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# Anthropometric Parameters in Public School Students and Seventh-day Adventist Vegetarian and Meat-Eating students

Joan Sabaté-Casellas

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LOMA LINDA UNIVERSITY

School of Public Health

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# Anthropometric Parameters in Public School Students and Seventh-day Adventist Vegetarian and Meat-Eating Students.

By

Joan Sabaté-Casellas

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A Dissertation in Partial Fulfillment of the Requirements for the Degree of Doctor of Public Health in Nutrition

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June, 1989

c 1989

Joan Sabaté-Casellas

ABSTRACT OF THE DISSERTATION

# Anthropometric Parameters in Public School Students and Seventh-day Adventist Vegetarian and Meat-Eating Students.

by

Joan Sabaté-Casellas

1989

Concerns have been expressed for the ability of some vegetarian diets to support normal growth of children. Animal protein or meat intake showed a positive relationship to attained height in children from developing countries. In this study, the relationship between meat intake/vegetarian status and physical growth was investigated in children living in California.

Height and weight were collected on 2,272 Caucasian children aged 6-18 years attending Seventh-day Adventist (SDA) or public schools who participated in a two year longitudinal study. Age-, sex-, and school-specific mean heights and weights were at or above the national reference values. Sex-specific, age-adjusted regression analysis showed that SDA boys were on the average 1.6 cm taller ($p<0.001$) than public school boys, but no difference was found for the girls. SDA school boys and girls were significantly leaner (-1.27 kg and -1.16 kg, respectively)

than their counterparts in public schools when weight differences were tested after controlling for height.

The administration of a food frequency questionnaire to a subsample of 1,765 children, showed that one third of SDA children were lacto-ovo vegetarians (meat intake <1/wk), another third were low meat eaters (1/wk - <1/d), and 31% ate meat products once or more per day. In contrast, 92% of public school children ate meat daily. Among SDA children, vegetarian boys and girls were on the average 2.5 cm ($p<0.001$) and 2.0 cm ($p=0.01$) taller, respectivly, than their non-vegetarian classmates. Height was not associated, however, with meat intake for either sex among public school children.

SDA lifetime vegetarian boys and girls were 3.1 and 2.2 cm taller compared to their classmates who had consumed meat throughout their lifetime. When controlling for parental height, socioeconomic status and passive smoking exposure, the differences were 3.3 and 2.2 cm for boys and girls, respectively.

These findings show that meat intake is not required for normal growth. A lifetime vegetarian diet supports physical growth of school-aged children at or above national standards.

Each person whose signature appears below certifies that this dissertation in his/her opinion, is adequate in scope and quality as a dissertation for the degree Doctor of Public Health.

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TABLE OF CONTENTS

LIST OF TABLES

Article 1

Anthropometric Parameters in Children Attending Seventh-day Adventist and Public Schools in California



Article 2

Meat Consumption and Height of School-Aged Children in California

Tables

Appendix I

## Appendix II

# LIST OF FIGURES

## Article 1

## Anthropometric Parameters in Children Attending Seventh-day Adventist and Public Schools in California



## Appendix I

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# INTRODUCTION

## Background

For the last two decades there has been an increased interest in vegetarian diets and these regimens have become popular in the United Stats and other Western Countries. A considerable body of scientific data suggests positive relationships between vegetarian lifestyles and decreased risk for several chronic degenerative diseases in adults (1). Concerns have been raised, however, about the possible nutritional risk some vegetarian diets may impose on children, and the ability of these regimens to support physical growth similar to norms (2).

Growth is considered one of the most sensitive indicators of a child's general health and especially of his/her nutritional status (2, 3,). Few systematic studies of the growth of vegetarian children exist and most of these relate to infants and preschoolers. Shull et al (4) compared growth of 72 vegetarian children younger than five years of age with Harvard standards (5). Weight and length increments of children under two years were substandard. The authors speculated that prolonged breast-feeding without appropriate weaning foods might have contributed to this. Growth velocities of children older than two years of age approximated the Harvard reference standards. Since these

children were already below average for height and weight, growth should have been above the norm if catch-up was to occur.

Dwyer et al. (6) compared the length and weight of 119 preschool children on various vegetarian diets to Harvard standards. They found that these vegetarian preschoolers fell below the anthropometric standards beginning around 6 months of age with the difference becoming progressively more pronounced in the children over 18 months of age. When comparison was made between the macrobiotic group and those consuming a more traditional vegetarian diet, it was found that, as a group, the non-breast fed macrobiotics with extreme avoidance of animal products were smallest. Over 65% of children, 87% of whom were macrobiotics, fell below the 10th percentile after adjustment for parental height.

In a larger sample, Dwyer and co-workers reported anthropometric measurements of 142 vegetarian children (7) and developed a growth curve from the data (8). Children's ages ranged from a few weeks to 6 years. Weight for age was not found to be significantly different from the National Center for Health Statistic norms (9). Length of children 1 - 3 years of age was below the norm, with macrobiotic children being significantly shorter than the other vegetarians. Length for age was more affected by dietary

practices than weight. Using the Jenss-Bayley curve fitting technique (10), the growth curves obtained for vegetarian children were from 0.5 - 1 kg and 1 - 2 cm lower, depending on age, sex, and diet, than were curves for reference omnivorous children.

Fulton et al (11) gathered data on 48 children ages 2 - 5 years fed solely on pure vegetarian diets and raised in a commune. Mean height and weight values of children 3 - 5 years of age were below standards, but that was not the case in two year old children. Similar findings were reported by Sander and Purves (12) on 23 vegan children in England. Although these children tended to be smaller in stature and lighter in weight when compared with normative standards, all but two were within the normal range for height and weight.

Not all studies, however, found that slower growth and smaller size are common in vegetarian children. Weight to height ratios of 45 Seventh-day Adventist preschoolers on meatless diets were found to be similar to comparable omnivorous children (13). This was the case for both sexes in younger and older preschoolers. Herbert (14) recently reported a positive correlation betwen vegetarian diets and growth of young children in South India. A vegetarian diet was a significant determinant for children older than 3

years of age for weight- and height-for-age, after controlling for per capita food expenditure.

The studies available thus far on preschoolers are not as complete as one would like. Also, it is difficult to draw firm conclusions because almost every study used different standards. However, the data seems to indicate that some vegetarian diets are likely to delay growth in infants and preschoolers. It is not clear, however, if the slower growth is directly related to the avoidance of animal products in the diet or to other factors. As has been pointed out, there may be an association between some vegetarian diets and a variety of lifestyles that may adversely affect the growth of the child independently of food intake per sè (15). No nutritional or growth deficiencies have been identified among lacto-ovo vegetarian children.

These findings among young children on vegetarian diets raise various questions. Is the slower growth found during younger ages also observed in older vegetarian children? Do specific vegetarian dietary practices preclude reaching normal height at adulthood? Unfortunately, longitudinal studies following vegetarian children living in Western countries from birth through adulthood are not available (16).

Limited cross-sectional information is available on the relationship between vegetarian diets or meat intake to attained height of older children and adolescents. Rona, et al (17) studied the relationship between vegetarian diets and growth in primary school children of various Asiatic ethnic minorities living in Britain. Vegetarian girls tended to be shorter than non-vegetarian girls in all Asian groups, although this difference was only significant in one ethnic group. No differences in height were found for boys according to vegetarian status. Graham et al (18) studied the nutrient intake - growth relationship in 123 children, 2-19 years of age from poor families in Peru. Multiple regression analysis identified the percentage of protein from animal sources and $\beta$-carotene intakes as strongly associated with achieved height and weight in boys. The correlations were not as strong in girls.

These studies seem to indicate that older vegetarian children are shorter than non-vegetarian children and animal protein relates positively to attained height. However, the results of these studies conducted in developing countries or among deprived minorities may be confounded by other nutritional or environmental factors such as socio-economic status or total energy intake.

Studies with a large number of older children or adolescents raised on vegetarian diets living in Western countries have not been identified. In the United States, however, SDA children provide a unique opportunity to study the relationship between vegetarian diets and physical growth.

Seventh-day Adventists (SDAs) are members of a conservative Christian denomination with about 700,000 members in the U.S. and over 5 million members world-wide (19). They follow a rather unique lifestyle. Over 98 per cent neither smoke nor drink alcoholic beverages (20), and about 50 per cent follow a lacto-ovo-vegetarian diet (21, 22). Nearly all SDAs abstain from pork and other biblically defined unclean meats. They also tend to avoid caffeine-containing beverages. These lifestyle patterns prevail among their offspring (23). The analytical advantage of their large variation in meat intake, from pure vegetarians to heavy meat eaters, is further enhanced by the relative homogeneity of SDAs with respect to other environmental factors that frequently confound the diet-height relationships such as exposure to passive smoking. Also, the availability of food choices and the adequacy of total energy intake are not limiting factors, as is often the case in vegetarian pediatric populations in developing countries.

