contrast to the communities of all other schools, which are dominated by parents originating from the federal state of Rio de Janeiro, parents of school 3 children come mainly from the Northeast. Within the community of school 5, the percentage of parents originating from outside Rio de Janeiro is only of minor significance. In school 4, about one fourth of parents come from São Paulo. In school 1, around the same proportion of parents originate from the Northeast.

Anthropometric Data

In a comparison of weight and height of the younger children of school 6 and the rest of the surveyed children, the anthropometric data show that the children from the middle-income community are biologically normally developed, whereas the children from the low-income communities have lower weight and height (Figure 2 a and b).

This difference can be observed in both boys and girls. As regards the criterion of sex, boys are slightly taller (138.3 cm and 137.4 cm, respectively) and weigh less (32.2 kg and 32.5 kg) than girls. However, these differences are not significant.

The retarded growth in the low-income group results in stunting which varied in schools 1 - 5 between 6.2 and 15.2% (Table 5). A much higher variation is observed within the 5 schools with regard to wasting. The percentage of wasting is lowest in the children from school 5, with 3.3% within the range of a normal distribution of the NCHS reference population, whereas in school 1 it is dramatically high (24.0%).

In the middle-income group from school 6, the proportion of stunted and wasted children lies within the normal distribution range (2.3 and 3.5%, respectively). But there is a high proportion of obese children (18.0%) which is not found in the five low-income group schools (0.8 - 6.2).

Table 6 shows some statistical relationships between socio-economic and demographic data and selected anthropometric data within the group of schoolchildren of low income communities. Sex does not significantly influence anthropometric characteristics. Age, however, bears a significant negative relationship to ht/age in the schoolchildren from low-income communities (F=7.34; p<0.001). The difference between the expected and the observed ht/age increases with growing age of the children. The household size of the low-income communities bears a significant negative relationship to ht/age and wt/ht (F=2.49; p=0.031). In households with more than 5 persons, wt/ht in the surveyed children decreases notably, whereas ht/age drops in households with more than 6 persons. School education and origin of the parents does not show any significant statistical relationship with anthropometric data. Children from low-income communities without flush toilets have a significant lower ht/age (F=5.62; p=0.021).

More statistical relationships between anthropometric and socio-economic data are found when schoolchildren from low and middle income communities are observed together. Age and size of family bear a marked relationship with anthropometric characteristics. A statistical relationship exists between school education of the parents and anthropometric characteristics of the pupils. Furthermore, some data of living conditions bear a relationship to the observed anthropometric data. Schoolchildren living in dwelling areas with street lighting have significantly higher wt/ht (F=6.66; p=0.01) than those living in areas without lighting. Children whose parents are house owners and children whose houses have a large number of bedrooms have a significantly higher wt/ht (F= 6.65; p=0.010 and F=3.23;

TABLE 1

Distribution of age and sex of schoolchildren according to the observed schools
(number and % of total surveyed low income and
middle income school children)

Children Characteristics	Schools Low income group							Middle income	
	1 (n)	2 (n)	3 (n)	4 (n)	5 (n)	Total (n)	(%)	6 (n)	(%)
Total children	805	390	548	310	353	2,127		1,254	
Total surveyed children	102	105	116	68	93	484	100.0	272	100.0
Age (years)									
7	-	-	3	-	-	3	0.6	30	11.0
8	7	4	22	-	7	40	8.3	76	27.9
9	15	21	41	4	10	91	18.8	81	29.5
10	17	13	21	14	26	91	18.8	58	21.3
11	16	19	12	18	10	75	15.5	27	9.9
12	20	23	1	16	15	75	15.5	-	-
13	9	11	11	6	10	47	9.6	1	0.4
14	15	9	3	6	12	44	9.3	-	-
15	2	4	1	3	2	12	2.5	-	-
16	1	1	-	1	1	4	0.8	-	-
17	-	-	1	-	-	1	0.3	-	-
Age (years)*	11.9	10.4	11.0	10.5	10.1			7.8	
Sex (% male)	49.5	47.6	52.7	44.9	53.8			50.3	

* statistical mean

TABLE 2

Selected characteristics of socio-economic, housing and basic infrastructure
conditions of the families of the surveyed pupils of six schools
in Ilha do Governador, Rio de Janeiro (1985/86).

