

# Growth and development of British vegan children<sup>1,2</sup>

Thomas AB Sanders, PhD

**ABSTRACT** The growth and development of children born of vegan mothers and reared on a vegan diet has been studied longitudinally. All of the children were breast-fed for the first 6 mo of life and in most cases well into the second year of life. The majority of children grew and developed normally but they did tend to be smaller in stature and lighter in weight than standards for the general population. Energy, calcium, and vitamin D intakes were usually below the recommended amounts. Their diets, however, were generally adequate but a few children had low intakes of riboflavin and vitamin B-12. Most parents were aware of the need to supplement the diet with vitamin B-12. It is concluded that provided sufficient care is taken, a vegan diet can support normal growth and development. *Am J Clin Nutr* 1988;48:822-5.

**KEY WORDS** Vegetarianism, growth, development, children

## Introduction

Problems of dietary inadequacy are more likely to occur in children than in adults. Their requirements relative to body weight are greater and they are unable to exert the same degree of control over what they eat compared with adults. The specific issue raised by veganism is how nutrients normally supplied by food of animal origin can be provided by alternatives of plant origin. Most nutrients can be provided by plant foods. The exceptions are retinol, vitamin B-12, vitamin D, carnitine, taurine, and C<sub>20-22</sub> polyunsaturated fatty acids, such as arachidonic acid (20:4 $\omega$ 6), eicosapentaenoic acid (20:5 $\omega$ 3), and docosahexaenoic acid (22:6 $\omega$ 3). Retinol, however, can be derived from carotenoids, which are abundant in foods of plant origin. Taurine and carnitine may be necessary in the diets of very young infants as may be certain long-chain polyunsaturated fatty acids. However, because these are furnished by breast-milk (1-3), this does not pose a problem if vegan children are breast-fed. Vegan diets do need to be supplemented with vitamin B-12 and also with vitamin D where exposure to sunlight is limited. Our studies show that if sufficient care is taken vegan diets can support normal growth and development.

## Known pitfalls

The three major hazards of vegan diets to children are bulk and vitamins B-12 and D deficiency. Bulk restricts the amount of food energy that can be consumed. Generally foods of animal origin and seeds are energy-dense foods and fruits and vegetables are low in energy. So if the diet contains too much fruit and vegetables it will be low in energy. Although a bulky diet can be advanta-

geous for adults trying to lose weight, it can be disastrous for a growing child who needs an energy-dense diet to support the cost of growth.

Vitamin B-12 is only present in very small amounts in unsupplemented vegan diets (4) and deficiency can result in vegans (5-7). Because the recognition that dietary deficiency of vitamin B-12 can occur, many vegans now take supplements or use foods supplemented with the vitamin. Vitamin B-12 deficiency can also occur in breast-fed infants if the maternal intake is not adequate (8). Mothers who do not take additional vitamin B-12 have low levels of vitamin B-12 in their milk (J Hughes, unpublished observations, 1980). The need for vegans to take additional vitamin B-12 in their diets cannot be too strongly emphasized.

Rickets has occasionally been reported in vegan children (9). There are few dietary sources of vitamin D but in the United Kingdom margarines are fortified with the vitamin. Rickets is best prevented by sufficient exposure to sunlight or by the use of vitamin D supplements. Synthetic vitamin D supplements are acceptable to many vegans.

## Subjects and methods

A long-term study on the growth and development of children who were born of vegan parents and have been brought up as vegans in the United Kingdom was conducted. Veganism excludes the consumption of all food of animal origin except breast milk. The families studied were not commune dwelling and tended to be well edu-

<sup>1</sup> From the Department of Food and Nutritional Sciences, King's College, University of London, London, UK.

<sup>2</sup> Reprints not available.

TABLE 1  
Energy intakes in vegan children compared with recommended daily amounts (RDA) and intakes in the general British population (13)