From 1976 to 1981 an epidemiological study was conducted at Loma Linda University to study the relationship of dietary, psychosocial and physical fitness factors to the blood pressure levels of youth aged 6-18 years attending SDA and public schools. This study is known as the "Child-Adolescent Blood Pressure Study" (23) and several other published papers were based on this data set as well as a Ph.D. dissertation (24, 25, 26). Data collection consisted of three phases and involved a two-stage sampling scheme that used both random and ranked sampling strategies (described in Appendix I). In brief, during Phase I, anthropometric, demographic and blood pressure data were documented on 7,840 screened children aged 6-17 years, who attended either SDA parochial schools or public schools in the Los Angeles basin. In Phase II, in addition to blood pressure, height and weight were obtained from approximately 2,300 white students randomly selected from the upper, middle and lower thirds of the Phase I blood pressure distributions for each age, sex and school system group. Extensive dietary information was obtained from a subgroup of 1,765 students. Phase III gathered anthropometric, demographic and lifestyle data on the parents of a subsample of the Phase II children. In addition, mothers completed a questionnaire detailing various lifestyle, gestational and past dietary characteristics of their offspring.

This data set offers a unique opportunity to test the relationship of height to meat consumption in older children without some of the major limitations of previous studies. First, a large number of vegetarian children are included in the sample. Second, for a large subsample of subjects a comprehensive set of growth correlates is available, including parental height. The control of this potentially confounding factor in the analysis facilitates the assessment of the true effect of diet on growth.

**Purpose and Research Objectives**

The purpose of this dissertation was to investigate the relationship between meat consumption/vegetarian status and physical growth in older children and adolescents attending SDA and public schools who participated in the "Child-Adolescent Blood Pressure Study".

The major research objectives can be summarized as follows:

1. To compare the anthropometric parameters of children attending SDA and public schools.

2. To describe the dietary patterns of the SDA and public school children, especially the meat consumption habits.

3. To investigate the relationships between meat intake and attained height in children ages 7 to 18.

4. To examine the influence of lifetime vegetarian status on attained height of SDA school children.

**Organization of the Dissertation**

This dissertation is organized along the following lines. The first paper, "Anthropometric Parameters of Children Attending Seventh-day Adventist and Public Schools", presents descriptive data on four anthropometric parameters: height, height velocity (growth rate), weight, and body mass index for children in the two school systems. Height and weight data are compared to national reference values. Sex-specific, age-adjusted comparisons of the parameters between groups are also presented.

The second paper, "Meat Consumption and Attained Height of School-aged Children", includes the description of the dietary patterns of SDA and public school students. It presents descriptive data on the height of SDA vegetarians, SDA non-vegetarians and public school children, and reports on the meat intake-height relationship separately in each school system.

Appendix I outlines the study design and sampling strategy of the "Loma Linda Child-Adolescent Blood Pressure Study".

Appendix II summarizes the results of the bivariate analyses (controlling for age) of correlates for height in SDA boys and girls whose parental height was available. It contains the algorithm description used to categorize SDA children into lifetime dietary patterns, and the final multivariate models.

Appendix III contains the anthropometric data forms and all questionnaires used in the data collection of variables pertinent to the present study.

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# ARTICLE 1

# ANTHROPOMETRIC PARAMETERS OF CHILDREN ATTENDING SEVENTH-DAY ADVENTIST AND PUBLIC SCHOOLS IN CALIFORNIA

**Abstract**

Height and weight data obtained from a two-year longitudinal survey were analyzed for 2,272 children aged 6-18 years attending Seventh-day Adventist (SDA) schools (542 boys, 548 girls) or public schools (609 boys, 573 girls). Age-sex-school-specific mean heights and weights were at or above the 50$^{th}$ percentile of the national reference values. Sex-specific, age-adjusted regression analysis showed that SDA boys were 1.6 cm taller ($p<0.001$) on the average than public school boys. There were no significant differences in height for girls. No significant differences in weight were found for either sex between the school groups in univariate analysis. However, after controlling for height, boys and girls in the SDA schools were found to be leaner, 1.27 kg ($p=0.002$) and 1.16 kg ($p=0.007$), respectively. Further study is needed to identify factors related to these anthropometric differences.

**Key Words:** body-height, body-weight, body mass index, growth rate, school-aged children, Seventh-day Adventist

## Introduction

Adult Seventh-day Adventists (SDAs) have been studied extensively in relation to health and disease for the past 30 years and over 150 reports have appeared in the literature. They have low risk for coronary heart disease (1, 2, 3, 4), cancer of many sites (5, 6, 7, 8) and other prevalent diseases (9, 10), and increased life expectancy has also been reported (10, 11, 12).

Seventh-day Adventists are members of a conservative Christian denomination with about 700,000 members in the U.S. and over 5 million members world-wide (13). They follow a rather unique life-style. Over 98 per cent neither smoke nor drink alcoholic beverages (2), and about 50 per cent follow a lacto-ovo-vegetarian diet (7). Nearly all SDAs abstain from pork and other biblically defined unclean meats. They also tend to avoid caffeine-containing beverages. These life-style patterns tend to prevail among their children (14).

The substantial data on adult SDAs describing their health status as compared to the non-SDA population contrasts with the paucity of reports dealing with the health status of their children. Most of the few studies dealing with SDA youngsters have related to the lower prevalence of dental caries in school-aged children (15, 16,

17) and the better profile of cardiovascular risk factors in adolescents (18, 19). Harris et al (14) found no difference in blood pressure of children attending SDA or public schools.

Anthropometric parameters are used widely to assess the health and nutritional status of pediatric populations (20). Limited information is available on body size of SDA pre-schoolers (21) and adolescents (19, 22) who follow a vegetarian diet; to our knowledge no data has been published on the physical growth and size of school-aged SDA children.

There is growing interest in the early precursors of chronic degenerative disease which may be present during childhood and the relation of life-styles in early life to disease prevention (23, 24). SDAs provide a unique opportunity to study the effects of a prudent life-style during childhood and adolescence on height, weight, and growth. This study compares the anthropometric parameters of children attending SDA parochial schools with those in public schools, all of whom participated in the Child-Adolescent Blood Pressure Study in Southern California (14).

**Methods**

This study is an analysis of data collected in the 1977-81 Loma Linda Child-Adolescent Blood Pressure Study (14), an epidemiologic study which investigated the relationship of dietary, psychosocial, and physical fitness factors to blood pressure levels of school-aged children. Data collection took place in several phases and involved a two-stage sampling scheme using both random and ranked sampling strategies (FitzSimmons SC, Ph. D. Dissertation, 1985). In brief, during phase I, 16 SDA schools and 12 public schools in the Los Angeles basin were selected. Criteria for selection were proximity to Loma Linda University, and an ethnic distribution of students similar to the general population of the area. All students enrolled in grades one to ten of the selected schools were eligible to participate. Informed consent from the parents was obtained before data collection. Anthropometric, demographic, and blood pressure data were documented for 7,840 screened children aged 6-17 years, or 84% of the eligible students. Refusal rates were low, less than 2%. The major limiting factor in obtaining data was absence from school on days the field team collected data (14%). Harris et al (14) reported on the distribution of the screened study population by age, sex, ethnicity and school type.

Data collection for phase II included only non-hispanic white children. Of the 1,618 SDA and 2,802 public school students from phase I, 3,000 were sampled rank-wise from the upper, lower and intermediate levels of the phase I blood pressure distributions for each age, sex and school group. As in phase I, absence from school on the days the field team collected data was the primary reason for non-participation. Height and weight measurements were obtained for 1,090 SDA and 1,182 public school children or 73% and 79%, respectively of those eligible. The distribution of these children by age, sex and school type is shown in Table 1.

Height was recorded to the nearest 1/4 inch, using a portable stadiometer, with the child standing erect in stocking feet without upward pressure exerted on the mastoids. Weight was recorded to the nearest pound with the child wearing light clothing without shoes, using a portable beam scale.

Body mass index (BMI) was calculated as weight in kg divided by height in meters squared. Height velocity (growth rate) was expressed in cm/year; it was computed by dividing the difference in height between phase II and phase I data collection by the time between measurements. Phase II measurements followed phase I by an average of 12 months,

varying from 9 to 15 months. Height velocity was plotted against age at phase II data collection. Age was computed by subtracting the birth date from the phase II data collection date. Age was used as a continuous variable for all analyses; however, it was categorized for constructing tables.