Family characteristics	Schools Low income group					Middle income
	1	2	3	4	5	6
Household members:						
Total*	5.6	6.3	6.4	6.7	6.1	4.6
Working*	1.5	1.3	1.7	1.6	1.3	0.8
Time of residence (years)*	8.6	7.5	7.7	7.2	8.4	6.5
Street lightning (%)	81	59	88	62	48	99
House ownership (%)	52	35	57	10	35	81
Housing conditons:						
No of bedrooms*	5.6	5.6	5.8	5.7	5.7	7.4
Running water (%)	96	89	95	88	97	100
Flush toilet (%)	65	40	49	54	8	86
Electricity (%)	98	90	99	96	100	100

* statistical mean

TABLE 3
Distribution of illiteracy and formal school education of parents
(% of total surveyed fathers and mothers)

Education of parents	Schools Low income group					Middle income
	1	2	3	4	5	6
Fathers:						
Illiterate	0	2	5	3	4	0
3-5 years	39	52	41	47	40	4
6-9 years	31	26	38	39	52	12
10-12 years	27	17	14	11	2	33
> 12 years	3	3	2	0	2	51
Total	100	100	100	100	100	100
Mothers:						
Illiterate	1	0	8	5	11	0
3-5 years	51	44	50	43	50	4
6-9 years	38	50	28	47	34	20
10-12 years	9	6	13	5	5	49
> 12 years	1	0	1	0	0	27
Total	100	100	100	100	100	100

TABLE 4
Distribution of origin of parents
(% of total surveyed fathers and mothers)

Origin Families	Schools Low income group					Middle income
	1	2	3	4	5	6
Fathers:						
Rio de Janeiro	56	69	38	66	87	55
São Paulo	11	12	9	20	4	9
Northeast	25	19	48	9	7	17
Other regions	8	0	3	5	2	19
Total	100	100	100	100	100	100
Mothers:						
Rio de Janeiro	60	56	47	56	80	54
São Paulo	13	24	10	26	11	15
Northeast	24	18	41	18	9	13
Other regions	3	2	2	0	0	18
Total	100	100	100	100	100	100

TABLE 5
Age, weight, height and point prevalence of malnourished children of the six
schools expressed by Waterlow classification (ht/age deficiency: stunting; cut-off
point: <90%) - wt/ht deficiency: wasting; cut-off point: <80%) and by obesity
(wt/ht excess; cut-off point:>120%).

Children characteristics	Schools Low income group					Middle income
	1	2	3	4	5	6
Age (years)	11.9	10.4	11.0	10.5	10.1	7.8
Weight (Kg)	36.9	30.9	34.8	33.8	28.9	31.0
Height (cm)	147	137	141	142	134	134
Stunted (%)	10.7	8.7	9.7	6.2	15.2	2.3
Wasted (%)	24.0	7.5	7.9	21.9	3.3	3.5
Stunted and wasted (%)	0.8	0	0.9	0	0	0.6
Obese (%)	0.8	1.2	3.5	6.2	3.2	18.0
Total malnourished children (%)	35.5	17.4	21.2	34.3	21.7	23.8
Total number of surveyed children	121	80	113	64	92	172

TABLE 6
Statistical significance of socio-economic, demographic and experimental
effects upon selected experimental effects (one-factor ANOVA; F-values and
level of significance).

Family Characteristics	Low income schools		Middle income school		All schools	
	ht/age	wt/ht	ht/age	wt/ht	ht/age	wt/ht
Individual data:						
Sex	0.55	<0.01	1.71	0.07	0.05	<0.01
Age	1.16	7.34***	1.07	2.23	5.04***	15.8***
School performance	0.93	1.40	1.74	1.98	0.45	0.84
Household members:						
Total	2.26*	0.37	0.71	1.73	2.49*	3.60**
Working	0.55	0.09	0.31	1.13	1.97	1.05
School education:						
Father	0.81	1.21	1.13	0.28	3.19**	9.46***
Mother	2.07	0.56	0.06	0.58	5.15***	8.61***
Origin:						
Father	0.35	0.96	0.61	0.44	1.06	1.68
Mother	0.92	0.84	0.93	0.80	0.89	1.97
Time of residence	1.63	1.02	0.91	0.57	3.49**	4.52**
Street lighting	0.52	0.02	0.12	0.29	1.08	6.66*
Housing conditions:						
House ownership	0.61	1.61	0.02	0.58	1.40	6.65*
No of bedrooms	0.59	1.01	1.26	0.89	1.43	3.23**
Running water	5.62*	0.07	∎	∎	3.01	2.04
Flush toilet	1.53	1.37	1.20	0.01	6.80**	3.00
Electricity	1.02	0.47	∎	∎	0.38	<0.01

∎ Variance analyses were not realized due to lack of variability

Significance level:
*   p<0.05
**   p<0.01
*** p<0.001

p=0.007, respectively). Children living in houses without flush toilets are shorter for their age (F=6.80; p=0.001).