Age	Sex	RDA	Energy intakes		Number of subjects	
			Nonvegetarians' intake Mean	Vegans' intake Mean      Range		
<i>y</i>						
<i>kcal/d</i>						
1-2	M	1200	1207	1000	820-1182	4
	F	1100	1133	1000	800-1180	6
2-3	M	1400	1370	1112	969-1360	5
	F	1300	1284	1085	931-1184	6
3-4	M	1560	1529	1230	995-1470	3
	F	1500	1387	1180	1023-1368	6
5-6	M	1740	—	1550	1510-1575	3
	F	1680	—	1600	1303-2000	4

cated and receptive to dietary advice. They followed a vegan diet primarily for ethical reasons but many also believed that a vegan diet was wholesome and healthy. The children were usually wholly breast-fed for the first 6 mo and then weaned onto a vegan diet. They generally continue to receive breast milk well into the second year of life. The study began in 1968 and 12 vegan children (aged 1-7 y) were surveyed and resurveyed in 1973 by Pamela Mumford. We have followed a further 27 vegan children born between 1975 and 1981. Twenty of the children have been followed from before birth because we were also conducting studies on pregnancy and lactation in vegans. In 1980 a survey on the diets and growth and development of vegan children under the age of 5 y was conducted (10). In the last year we have been carrying out a follow up study of these children and those originally surveyed in 1968 by Pamela Mumford. We have obtained 7-d weighed dietary records to estimate nutrient intakes and have assessed their rate of growth by measurements of height and weight and other anthropometric measurements. In a few cases we also obtained venous blood samples (1, 11) for analysis.

### Dietary intakes

Cereals, pulses, and nuts were the main providers of energy and protein in our subjects. Fruits and vegetables, although they accounted for about two-fifths of the weight of food consumed, made far smaller contributions to energy and protein intakes. The main cereal food eaten was whole-meal bread, which was usually eaten with a spread such as peanut butter, tahini, vegetable margarine, and yeast extract. Soya milks and home made nut milks were used as milk substitutes by most families. The children were usually given a wide variety of vegetable and pulse dishes and there tended to be a liberal supply of fruit and salads. Confectionary was not expressly forbidden though reportedly rarely eaten. The children were generally allowed to eat snacks, which were usually bread or biscuits and fruit and nuts, between meals. Refined sugar was avoided by many families but molasses and dried fruit were quite widely used.

The majority of the children had energy intakes below the United Kingdom RDA (12). This however, is not an uncommon observation as many nonvegetarian children fail to meet the RDA. However, the energy intakes of the vegan children were lower than those found in nonvegetarian children (13). This difference was most marked in the 2-4-y-old age group (Table 1). Protein provided a minimum of 10% of the energy in all the children. The vegan diets provided on average 30% energy from fat (range 16-39%). Calcium intakes tended to be

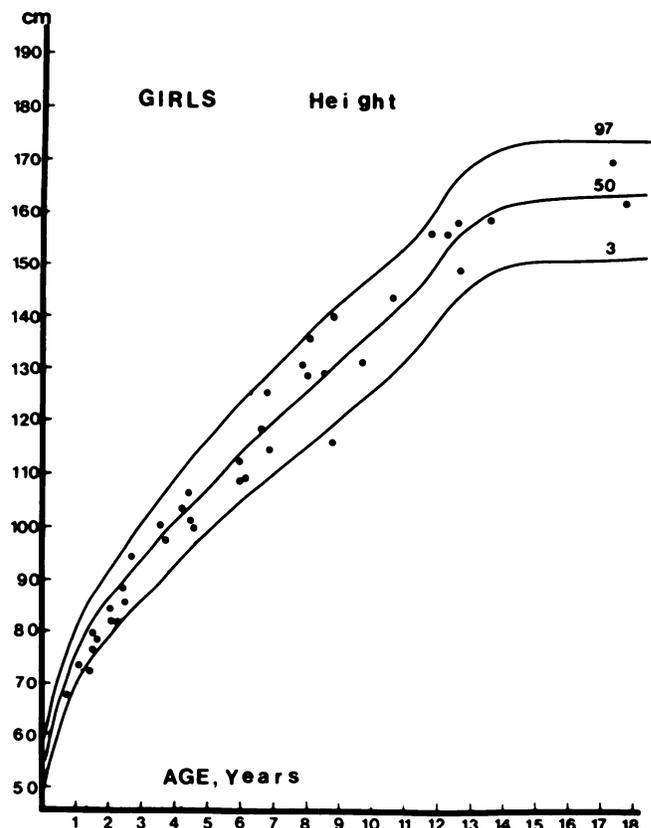


FIG 1. Heights of vegan girls compared with standards for nonvegetarian British children.