To test for significant differences in attained height, weight and BMI between the school sub-groups, we performed sex-specific, age-adjusted multiple linear regression analyses, using SPSS software for microcomputers (25). This method has several advantages over the T-test for each age-sex-strata. Height, weight and BMI can be used as continuous variables, with the regression coefficient giving an estimate of the effect. Modeling also avoids the problem of small sample size in some strata.

Since height, weight or BMI might not be related linearly with age, we first determined the best fit model between height, weight or BMI and age separately for each sex. We then tested for school differences by including a binary variable for school group. Selection criteria for the best model was the highest coefficient of determination ($R^2$) with minimal colinearity. Age and age-cubed ($age^3$) were used as independent variables in all models for height. Age alone was used on the models for weight and BMI. For

boys the addition of age$^3$ to the height model added only a marginal increase in the explained variance but it was included to make that model comparable to the one used for girls where age$^3$ made a significant contribution. Age squared explained the variance in height nearly as well as age$^3$, but it was closely correlated to age resulting in tolerance problems.

Since weight is related to height, it was necessary to control for height when studying differences in weight between the two school systems. We used two approaches: 1) testing for differences in Quetelet index, and 2) controlling for height when testing for weight differences.

**Results**

Tables 1, 2 and 3 show, respectively, the mean height, weight and BMI by age, sex and school groups. The samples were considered too small to show percentiles. Except for the extremes of the age distribution, where subjects were few, there were about 50 subjects in each age-sex-school group.

For both sexes in each school group, mean height values were well above the 50th percentile of the National Center for Health Statistics (NCHS) reference values (26), except

for 12-year-old SDA girls, who were 1.2 cm below, at approximately the 45$^{th}$ percentile.

SDA boys were taller than public school boys throughout the age range studied, except at 11 and 18 years. The latter age category, however, contained only a few subjects. Age-adjusted regression analysis revealed that SDA boys were 1.6 cm taller ($p < 0.001$) than public school boys (Table 4). No significant differences existed between school types for girls.

The mean weight for each age-sex-school group was above the NCHS reference values, except for 12-year-old SDA girls who were also shorter, and SDA girls aged 15 1/2 to 18 1/2. SDA girls tended to weigh less than public school girls, but the differences did not reach statistical significance. No significant differences in weight existed between the boys.

BMI for girls attending SDA schools was 0.433 lower ($p=0.01$) than their counterparts in public schools. SDA boys showed a non-significant tendency for lower BMI (data not shown). SDA boys and girls were significantly lighter (1.276 kg and 1.163 kg, respectively) than their counterparts at public schools, when weight was compared controlling for height differences (Table 5).

Mean height velocities for each group are graphically presented in Figure 1. The height velocity decreased and was similar in all groups during the preadolescent years. Onset of the pubertal growth spurt occurred at age 9 in public school girls, at age 10 in SDA girls, and near age 12 for boys in both school systems. Peak height velocity was reached by 11 years for girls and by 14 years for boys of both school systems. The magnitude of the growth spurt was greater in public school children than in SDA children; it was also greater for boys than girls in both school groups.

**Discussion**

The Caucasian children we studied in Southern California were taller and heavier than national standards which include Caucasians, Blacks and other races (27,28). The higher stature of the children studied cannot be explained by racial differences, since black children in the U.S. grow at a similar rate as whites, although black children have been found to have lower weight (29).

The salient findings are that SDA boys were significantly taller than public school boys of the same age, and that both boys and girls in SDA schools were leaner than their counterparts in the public schools. These differences cannot be attributed to methodology, since data

was collected by the same team using the same instruments and protocol in both school systems.

There is no reason to believe that SDAs have a genetic predisposition to be taller or slimmer, any more than they have a genetic predisposition to have lower risk for ischemic heart disease (30, 31). California SDAs are better educated and have a higher socioeconomic status than the general population (4, 8) factors which have been positively related to the height of children in other populations (32, 33, 34). However, median height values of the Fels study (27), where children were drawn from middle- to upper-class white families, are quite similar to NCHS values.

It is reasonable to suspect that weight and height differences observed between the school groups may be related to the lifestyle of the children and/or their parents. It is worth mentioning that the comparison was not strictly between SDAs and non-SDAs, since the SDA schools were estimated to have a 10 per cent enrollment of non-SDAs (Office of Education of the SDA Church, personal communication, 1989), and the public schools were estimated to have about 5 percent of SDAs (14). If any lifestyle characteristics were related to physical growth, this degree of dilution would tend to decrease any differences we found.

The vegetarian diet followed by a large percentage of SDA school children (14), has been associated with lower weight of adults and children (35, 36, 37, 38, 39, 40, 41). However, other authors found no difference between the weight of adult vegetarians and non-vegetarians (42, 43, 44), and the Quetelet index of SDA adolescents in Illinois was similar to the general U.S. population (19). We did not find significant differences for either sex between school groups when unadjusted weight data were compared. However, when weight differences were tested controlling for height, SDA boys and girls were shown to be significantly leaner.

Children attending SDA schools were possibly exposed to much less passive smoking in both their intra- and extra-uterine lives than children attending public schools. This may explain some of the height differences between the groups. The negative association of maternal smoking with growth is well known for young children (45, 46, 47), but in older ages it is less clear as to whether the retarding effect on physical development is due entirely to maternal smoking during pregnancy or passive smoking during childhood (48, 49). There is a dose-response relationship with the amount of current maternal smoking and attained height of children 6 to 11 years of age (49). Children of non-smoking mothers were approximately 0.65 cm taller than children of

heavy smokers (49), and in 14 year old children the difference was a few millimeters (50).

It is unclear as to why differences in height were found in boys but not in girls. Although genetic and environmental factors could be expected to have similar effects in both sexes, it is possible that differences in the timing and rate of maturation obscured the effect of these factors on height. The relatively later onset of the adolescent growth spurt in SDA girls (Figure 1) may denote a delay in physical maturation. Kissinger et al (51) and Sanchez et al (52) reported a later age of menarche in vegetarian girls as compared to meat eaters. The height velocity curves from our one-year longitudinal study are related to chronological age, which is a poor indicator of development during adolescence (53). Such curves are not representative of the shape and size of the true velocity curve (54, 55); the magnitude and duration of the true height velocity spurts cannot be ascertained exactly in this study. Other parameters of maturation such as bone age or secondary sexual characters were not collected in this study.

The finding that mean heights of SDA boys and girls were above national standards confirms the suggestion of Dwyer et al (56) that the dietary regimen of SDAs is likely

to sustain adequate growth for children and adolescents. The taller stature of SDA children is associated with lower weight for height, especially in older children. This relative lower weight may result in a health advantage in adult life. Studies are now underway to evaluate the role of diet on physical growth in this population. Furthermore, longitudinal studies from birth to adulthood looking at the time and rate of maturation concurrently with anthropometric parameters and dietary intake may provide new information regarding the relatively unknown interactions of diet, maturation, and growth.

