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DIETARY AND ANTHROPOMETRIC ASSESSMENT OF THE NUTRITIONAL STATUS OF ABORIGINAL AND WHITE SCHOOLCHILDREN IN WALGETT, N.S.W.

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Summary

The nutritional status of 29 aboriginal and 43 white children in Walgett was assessed by dietary and anthropometric measurements. For all nutrients a higher proportion of aboriginal than white children had intakes below the intakes recommended by FAO/WHO. Anthropometry indicated that a significant proportion of aboriginal children had been malnourished in the past and were currently malnourished.

I. INTRODUCTION

In recent years there has been increasing recognition that malnutrition is an important health problem among Australian Aborigines. Recent investigations of nutritional status have, to a large extent, concentrated on growth retardation (Maxwell and Elliot 1969; Edwards and Craddock 1973), multiple vitamin deficiencies (Kamien et al 1974; Nobile 1974), and single vitamins, particularly ascorbic acid (Kalokerinos 1971). Few studies have attempted to measure food and nutrient intake of aborigines or to compare them with the intakes of white populations living in the same area.

In 1976 the School of Public Health and Tropical Medicine collaborated with the Aboriginal Health Section of the Health Commission of N.S.W. in a vitamin supplementation trial of aboriginal and white schoolchildren in Walgett. This paper is based on measurements of food intake made, as part of the trial, at three points during the 1976 school year. Attention will be focussed on intakes of energy, protein, iron, thiamine, riboflavin and ascorbic acid.

II. SUBJECTS

A random sample of 80 was selected from among the 580 children attending the two primary and two pre-schools. Ages ranged between 4 and 12 years. The age distribution by sex and race, of the 71 children on whom complete dietary information was obtained, is shown in Table 1.

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Table 1. Age distribution of sample by sex and race

Age at last birthday (yrs)	Aborigines		Whites	
	Male	Female	Male	Female
4	0	0	1	2
5	1	0	1	3
6	1	1	3	2
7	1	2	6	2
8	2	3	2	1
9	3	3	4	2
10	0	0	5	2
11	1	4	1	4
12	6	1	0	1
	15	14	23	19

III. METHODS

(a) Dietary methods

The Food intake of each child during the previous 24-hours was estimated on three occasions during the 1976 school year - in March, July and November - using the 24-hour recall technique. Any nutritional supplements consumed were also recorded. Food "models" and actual foods were used during the interview to assist children in estimating the amounts of food eaten. In cases where children could not give an accurate description of the previous day's food intake - this was particularly true for children under 8 years of age - mothers were interviewed at home. Further details of the method are given by Allen *et al* (1977).

Food intake was recorded on a standard form and nutrient intakes calculated using a nutrient file based on the Tables of Composition of Australian Foods (Thomas and Corden 1970) and a computer program developed by the Nutrition Section of the School of Public Health and Tropical Medicine in collaboration with C.S.I.R.O. Except where otherwise stated the nutrient intake data reported here are averages, for each subject, of the three estimates made in March, July and November.

(b) Anthropometry

The anthropometric data reported here were obtained in November 1976. Height was measured without shoes and weight in light summer clothing. In the weight data, no allowance has been made for clothing.

IV. RESULTS AND DISCUSSION

(a) Nutrient intakes

The average intakes of the various nutrients by aboriginals and whites, the significance of the differences in intake between the two groups and the proportion of each group with intakes below the most recent FAO/WHO recommended intakes are shown in Table 2.

Table 2. Average intakes of various nutrients by aboriginal & white children and proportion with intakes below those recommended by FAO/WHO (figures in parenthesis indicate number of subjects)

Nutrient (units)	Average nutrient intake		t-test on difference(p)	% of subjects with intakes below those recommended by FAO/WHO	
	Aboriginals	Whites		Aboriginals	Whites
Energy (MJ)	8.17	8.46	>.10	55	56
Protein (g/kg)	2.0	2.6	<.01	17(5)	7(3)
Iron (mg)	10.2	10.3	>.10	21(6)	7(3)
Thiamine (mg/4.186MJ)	0.53	0.63	<.10	24(7)	5(2)
Riboflavine (mg/4.186MJ)	0.81	0.98	=.01	17(5)	2(1)
Ascorbic acid (mg)	45.1	113.3	<.01	24(7)	7(3)

For each nutrient, average intakes of individuals have been compared with the most recent FAO/WHO recommended allowances. These have been used in preference to the Australian recommendations (National Health & Medical Research Council 1970) for two reasons. Firstly, the Australian recommendations have not been revised since 1970 - in most cases the FAO/WHO recommendations are more recent. Secondly, the Australian recommendations are, as stated in the introduction, "interpretations" of the FAO/WHO documents and are not based on additional information about nutrient requirements. The further an intake is below the recommended level, the greater the probability that intake is below requirement. For those nutrients where estimates of the mean and variance of requirement are available the probability that intake is below requirement can be calculated, (Beaton 1972). This allows more realistic estimates of the prevalence of deficiency based on dietary intake data to be made. This approach is illustrated below with respect to thiamine.