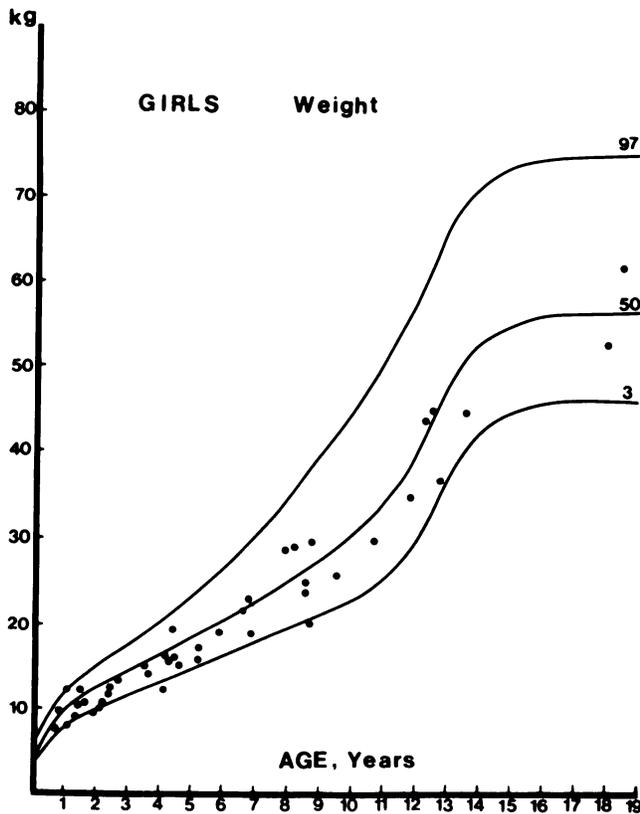


FIG 2. Weights of vegan girls compared with standards for nonvegetarian British children.

below the recommended amount (average 52%, range 28–85%) in many of the children because of the absence of dairy foods from the diet. Nuts and pulses were the major dietary sources of Ca. In addition to the dietary calcium some Ca would also be supplied in the drinking water. In common with nonvegetarian children, vitamin D intakes from diet were lower than the recommended daily amount. Most of the parents were aware of the need to expose their children to sunlight particularly in winter and some gave the children vitamin D supplements. Most of the parents were also aware of the need to give their children vitamin B-12 supplements or foods containing the vitamin. Reassuringly, most of the children had intakes of vitamin B-12 (mean 280%, range 20–1695%) and iron greater than the recommended daily amount (mean 142%, range 108–200%). The Fe intakes were derived primarily from whole-meal bread. The average nutrient density, expressed as nutrient/1000 kcal, of the vegan diets were higher for most nutrients with the exceptions of Ca and fat compared with the average UK diet.

#### Growth and development

Heights, weights, and head and chest circumference measurements were inside the normal range for the majority of children. One child showed some evidence of

malnutrition at 13 mo and was suffering from an allergic disorder. On resurveying at age 8, her growth had caught up and she was now on the 75% percentile for weight and height for her age. The girls tended to be below the 50th percentile for weight. The boys, however, tended to be below the 50th percentile for both height and weight (Figs 1–4). Haematological studies were carried out revealed normal blood formation (13). The educational and physical development of the children appeared to be quite normal.

#### Discussion

Although the growth and development of vegan children is normal, there is a tendency for vegan children to be smaller in stature and lighter in weight than nonvegetarian children. This difference is more marked among the boys. Although it could be argued that the standards (14) against which the comparisons were made are not appropriate because they were derived on a population that was predominantly bottle fed, the fact that the difference is more marked between boys than girls suggests an effect of the vegan diet. This difference in size could be due to either the amount of food energy eaten or the quality of the diet.

It would seem unlikely that protein intakes were inadequate especially as the children derived their protein intake from complementary sources. Dietary energy is believed to be the major factor determining rate of growth. The energy intake of the vegan children was consistently