## Table 1

### Age-specific mean heights of boys and girls attending Seventh-day Adventist and public schools

| | | SDA Schools | | | Public Schools | | |
|---|---|---|---|---|---|---|---|
| Boys | Age (Years) | n | mean (cm) | SD | n | mean (cm) | SD |
| | 6.5 - 7.5 | 4 | 128.9 | 4.0 | 14 | 124.5 | 6.2 |
| | 7.5 - 8.5 | 42 | 128.9 | 5.4 | 57 | 127.1 | 5.6 |
| | 8.5 - 9.5 | 49 | 135.3 | 6.8 | 53 | 133.9 | 6.5 |
| | 9.5 - 10.5 | 58 | 140.4 | 5.8 | 79 | 138.8 | 5.7 |
| | 10.5 - 11.5 | 58 | 144.0 | 5.7 | 43 | 145.3 | 6.9 |
| | 11.5 - 12.5 | 59 | 150.8 | 6.3 | 55 | 148.9 | 7.8 |
| | 12.5 - 13.5 | 70 | 158.4 | 7.5 | 36 | 157.3 | 8.4 |
| | 13.5 - 14.5 | 67 | 165.8 | 8.6 | 68 | 163.6 | 8.5 |
| | 14.5 - 15.5 | 63 | 173.7 | 8.3 | 56 | 169.8 | 9.7 |
| | 15.5 - 16.5 | 44 | 176.9 | 8.6 | 85 | 175.0 | 8.0 |
| | 16.5 - 17.5 | 24 | 177.4 | 5.8 | 57 | 176.9 | 6.8 |
| | 17.5 - 18.5 | 4 | 177.8 | 3.8 | 6 | 182.9 | 6.2 |
| Girls | | | | | | | |
| | 6.5 - 7.5 | 3 | 125.3 | 5.2 | 12 | 122.7 | 5.6 |
| | 7.5 - 8.5 | 50 | 129.3 | 5.9 | 53 | 128.1 | 6.1 |
| | 8.5 - 9.5 | 65 | 133.7 | 5.3 | 61 | 133.4 | 5.5 |
| | 9.5 - 10.5 | 61 | 140.0 | 7.0 | 39 | 139.8 | 6.6 |
| | 10.5 - 11.5 | 48 | 146.0 | 6.3 | 62 | 147.7 | 7.6 |
| | 11.5 - 12.5 | 43 | 150.3 | 7.5 | 52 | 151.9 | 8.2 |
| | 12.5 - 13.5 | 54 | 158.7 | 5.8 | 34 | 158.8 | 7.9 |
| | 13.5 - 14.5 | 83 | 163.5 | 6.2 | 67 | 162.3 | 5.7 |
| | 14.5 - 15.5 | 79 | 164.0 | 5.7 | 61 | 164.3 | 7.0 |
| | 15.5 - 16.5 | 43 | 164.2 | 5.8 | 89 | 164.7 | 6.2 |
| | 16.5 - 17.5 | 16 | 163.2 | 6.3 | 41 | 163.9 | 5.2 |
| | 17.5 - 18.5 | 3 | 165.7 | 4.5 | 2 | 168.3 | 2.6 |

## Table 2

### Age-specific mean weights of boys and girls attending Seventh-day Adventist and public schools

| | | SDA Schools | | Public Schools | |
|---|---|---|---|---|---|
| **Boys** | **Age (Years)** | **mean (kg)** | **SD** | **mean (kg)** | **SD** |
| | 6.5 - 7.5 | 26.1 | 1.5 | 24.9 | 3.6 |
| | 7.5 - 8.5 | 27.0 | 5.0 | 26.0 | 4.0 |
| | 8.5 - 9.5 | 31.2 | 5.5 | 30.1 | 4.5 |
| | 9.5 - 10.5 | 33.0 | 4.7 | 33.0 | 6.6 |
| | 10.5 - 11.5 | 36.1 | 6.6 | 39.0 | 7.6 |
| | 11.5 - 12.5 | 42.1 | 8.3 | 41.7 | 10.0 |
| | 12.5 - 13.5 | 47.7 | 9.5 | 50.3 | 16.5 |
| | 13.5 - 14.5 | 54.8 | 11.2 | 52.3 | 9.1 |
| | 14.5 - 15.5 | 61.1 | 8.6 | 59.3 | 12.8 |
| | 15.5 - 16.5 | 66.3 | 13.5 | 65.1 | 10.5 |
| | 16.5 - 17.5 | 66.2 | 6.5 | 68.8 | 9.4 |
| | 17.5 - 18.5 | 78.0 | 13.4 | 73.1 | 7.1 |
| Girls | | | | | |
| | 6.5 - 7.5 | 26.3 | 1.4 | 23.3 | 4.4 |
| | 7.5 - 8.5 | 27.4 | 4.8 | 27.6 | 5.2 |
| | 8.5 - 9.5 | 29.5 | 4.8 | 31.7 | 6.0 |
| | 9.5 - 10.5 | 33.2 | 5.4 | 34.7 | 8.4 |
| | 10.5 - 11.5 | 36.5 | 6.0 | 40.3 | 9.4 |
| | 11.5 - 12.5 | 40.9 | 7.1 | 42.0 | 9.3 |
| | 12.5 - 13.5 | 50.0 | 8.7 | 50.9 | 12.4 |
| | 13.5 - 14.5 | 55.1 | 11.4 | 51.6 | 8.9 |
| | 14.5 - 15.5 | 54.3 | 7.9 | 56.0 | 9.9 |
| | 15.5 - 16.5 | 55.2 | 7.2 | 58.4 | 11.0 |
| | 16.5 - 17.5 | 56.4 | 6.6 | 57.5 | 11.3 |
| | 17.5 - 18.5 | 56.1 | 4.5 | 60.3 | 5.1 |

## Table 3

### Age-sex-specific mean of Body Mass Index* of children attending SDA and public schools

| | | SDA Schools | | Public Schools | |
|---|---|---|---|---|---|
| **Boys** | **Age (Years)** | **mean** | **SD** | **mean** | **SD** |
| | 6.5 - 7.5 | 15.7 | 1.1 | 16.0 | 1.0 |
| | 7.5 - 8.5 | 16.6 | 1.9 | 16.0 | 1.6 |
| | 8.5 - 9.5 | 16.9 | 1.8 | 16.7 | 1.6 |
| | 9.5 - 10.5 | 16.7 | 1.5 | 17.0 | 2.6 |
| | 10.5 - 11.5 | 17.3 | 2.3 | 18.4 | 2.6 |
| | 11.5 - 12.5 | 18.4 | 2.7 | 18.6 | 3.0 |
| | 12.5 - 13.5 | 18.8 | 2.6 | 20.1 | 5.8 |
| | 13.5 - 14.5 | 19.9 | 3.5 | 19.5 | 2.6 |
| | 14.5 - 15.5 | 20.2 | 1.9 | 20.4 | 3.2 |
| | 15.5 - 16.5 | 21.1 | 3.2 | 21.2 | 2.8 |
| | 16.5 - 17.5 | 21.0 | 1.6 | 21.9 | 2.5 |
| | 17.5 - 18.5 | 24.8 | 5.3 | 21.9 | 2.4 |
| Girls | | | | | |
| | 6.5 - 7.5 | 16.0 | 1.1 | 15.4 | 2.0 |
| | 7.5 - 8.5 | 16.3 | 1.8 | 16.8 | 2.4 |
| | 8.5 - 9.5 | 16.4 | 1.8 | 17.7 | 2.5 |
| | 9.5 - 10.5 | 16.9 | 1.8 | 17.7 | 3.4 |
| | 10.5 - 11.5 | 17.0 | 1.8 | 18.2 | 2.8 |
| | 11.5 - 12.5 | 18.0 | 2.1 | 18.0 | 2.5 |
| | 12.5 - 13.5 | 19.8 | 2.8 | 20.0 | 3.8 |
| | 13.5 - 14.5 | 20.6 | 3.9 | 19.6 | 2.9 |
| | 14.5 - 15.5 | 20.2 | 2.4 | 20.7 | 3.1 |
| | 15.5 - 16.5 | 20.5 | 2.3 | 21.6 | 4.0 |
| | 16.5 - 17.5 | 21.2 | 2.6 | 21.4 | 4.0 |
| | 17.5 - 18.5 | 20.4 | 1.5 | 21.3 | 1.1 |

* Body Mass Index: weight in kg/(height in m)$^2$

## Table 4

## Multiple Linear Regression Coefficients for Various Predictors of Height in 2272 School-aged Children in Southern California

| | Boys (n=1,151) | | | Girls (n=1,121) | | |
|---|---|---|---|---|---|---|
| Term | Estimated Effect (SE) | | p | Estimated Effect (SE) | | p |
| Age (years) | 6.71 cm | (0.39) | <0.001 | 10.30 cm | (0.35) | <0.001 |
| Age cube ($y^3$) | 0.002 cm | (0.00) | 0.030 | -0.01 cm | (0.00) | <0.001 |
| SDA vs. public* | 1.56 cm | (0.44) | <0.00 | -0.01 cm | (0.38) | 0.97 |
| Constant | 73.76 cm | (3.07) | <0.001 | 49.92 cm | (2.76) | <0.001 |

* Seventh-day Adventists compared to public school children.