(i) Energy The difference in average energy intake between the two groups was not significant. In comparing the intakes of individuals with the FAO/WHO recommendations (FAO/WHO 1973) appropriate adjustments were made based on the weight of the individual in November - that is, at the time of the third measurement of food intake. Slightly more than half of each group had intakes below their calculated requirements. It should be noted that, in contrast to the situation for other nutrients, recommended intakes for energy are based on the estimated average requirement. Thus, it is to be expected that approximately 50% of a given population will have requirements below the recommendations.

(ii) Protein The average protein intake of aboriginals (expressed in g/kg) was significantly lower than that of whites. It should be noted that of the 17% of aboriginals (5 cases) whose protein intake was lower than the FAO/WHO recommendations (FAO/WHO 1973), 3 fell short by less than 0.1 g/kg. Given the distribution of protein requirements, the probability that their intake is below requirement is very low. The intake of the remaining 2 aboriginals fell short of the recommendations by 0.36 g/kg and 0.16 g/kg respectively. For the three whites whose intakes fell below the recommendations the deficits were 0.04 g/kg, 0.18 g/kg and 0.46 g/kg. On this basis, the risk of protein deficiency in either group is very low.

(iii) Iron The difference between the average intakes of aboriginals and whites was not significant. The FAO/WHO recommendations (FAO/WHO 1970) for iron intake for the type of diet consumed by the subjects in this study is 7 mg/day for children between the ages of 1 year and 12 years. Twenty-one per cent (6 cases) of aboriginals and 7% of whites (3 cases) had average intakes below this recommendation. Given the influence of dietary ascorbic acid on iron absorption (Bjorn-Rasmussen and Hallberg 1974), it is significant that the intake of this vitamin was low in those subjects whose iron intake failed to meet the FAO/WHO recommendations. The distribution of ascorbic acid intakes in these subjects is shown in Table 3.

Table 3. Distribution of ascorbic acid intake in subjects with iron intakes below the FAO/WHO recommendations

Ascorbic acid intake (mg)	Aborigines	Whites
≤20	3	1
21-30	1	1
31-40	1	-
40	1	1

This combination of low iron and ascorbic acid intakes is likely to increase the risk of iron deficiency.

(iv) Thiamine The intake of thiamine (expressed in mg/4.186MJ) was significantly lower in aboriginals than in whites. Twenty-four per cent (7 cases) of aboriginals and 5% (2 cases) of whites had thiamine intakes below the FAO/WHO recommended intake (FAO/WHO 1967) of 0.4 mg/4.186 MJ. The distribution of intakes is shown in Table 4.

Table 4. Distribution of thiamine intakes

Thiamine intake (mg/4.186 MJ)	Aboriginals	Whites
>0.40	22	41
0.34-0.40	6	0
0.32-0.33	1	2

Following the approach of Beaton (1972) and given the estimates of the mean and variance of thiamine requirements it can be calculated that the probability of an intake of 0.34 mg/4.186 MJ being less than requirement is 0.35. Thus, it is predicted that 2 of the 6 aboriginals with an intake between 0.34 and 0.40 mg/4.186 MJ would have intakes below their requirements. Which particular individuals these are cannot be predicted. The analagous probability associated with an intake of 0.32 mg thiamine /4.186 MJ is 0.65.

(v) Riboflavine The intake of riboflavine (expressed in mg/4.186 MJ) was significantly lower in aboriginals than in whites. Seventeen per cent (5 cases) of aboriginal children and 2% (1 case) of white children had intakes below the recommended levels (FAO/WHO 1967).

The distribution of intakes is shown in Table 5.