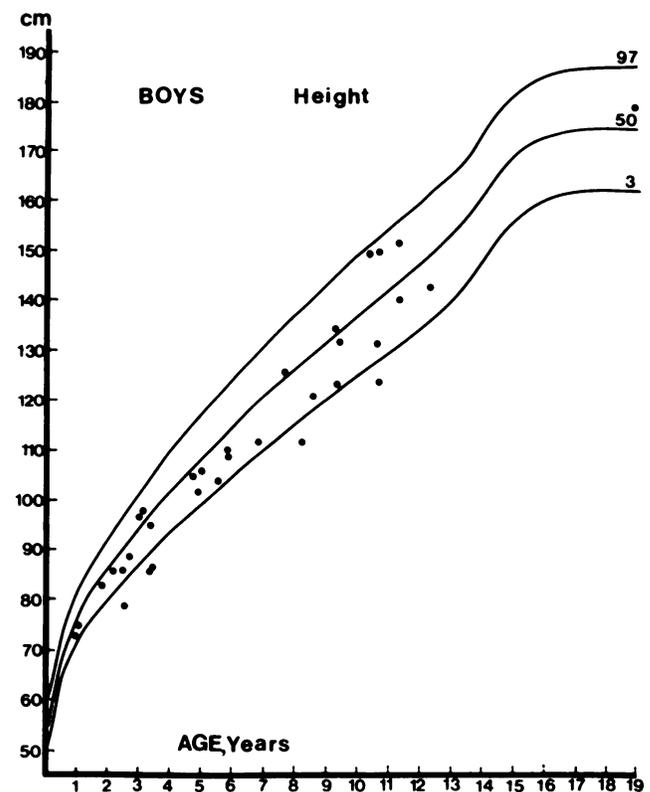


FIG 3. Heights of vegan boys compared with standards for nonvegetarian British children.



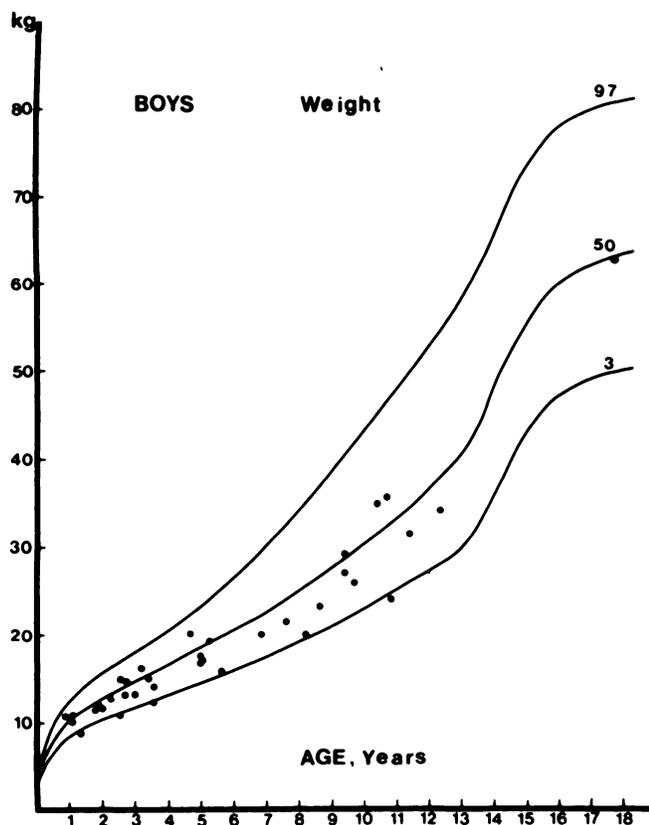


FIG 4. Weights of vegan boys compared with standards for non-vegetarian British children.

lower than the recommended daily amounts and this difference was most marked in the 2–4-y-old age group. The low intakes of fat by the vegan children contribute to their low energy intake. Although low fat intakes are thought to be desirable in adults, higher fat intakes are beneficial in infants and young children because they increase the energy density of the diet. Fruit and vegetables often account for a large proportion of the weight of the vegan diets but only contribute small amounts to the total energy and protein intakes. Cereals, pulses, and especially nuts provide far more nutrients on a weight basis. These foods are also good sources of protein. It would seem unwise to feed young children large amounts of fruits and vegetables because this will restrict energy intakes. The energy density of the diets of vegan children is best maintained through the consumption of cereals, legumes, and nuts rather than large amounts of watery fruits and vegetables.

It is important to recognize that there are adequate and inadequate vegan diets. Malnutrition can arise because of ignorance and misinformation. Severe malnutrition was reported in Rastafarian vegan children (9). Rastafarians are often alienated from the rest of society by their beliefs. Consequently they may be less accessible to dietary advice. Individual cases of severe malnutrition are occasionally reported in medical journals in children fed inappropriate vegan diets (15). These cases usually receive widespread publicity and have led many health

professionals to condemn vegan diets as being nutritionally inadequate.

Children reared as vegans can grow up to be normal children. There is no evidence that their intellectual functioning is impaired or that the vegan diet adversely affects their physical stamina. The parents of vegan children, however, do need to take care to avoid the known pitfalls. There is a need for vegetarian and vegan organizations to give out sensible dietary advice to their followers. Health professionals also need to be more tolerant of vegans. They follow their diets for strongly held beliefs and deserve the same respect afforded to other groups that have dietary restrictions, such as Jews, Muslims, and Hindus. 

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