Table 5

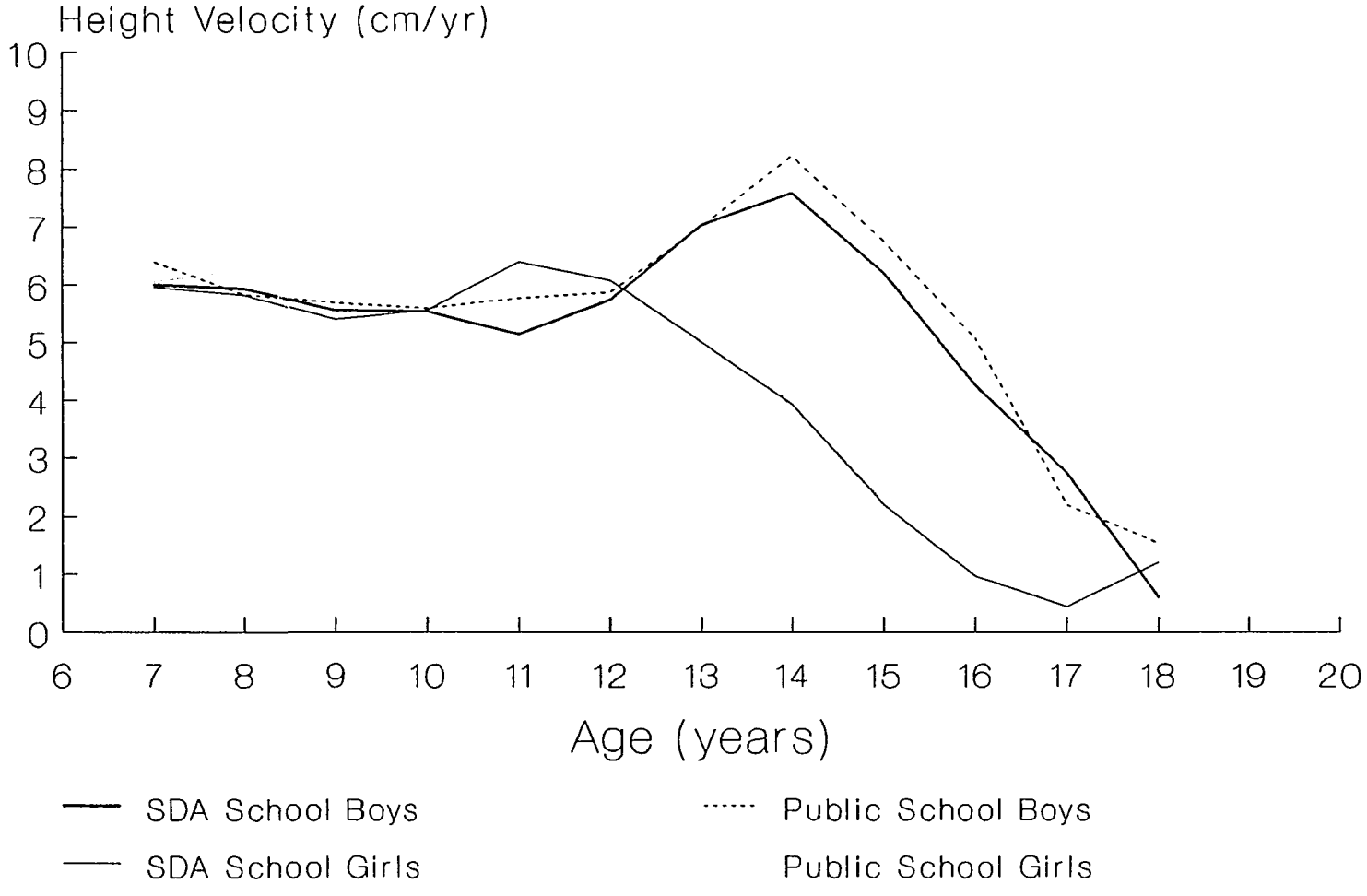
Multiple Linear Regression Coefficients for Various Predictors of Weight

in 2272 School-aged Children in Southern California

| | Boys (n=1,151) | | | Girls (n=1,121) | | |
|---|---|---|---|---|---|---|
| Term | Estimated Effect | (SE) | p | Estimated Effect | (SE) | p |
| Age (years) | 0.357 kg | (0.182) | 0.050 | 0.788 kg | (0.158) | <0.001 |
| Height (cm) | 0.776 kg | (0.028) | <0.001 | 0.674 kg | (0.030) | <0.001 |
| SDA vs. public* | -1.276 kg | (0.421) | 0.002 | -1.163 kg | (0.432) | 0.007 |
| Constant | -77.134 kg | (2.46) | <0.001 | -66.812 kg | (3.02) | <0.001 |

* Seventh-day Adventists compared to public school children.

# Growth Rate


Height Velocity (cm/yr)
10
9
8
7
6
5
4
3
2
1
0
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Age (years)
SDA School Boys
SDA School Girls
Public School Boys
Public School Girls

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# ARTICLE 2

# MEAT CONSUMPTION AND HEIGHT OF SCHOOL-AGED CHILDREN IN CALIFORNIA

**Abstract**

The relationship of meat consumption and height of school-aged children in Southern California was determined by use of a food frequency questionnaire and height measurements of 1,765 Caucasian children, aged 7 to 18 years, attending public schools (452 boys, 443 girls) and Seventh-day Adventist (SDA) schools (427 boys, 443 girls). One third of the SDA children were vegetarians (meat intake <1/wk), one third were low meat eaters (1/wk - <1/d), and 31% ate meat once or more per day. In contrast, 92% of public school children ate meat daily. Age-adjusted regression analysis showed that SDA school vegetarian boys and girls averaged, respectively, 2.5 cm ($p<0.001$) and 2.0 cm ($p=0.01$) taller than their meat-eating classmates. When SDA vegetarian girls were compared with subgroups of low, medium or high meat eating SDA girls, the differences were 2.3 ($p<0.005$), 1.8 ($p<0.05$), and 1.1 ($p=0.2$) cm, respectively. No significant differences ($p>0.05$) in height were observed between the low, intermediate and high tertiles of meat intake for either sex among public school children. These results suggest that a vegetarian diet can support normal growth of school-aged children.

**Key Words**. Meat intake, vegetarian diet, body-height, school-aged children, Seventh-day Adventist, physical growth, diet assessment.

## Introduction

The growth of vegetarian children has been a cause for concern among health professionals for the last two decades (1, 2, 3, 4, 5, 6,). Several studies have reported that some vegetarian diets may compromise or delay growth in infants and preschoolers (7, 8, 9, 10, 11, 12, 13, 14). Other studies, however, found no such effect (15, 16).

In school-aged children from developing countries or among deprived minorities vegetarian diets were associated with short stature (17), while animal protein was positively related to attained height (18). However, other factors such as total caloric intake or differences in socioeconomic status may have influenced the results. There is little data on the meat consumption-height relationship of school-age children living in an affluent society. The issue is of relevance, in view of the increased interest in vegetarian diets in the U.S. (19).

In a recent study (20), we found that school-aged children who attended Seventh-day Adventist (SDA) parochial schools in Southern California were taller than National Center for Health Statistics normative standards for both sexes. SDA school boys were taller than public school boys, but no significant difference in height was found for girls. A distinguishing lifestyle characteristic of SDAs appears to

be their dietary habits (21). Phillips (22) estimated that approximately 50% of adult SDAs in California consume a lacto-ovo-vegetarian diet, and almost all refrain from eating pork products. It is reasonable to expect that similar patterns prevail among the children attending SDA schools.

In the present study, we investigated the relationship between meat consumption and attained height in children attending SDA and public schools in Southern California.

## Subjects and Methods

This study is an analysis of data collected during Phase II of the Child-Adolescent Blood Pressure Study (23), an epidemiologic study of the relationship of dietary, psychosocial and physical fitness factors to the blood pressure levels of school-aged children. Data collection consisted of three phases involving a two-stage sampling scheme that used both random and ranked sampling strategies (SC FitzSimmons, Ph.D. dissertation 1985) (23). Informed consent was obtained from the parents before data collection. In brief, during Phase I, anthropometric, demographic and blood pressure data were documented on 7,840 screened children aged 6-17 years who attended either SDA or public schools in the Los Angeles basin. During Phase II, blood pressure, height, and weight measurements were

obtained from approximately 2,300 non-Hispanic white students sampled rank-wise from the upper, middle and lower levels of the Phase I blood pressure distributions for each age, sex, and school group. Dietary and psychosocial information was obtained on 1,765 students. Phase III gathered similar data on the parents of a subsample of phase II children.

To characterize the dietary habits of the children studied, a non-quantitative food frequency questionnaire was developed and validated. It included questions on current use of 106 different types of meat, dairy products, sweets and desserts, snack foods, fruits, vegetables, breads and cereals, beans, and meat analogs. The questionnaire was self-administered by all youngsters age 10 or older, and completed by the mothers of children age 6 to 9 years. Frequency choices were (1) never (almost never), (2) every month (sometimes), (3) every week (often), and (4) every day (very often).

For each child we constructed a simple frequency index giving approximate monthly consumption of foods for each of six food groups (shown in Table 1): 1) Meat - including poultry and fish; 2) Dairy products - milk, cheese, ice cream, yogurt and eggs 3) Fruit and vegetables - both fresh and canned; 4) Starchy foods - bread, cereals, pasta and

legumes; 5) "Junk foods" - candy, cookies, potato chips and other snack foods; and 6) Vegetable protein meat analogs. The index was calculated as the sum of the reported frequency of usage for each food in the group -never, every month, every week or every day- times 0, 2, 8 or 30, respectively.