Table 5. Distribution of riboflavine intakes

Riboflavine intake (mg/4.186 MJ)	Aboriginals	Whites
>0.55	24	42
0.46-0.55	2	1
0.42-0.45	2	0
0.35-0.41	0	0
<0.35	1	0

An approach analogous to that used for thiamine can be used to calculate the probability of a particular intake being less than requirement. The probabilities associated with riboflavine intakes of 0.55, 0.46, 0.42 and 0.35 mg/4.186 MJ being less than requirement are 0.025, 0.35, 0.65 and 0.975, respectively.

(vi) Ascorbic acid The average ascorbic acid intake of white children was significantly higher than that of aboriginals. The intake recommended by FAO/WHO for children of this age group (FAO/WHO 1970) is 20 mg. The proportion having intakes below this level is shown in Table 2. The Australian recommendation (National Health & Medical Research Council 1970) is 30 mg. As ascorbic acid intake has received considerable attention with respect to aborigines (for example, Kalokerinos 1969) and many of the issues are still unresolved, the distribution of intakes is shown in Table 6.

Table 6. Distribution of intakes of ascorbic acid

Ascorbic acid intake (mg)	Aboriginals	Whites
≤20	7	3
21-30	5	4
31-40	3	1
41-50	3	2
51-100	10	13
>100	1	19

Despite the fact that the FAO/WHO recommended intake is much lower than the Australian figure, 24% (7 cases) of aboriginals and 7% (3 cases) of whites had intakes below this level. The risk of subclinical ascorbic acid deficiency would seem to be quite high.

(vii) Nutrients considered jointly As is frequently the case, some individuals have intakes below the recommended levels for more than one nutrient. The distribution is shown in Table 7.

Table 7. Distribution according to number of nutrients for which intakes fall below recommended levels

Number of nutrients	Aboriginals	Whites
1	4	7
2	4	1
3	3	1
4	1	0
5	1	0

Five aboriginal children had intakes below the recommended level for three or more nutrients. Only one white child was in this situation. For these children, a major restructuring of the dietary pattern is indicated.

(b) Anthropometry

Waterlow (1976) has suggested that community studies of nutritional status using height, weight and age should use a cross-classification of subjects based on weight as a per cent of expected height for age (H/A). W/H gives "a measure of current malnutrition in the strict sense of alteration in body proportions and composition". H/A is a measure of retardation and therefore of past malnutrition. The subjects in this study have been classified as suggested by Waterlow using the 50th per centile of height for age and the mean weight for height of the standards derived by Jones et al (1973) from schoolchildren in N.S.W. - the results for aboriginals are shown in Table 8 and for whites in Table 9.

Table 8. Aboriginals - cross-classification by % weight for height and % height for age (figures in parenthesis indicate % of total number)

% height for age	% weight for height			
	>90	90-81	80-71	Totals
>95	11(39.3)	5(17.9)	-	16(57.2)
95-91	2(7.1)	2(7.1)	1(3.6)	5(17.8)
90-86	3(10.7)	4(14.3)	-	7(25.0)
Totals	16(57.1)	11(39.3)	1(3.6)	28(100.0)

Table 9. Whites - cross-classification by % weight for height and % height for age (figures in parenthesis indicate % of total number)

% height for age	% weight for height			
	>90	90-81	80-71	Totals
>95	27(75.0)	5(13.9)	-	32(88.9)
95-91	2(5.6)	-	2(5.5)	4(11.1)
90-86	-	-	-	-
Totals	29(80.6)	5(13.9)	2(5.5)	36(100.0)

Ninety-five per cent height for age corresponds approximately to the tenth percentile. Forty-two per cent of aboriginal children are below this point. Ninety per cent weight for age corresponds, approximately, to the mean minus 1 standard deviation. Forty three

per cent of aboriginal children are below this point. For white children, 11% fall below 95% height for age and 19% below 90% weight for height.

These data strongly suggest that a significant proportion of the aboriginal children have suffered malnutrition in the past and are malnourished currently.

V. CONCLUSION

A higher proportion of the aboriginal children had, in comparison with white children attending the same schools, intakes of protein, iron, thiamine, riboflavin and ascorbic acid below the FAO/WHO recommended intakes. An intake below the level recommended does not imply deficiency. However, the further below the recommended level the greater is the probability that an individual's intake is less than requirement. For those nutrients in which estimates of variation in requirement are available, estimates of the probability that intake is below requirement have been made. Using this approach it is still apparent that aboriginals are at greater risk than whites. Aboriginal children were also more likely than white children to have intakes below the recommended levels for more than one nutrient.

Anthropometric indicators of nutritional status also indicate current malnutrition among the aboriginal children and, in addition, that a significant proportion have suffered malnutrition in the past.

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