DISCUSSION

The comparison of children in primary schools is dominated by the fact that the children from the middle-income community in the same school year are younger than those from the low-income group. This is due to the lower age of school entry and the lower rate of school year repetition among the middle-income children. Although the age of the middle-income children is much lower, the biological development expressed in terms of anthropometric data is more or less the same as that of the low-income group. These data indicate that the middle-income children have several advantages over the low-income children. From an economic point of view, the children from the poorer communities need more time and therefore more money to compete with middle-income group children. This fact has been confirmed in other Latin American countries such as Colombia[1] and Costa Rica[17].

As shown in Table 5, from the point of view of anthropometric data it can be stated that the magnitude of the problem of malnutrition in the children from the middle-income community in the observed metropolitan area is no lower(23.8%) than in the children from the low-income group communities (17.4 - 35.5%). However, the type of problem differs in the two groups. The food energy supply of the low-income group is often too low to meet biological requirements, whereas in the case of middle-income group calory intake seems to be too high. This differentiation was also found in other schoolchildren in the State of São Paulo[5] and Recife[10] and pupils in Colombia[1].

As has already been mentioned, there are many statistically significant relationships between the observed socio-economic variables and the anthropometric data of the children when all children are grouped together. This is due mainly to the different socio-economic conditions in the communities of children from schools 1 - 5 and children from school 6. If the children are observed separately within their income group, many of the statistical relationships are no longer significant.
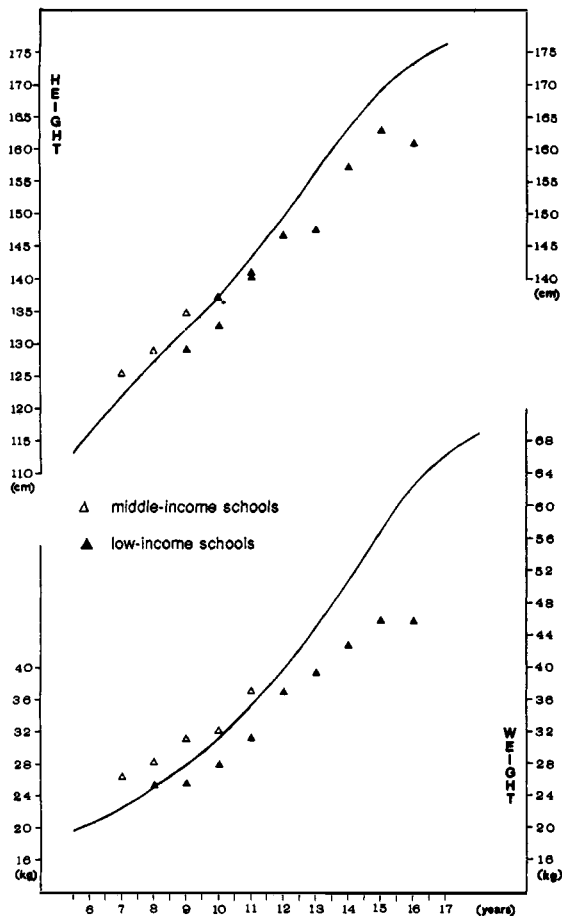

Fig. 2a. Height (cm) and weight (Kg) of different age groups of school boys of low income and middle income groups.
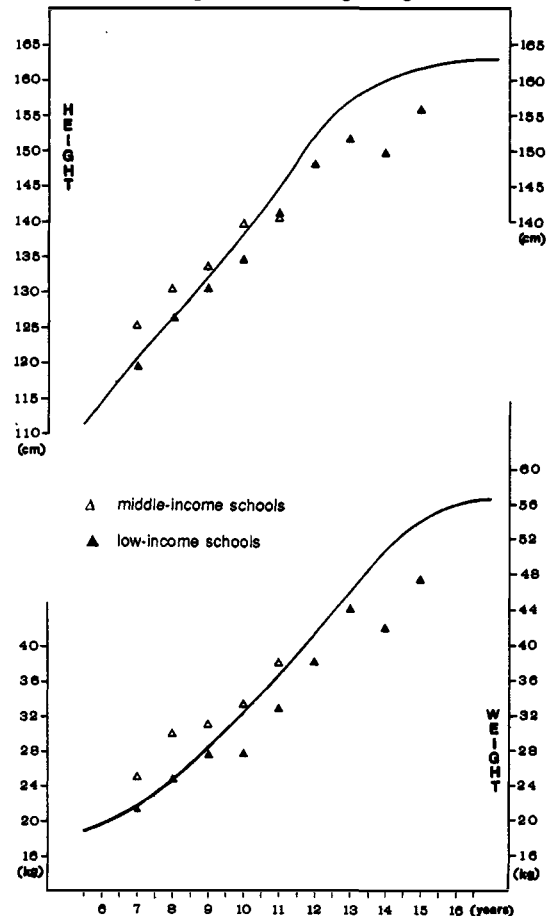