A child consuming meat less than once per week was defined as vegetarian. This definition was used previously in other studies relating dietary habits of SDAs to health/disease outcomes (24). A child was defined as a low meat-eater if his/her consumption of meat products was one or more times per week, but lower than once per day, and a medium/high meat-eater if meat was consumed one or more times per day.

The age of a child was computed by subtracting the birth date from the phase II anthropometric data collection date. Age was used as a continuous variable for all analyses; however, it was categorized for constructing tables. To test for significant differences in attained height among the dietary and school sub-groups, we performed sex-specific, age-adjusted multiple linear regression analysis, using the SPSS program (25). This method has several advantages over T-tests for each age-sex-strata. Height can be used as a continuous variable, the effect of

meat consumption can be measured using the beta coefficient, and modeling avoids the problem of small numbers in some strata.

Since height might not be related linearly with age, we first fitted the best model between height and age for each sex. We then tested for differences in height among dietary sub-groups by including dummy variables. Selection criteria for the best model was the highest coefficient of determination ($R^2$) with minimal collinearity. Age and age cubed ($age^3$) were included in all models as independent variables. For boys the addition of $age^3$ to the model added only a marginal increase in the explained variance but it was included to make the model comparable to the one used for girls where this term made a significant contribution. Age squared explained the variance in height almost as well as $age^3$, but it was closely correlated with age, thus resulting in tolerance problems.

We investigated the relationship between meat consumption and attained height separately for the two school systems since there was reason to believe that students in the two systems might differ in unmeasured confounding variables, such as socioeconomic status.

**Results**

Table 1 shows the mean frequency of monthly consumption for the six food groups according to school system, indicating the 25th and 75th percentiles. A striking difference between the two school systems was the lower meat intake by SDA children.

Table 2 compares the children's meat consumption habits. Approximately one-third of the SDA children were vegetarians, another third were low meat eaters, and the rest were in the medium/high category of meat consumption. In contrast, 92% of public school students were medium/high meat eaters, with only one child a vegetarian and 7.6% low meat eaters. Sex-specific meat consumption habits for SDA children are also detailed in Table 2.

Tables 3 and 4 show the age- and sex-specific mean heights for the SDA and public school students according to vegetarian and meat eating status. For both boys and girls, mean height of vegetarian SDA children was similar or greater than non-vegetarians whether from SDA or public schools for most age categories.

Table 5 compares SDA vegetarian children to SDA meat eaters. Vegetarian boys and girls were, respectively, 2.5 cm and 2.0 cm taller than the meat eaters. To test for a

dose-response relationship, meat eaters were subdivided into two categories: Low or medium/high meat consumption, as previously defined (Table 2). Boys in both meat eating groups were 2.5 cm shorter than the vegetarian boys after controlling for age (Table 6). For girls, however, the low meat eaters were shorter than the medium/high meat eaters (data not shown). To determine if these results were related to the grouping of subjects, the meat eating girls were split into tertiles. A dose-response was observed for girls among the meat eaters, with low meat eaters being shorter than high meat eaters (Table 7). Girls in the three meat eating categories tended to be shorter than the vegetarians, although the high meat eating group was not significantly so.

In public school children no significant differences (p value >0.05) in height were observed between the low, intermediate or high tertiles of meat intake for either sex. The regression coefficients for comparing intermediate (2-3/d) and high (>3/d) to low meat intake (<2/d) were 0.25 cm and 0.3 cm, respectively, for boys and for girls 0.74 cm and -0.15 cm, respectively (data not shown in tabular form).

## Discussion

The dietary patterns of children attending SDA schools (tables 1 and 2) were similar to the ones previously reported in the adult SDA population (26, 27, 28). SDA children eat meat, poultry, fish, and "junk food" less frequently, and fruits, vegetables, starchy foods, and vegetable protein products more frequently than a comparable group of public school children living in the same geographic area. A sizable number of children attending SDA schools follow a lacto-ovo-vegetarian diet. However, about one third of the SDA youngsters reported a frequency of meat intake similar to their counterparts in public schools.

The salient finding in this study was that vegetarian boys and girls attending SDA schools were significantly taller than their meat-eating classmates. Among SDA children, meat intake or possibly other factors closely associated with it, had a negative relationship to attained height, but with an apparent threshold effect. This may indicate that there is a low or very low level of meat consumption, above which the negative effect on height can be observed, but further increase has no additional effect. In favor of this explanation is the fact that we did not find height differences in public school students where meat was in the higher range of consumption. In SDA students, where the wide variation of meat consumption patterns

encompassed the threshold limit, we observed the negative relation. Our data are compatible with this interpretation except for the moderately positive dose-response effect among the meat eating SDA girls.

Alternative explanations as to why vegetarians were taller must be considered. Among SDA children, vegetarians consumed significantly ($p \leq 0.001$) less "junk foods", dairy products and eggs, and significantly ($p \leq 0.001$) more starch foods, meat analogs, fruit and vegetables than those who ate meat (data not shown). One or more of these foods, or the differences in eating patterns between the groups may be related to growth. The inferior nutritional value of "junk foods" may negatively influence growth. Conversely, meat analogs were found to be adequate substitutes of meat in animal growth studies (29) or in nitrogen balance in humans (30). Whether long-term use of these foods affects growth is presently unknown.

Factors other than food intake might also affect growth. The meat consumption-height relationship in each school system was investigated separately to control for factors not measured in our study, such as socioeconomic status and exposure to passive smoking, which are known to affect attained height of school-aged children (31, 32, 33, 34, 35, 36). Families of children attending private (SDA)

schools were likely to have higher socioeconomic status than families of children in public schools. Additionally, previous studies of adult SDAs in California reported that they were almost exclusively non-smokers (37, 38) and better educated, with a larger percentage having white collar professions than the general population (39, 40).

It could be argued that vegetarian families may have other non-dietary lifestyle factors that favorably affect the growth of their children. However, this seems unlikely within our SDA population, since California adult SDAs are quite homogenous in health practices other than diet (36, 37).

Variations in genetic potential may exist between the vegetarians and the non-vegetarian children studied. Parental height is a proxy measure of the genetic influence on height. Unfortunately, we do not have this variable for the entire study population, although available data on a sub-sample of parents (Phase III, unpublished data) argues against this explanation.

Yet another explanation could be the limitation of the study design and the possibility of self-selection into the different diet groups. This cross-sectional design shares a common problem with most of the published studies on

vegetarian diets and growth, namely, inability to assess temporality of the events. Since measurement of exposure (meat intake) and outcome (height) were made simultaneously, it is impossible to determine which came first. Only a longitudinal study design would be able to address these questions.

Regardless of its limitations, this is one of the few epidemiological studies to find a relationship between food intake and growth in a developed country (41), in contrast with the lack of such a relationship in other studies (42, 43, 44). The participants' wide range of meat intake and the large number of subjects in both extremes of the spectrum (vegetarians versus heavy meat eaters) may have contributed to these results. SDA children provide a unique opportunity to study the possible relation between a vegetarian diet and physical growth. The analytical advantage of their large variation in meat consumption is further enhanced by the relative homogeneity of SDAs with respect to other environmental factors that frequently confound the diet-height relationship, such as passive smoking (36).

In conclusion, the results of this study support the view that meat intake is not essential for normal growth. A lacto-ovo-vegetarian diet is compatible with and conducive to normal physical growth of school-aged children. These findings should be validated in longitudinal studies.

## Table 1

**Frequency of use (times/month) of 6 food groups by Seventh-day Adventist and Public School Children in Southern California**

| | Mean + SD (Values for 25th - 75th percentiles) | | |
|---|---|---|---|
| | SDA (n=870) | Public (n=895) | p* |
| Meat Group | 27.8 ± 39.7 (0 - 38) | 86.4 ± 56.0 (52 - 104) | <0.001 |
| Dairy Products | 84.6 ± 37.4) (60 - 102) | 92.4 ± 43.4 (64 - 108) | <0.001 |
| Fruit/Vegetables | 120.9 ± 63.2 (72 - 160) | 94.5 ± 58.9 (52 - 124) | <0.001 |
| Starchy Foods | 84.2 ± 39.6 (58 - 102) | 77.8 ± 45.5 (47 - 98) | 0.002 |
| Junk Foods | 67.0 ± 46.3 (36 - 86) | 95.6 ± 62.5 (53 - 114) | <0.001 |
| Vegetable Protein Meat Analogues** | 32.9 ± 33.2 (12 - 44) | ---- | |

* p value of the t-test comparing the frequency of use among children of both school systems.

** Vegetable protein products were not include in the questionnaire given to public school children

Table 2

Frequency of Meat Usage in Children Attending SDA Schools and Public Schools in Southern California

| | Vegetarians (<1/wk) | Low Meat Intake (1/wk - <1/d) | Med/High Meat Intake (1 or more/d) |
|---|---|---|---|
| Public School Children (n=895) | 0.1% (1) | 7.6% (68) | 92.3% (826) |
| SDA Children (n=870) | 32.5% (283) | 36.3% (316) | 31.1% (271) |
| SDA Boys (n=427) | 28.8% (123) | 34.0% (145) | 37.2% (159) |
| SDA Girls (n=443) | 36.1% | 38.6% | 25.3% |

Table 3

Mean Height for Boys by Age, School Type and Vegetarian Status.

| Age | Seventh-day Adventist Schools | | | | | | Public Schools | | |
|---|---|---|---|---|---|---|---|---|---|
| | Vegetarians (n=123) | | | Meat Eaters (n=304) | | | (n=452) | | |
| | n | mean | SD | n | mean | SD | n | mean | SD |
| 7* | | | | | | | 3 | 120.9 | 8.3 |
| 8 | 7 | 130.6 | 4.9 | 6 | 129.0 | 4.5 | 20 | 128.6 | 5.3 |
| 9 | 6 | 135.9 | 5.4 | 14 | 136.3 | 6.2 | 18 | 136.1 | 6.2 |
| 10 | 16 | 139.6 | 6.7 | 12 | 141.2 | 5.5 | 27 | 139.7 | 6.3 |
| 11 | 15 | 144.8 | 3.8 | 33 | 144.4 | 6.3 | 35 | 145.1 | 7.3 |
| 12 | 11 | 152.3 | 7.0 | 43 | 150.9 | 6.3 | 49 | 148.6 | 7.9 |
| 13 | 15 | 160.2 | 6.0 | 55 | 158.0 | 8.0 | 36 | 157.3 | 8.5 |
| 14 | 13 | 165.0 | 6.3 | 53 | 165.8 | 9.2 | 67 | 163.7 | 8.6 |
| 15 | 21 | 177.6 | 7.5 | 41 | 171.4 | 8.0 | 54 | 169.6 | 9.8 |
| 16 | 16 | 177.9 | 8.1 | 26 | 176.4 | 9.2 | 82 | 175.2 | 8.0 |
| 17 | 3 | 181.8 | 2.7 | 17 | 177.5 | 6.1 | 55 | 176.7 | 6.9 |
| 18 | | | | 4 | 177.8 | 3.8 | 6 | 182.9 | 6.3 |

* The seven year category includes children aged 6.5 - 7.49 years, the eight year category from 7.5 - 8.49, and so on.

Table 4

Mean Height for Girls by Age, School Type and Vegetarian Status

| Age | Seventh-day Adventist Schools | | | | | | Public Schools | | |
|---|---|---|---|---|---|---|---|---|---|
| | Vegetarians (n=160) | | | Meat Eaters (n=283) | | | (n=443) | | |
| | n | mean | SD | n | mean | SD | n | mean | SD |
| 7* | 2 | 128.3 | 1.8 | | | | 5 | 119.5 | 4.8 |
| 8 | 8 | 133.9 | 6.0 | 15 | 128.6 | 7.1 | 19 | 126.0 | 7.3 |
| 9 | 14 | 133.1 | 4.8 | 13 | 131.9 | 6.2 | 16 | 134.4 | 3.3 |
| 10 | 16 | 142.7 | 6.3 | 16 | 138.7 | 5.5 | 15 | 140.0 | 6.0 |
| 11 | 14 | 146.7 | 6.1 | 32 | 146.1 | 6.4 | 58 | 148.3 | 7.4 |
| 12 | 17 | 151.2 | 7.5 | 24 | 150.3 | 7.6 | 48 | 152.0 | 8.2 |
| 13 | 18 | 159.5 | 4.8 | 34 | 158.2 | 6.5 | 33 | 158.8 | 8.1 |
| 14 | 21 | 166.2 | 5.7 | 60 | 162.5 | 6.2 | 67 | 162.3 | 5.7 |
| 15 | 28 | 166.3 | 6.1 | 50 | 162.7 | 5.3 | 57 | 164.6 | 7.2 |
| 16 | 15 | 163.7 | 6.0 | 27 | 164.2 | 5.8 | 85 | 164.8 | 6.4 |
| 17 | 6 | 165.8 | 6.5 | 10 | 161.6 | 6.0 | 38 | 163.4 | 5.1 |
| 18 | 1 | 164.5 | - | 2 | 166.4 | 6.3 | 2 | 168.3 | 2.7 |

* The seven year category includes children aged 6.5 - 7.49 years, the eight year category from 7.5 to 8.49, and so on.

Table 5

Multiple Linear Regression Coefficients for Various Predictors of Height in Seventh-day Adventist School Children

| | Boys (n=427) | | | Girls (n=443) | | |
|---|---|---|---|---|---|---|
| Term | Estimated Effect | (SE) | p | Estimated Effect | (SE) | p |
| Vegetarian Status* | 2.46 cm | (0.086) | 0.002 | 2.03 cm | (0.616) | 0.001 |
| Age (y) | 7.29 cm | (0.790) | <0.001 | 10.80 cm | (0.607) | <0.001 |
| Age cube ($y^3$) | -0.0025cm | (-0.0015) | 0.104 | -0.013 cm | (-0.0012) | <0.001 |
| Constant | 69.07 cm | (6.74) | <0.001 | 45.62 cm | (5.01) | <0.001 |

* Vegetarian status defined as meat consumption <1/wk, compared to meat eaters.

Table 6

Linear Regression for Various Predictors of Height (cm)

in SDA School Boys

| Term | Estimated Effect | (SE) | p value |
|---|---|---|---|
| Low Meat Intake* | -2.46 cm | (0.920) | 0.008 |
| Med/High Meat Intake* | -2.47 cm | (0.911) | 0.007 |
| Age (y) | 7.3 cm | (0.800) | <0.001 |
| Age cube ($y^3$) | -0.0025 cm | (0.0015) | 0.105 |
| Constant | 71.53 cm | (6.707) | <0.001 |

* Low meat intake (1/wk - <1/d) and medium/high meat intake ($\geq$ 1/d) groups) compared to vegetarians (meat intake < 1/wk).

Table 7

Linear Regression for Various Predictors of Height (cm) in SDA School Girls

| Term | Estimated Effect | (SE) | p value |
|---|---|---|---|
| Low Meat Intake * | -2.30 cm | (0.797) | 0.004 |
| Intermediate meat Intake * | -1.76 cm | (0.814) | 0.031 |
| High Meat Intake * | -1.11 cm | (0.835) | 0.184 |
| Age (y) | 10.73 cm | (0.610) | <0.001 |
| Age cube ($y^3$) | -0.013cm | (0.0012) | <0.001 |
| Constant | 48.15 cm | (5.00) | <0.001 |

* Meat eating girls are divided into tertiles: "Low", "Intermediate" and "High" meat intake, and compared to the vegetarians.

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## SUMMARY RESULTS AND CONCLUSIONS

When comparing selected anthropometric parameters of children attending Seventh-day Adventist (SDA) and public schools we found that SDA boys but not girls were significantly taller than those of the same age attending public schools. Both boys and girls in SDA schools were leaner than their counterparts in public schools. The adolescents' growth spurt was greater in public school children than in SDA school children and occurred earlier in public school girls than in SDA girls.

Although some of the anthropometric differences between the SDA and public school students may be explained by differences in socioeconomic status, it is reasonable to suspect that some lifestyle characteristics of the children and/or their parents, namely passive smoking exposure and diet, are related as well.

The most relevant dietary differences between the two school systems was the lower meat intake by SDA children. One third of SDA children were vegetarians, another third were low meat eaters and only one third ate meat products daily. In contrast, the large majority of public school children (92%) ate meat daily. The large variation in meat intake within the SDA children is of obvious analytical

advantage when studying the relationship between meat consumption or vegetarian status and health/disease outcomes.

Vegetarian boys and girls attending SDA schools were on the average 2.5 cm and 2.0 cm taller than their meat eating classmates, respectively. No differences in height, however, were found among public school students of either sex in relation to frequency of meat consumption.