Fig. 2b. Height (cm) and weight (Kg) of different age groups of school girls of low income and middle income groups.

There is a tremendous variation of prevalence of wasting between the schools of low income communities (3.3 -:24.0%). This may be due to the different age distribution within the schools. School 1 with the highest prevalence of wasting is attended from the oldest schoolchildren. However, it is unclear whether the high prevalence can be explained by the high age or both factors due to the same socio-economic factor(s).

With increasing age the difference between the average weight of a standard population of children and the observed weight of the low-income communities increases. This fact has also been demonstrated in Brazilian pre-school children by other surveys [5, 9]. This might be due to reduced care as regards food distribution within the family. Perhaps mothers think that the older children who go to school are already privileged enough by their participation in the school feeding program. Another reason could be the earlier onset of puberty in the middle-income children from school 6, since it is known that children from economically better-off families and societies reach puberty earlier than those from poor communities[3, 10].

Moreover, low-income families face the potential problem that with the increase in the size of the family children are smaller for their age. It seems that the economic constraints increase with the number of children and limit the biological development of the children. Victora et al. [16] found that the prevalence of stunting and low weight increases with the number of siblings already in pre-school aged children.

The source of water was the only variable which is responsible for the retarded growth development of the children in the low-income communities. Several studies have shown that repeated infections due to an inadequate water supply may lead to stunting in children [6, 15, 16]. However, it is equally possible that the general socio-economic and socio-cultural conditions of the families without adequate water supply lead to stunting and not the polluted water itself. The fact that the form of refuse disposal facilities does not influence the anthropometric data of children in a statistically significant way demonstrates that this factor is not of health relevance for this age group under the conditions observed.

Although there is an obvious variation as regards school education of the parents and family wage (indirectly measured by house ownership) within the low-income group, there is no significant relationship between these two factors and the anthropometric characteristics of the children. It is known from other studies that within the population of urban communities there is not necessarily a direct casual link between family wage and nutritional status[11, 18].

Finally it has to stress, that within the geographically very limited observed metropolitan area two completely different nutritional problems occur: undernutrition and obesity. The later problem was described in Brazil already in an earlier study by Artega et al. [2]. However, this problem which can be found in middle income communities seems to be still neglected in many developing countries.

CONCLUSION

It can be stated that in, low-income, urban communities of Brazil there may be a higher risk of wasting with increasing age of the children. This fact is reinforced by studies of different urban, low-income populations in Brazil, where it has been demonstrated that wasting in pre-school-aged children is not a problem[3, 8, 12]. However, more studies on the magnitude and cause of wasting in schoolchildren are necessary.

Furthermore, it is important to realize that within the same city nutritional problem may vary substantially, as there may be cases of both undernutrition and overnutrition. This fact has to be taken into consideration in the field of public health nutrition, where diagnosis and interventions are often confined solely to undernutrition.

Finally, the question as to whether nutritional surveillance in urban areas should be extended to schoolchildren must be taken into consideration, since with increasing age the anthropometric indicators point to increasing nutritional problems.

RESUMO: O estado nutricional, de acordo com os dados antropométricos, foi avaliado em 756 escolares de cinco escolas estaduais de baixa renda e uma escola particular, na mesma área geográfica do Rio de Janeiro, Brasil. A prevalência de déficit de estatura/idade e de peso/altura (pontos de corte: 90% estatura/idade e 80% peso/estatura) encontrada nas escolas estaduais foi de 6,2 a 15,2% e 3,3 a 24,0%, respectivamente, enquanto que na escola particular foi de 2,3 a 3,5%, respectivamente. Maior número de obesos foi encontrado na escola particular (18%). Os problemas nutricionais parecem ocorrer mais assiduamente com o aumento da idade das crianças. Recomenda-se avaliar os escolares dentro do contexto de um sistema de vigilância nutricional.

DESCRITORES: Estado Nutricional. Antropometria. Fatores sócio-econômicos.

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