Among SDA school children, lifetime vegetarian boys and girls were 3.1 cm and 2.2 cm taller respectively, than their lifetime meat eating counterparts. This difference increased in boys and remained unchanged in girls when controlling for parental height, socioeconomic status, passive smoking and other potential confounding factors.

These results support the view that meat intake is not required for growth. Apparently, a vegetarian diet supports physical growth at or above national standards. The results of this study suggest that either a vegetarian diet, a low meat intake or other closely related factors are causally related to the attained height of school-aged children in a developed country. Growth retardation often observed in developing countries apparently is caused by factors other than low meat intake.

The finding that vegetarian school-aged children are taller than meat eaters deserves further study. First, replication of these results in another SDA pediatric population will increase the external validity of our findings. Second, a follow-up of our population, when maturation is completed for all study subjects, will allow us to determine if height differences persist in adulthood. Alternatively, a non-concurrent cohort study in lifetime vegetarian adults may help determine if vegetarians are taller.

In the present study, sexual and other maturation parameters were not assessed making it impossible to determine if the anthropometric differences observed between the dietary groups were related to maturation. A longitudinal study from birth to adulthood looking at the time and rate of maturation concurrently with anthropometric parameters and dietary intake could provide a wealth of information into the relatively unknown area of diet, maturation and growth interactions.

# APPENDIX I

## CHILD-ADOLESCENT BLOOD PRESSURE STUDY OF LOMA LINDA UNIVERSITY: GENERAL STUDY DESIGN, SAMPLING STRATEGY AND PARTICIPATION RATES.

## APPENDIX I

## CHILD-ADOLESCENT BLOOD PRESSURE STUDY OF LOMA LINDA UNIVERSITY: GENERAL STUDY DESIGN, SAMPLING STRATEGY AND PARTICIPATION RATES.

### Introduction

This dissertation represents an analysis of data from the Child-Adolescent Blood Pressure Study of Loma Linda University, California. The original study was designed to determine the relationship of dietary factors, psychosocial factors and physical fitness to the blood pressure (BP) levels of children aged 6-17. In particular the study was interested in comparing BP levels and potential lifestyle determinants of BP among Seventh-day Adventist (SDA) and non-SDA children and their parents.

The Child-adolescent Blood Pressure Study consisted of three phases and was conducted in the Los Angeles basin of California between 1976 and 1981. Figure 1 illustrates the progression of the study by phase and participants. Most of the material for this appendix has been taken from S.C. FitzSimmons' doctoral dissertation appendix (1), who worked closely with the late Dr. Roland Phillips, the principal investigator of the original project. Since Dr. Phillips'

death, some of the original records of the study were lost; thus, Dr. FitzSimmons' dissertation account of the study strategies is the most complete and for some information the only available. Single spaced paragraphs of this appendix were taken verbatim from FitzSimmons (1) and double spaced writings were elaborated from several sources, including original records.

## 1. Phase I

### Sampling procedure

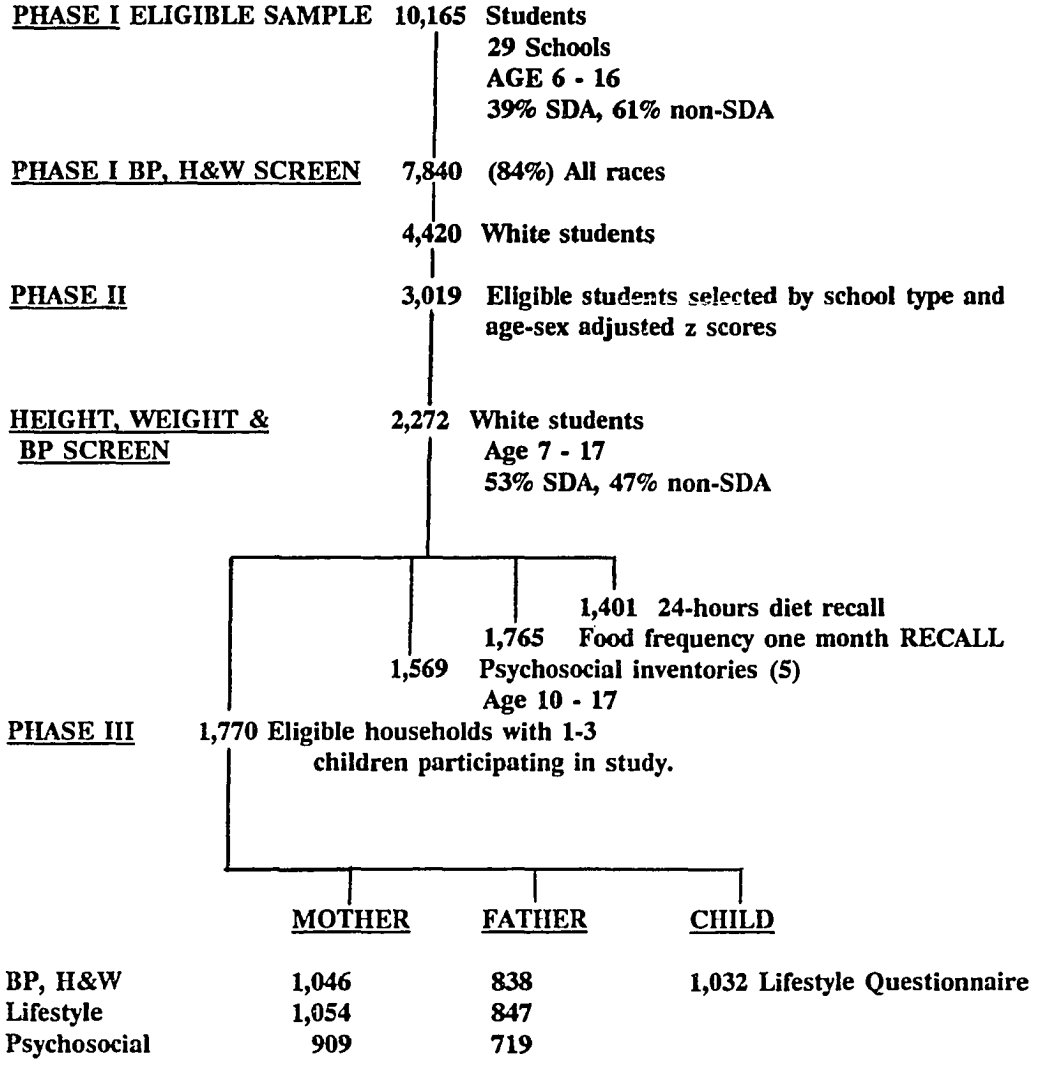
All SDA schools within the greater Los Angeles Basin and all public schools in the San Bernardino School District were considered for inclusion in the Loma Linda study. From these schools, particular schools (N=31) were selected which were located as close as possible to Loma Linda University (LLU) and which had an ethnic distribution that would ensure sufficient numbers of Black and Hispanic youth to provide meaningful descriptive statistics for later BP distributions by age, ethnicity, sex and type of school.

The ethnic composition of each potential school was carefully analyzed and where the enrollment of any school appeared to be heavily skewed in the direction of any particular ethnic group (as compared to the general population of the area) that school was excluded. In each selected school students from grades one to ten were included.

Of the schools initially selected, agreement to participate in the study was obtained for all of the 16 SDA schools and for 13 of the 15 public schools contacted.

Figure 1

LOMA LINDA UNIVERSITY CHILD-ADOLESCENT BLOOD PRESSURE STUDY




Abbreviations: H = Height, W = Weight, BP = Blood Pressure

**Participation Rates**

In grades one to ten, there were 3,916 students in SDA schools and 6,249 in the public schools who were eligible for screening, a total of 10,165 students. A total of 8,520 students , or 84%, participated in the phase I blood pressure screen. Table 1 presents participation rates for phase I. Usable data were collected from 7,840, or 77% of all eligible students 81% of the SDA students and 75% of the public school students. Refusal rates (by parents for the student) were low, less than 2%. The major limiting factors to obtaining the data were absence from school on the days the field team collected data (14%), or an inability by the field staff to interpret the Psychometric automated BP measuring devise disc printout (7%). Screening success rates differed by type of school on two issues, public school children were more likely to be absent from school than were SDA students (16% versus 11%, $p < 0.001$), and more public school parents refused their child's participation (3% versus 1%, $p<0.001$).

Harris et al. reported on the distribution of the screened study population by age, sex, ethnicity and type of school (2). Children from four ethnic groups were screened as follows: White (56%), Black (21%), Hispanic (19%), and Asian (4%). Sixty per cent of the children were from public schools, and 40% attended SDA schools. The public schools had a larger proportion of Whites, slightly fewer Blacks, more Hispanics and fewer Orientals. Adjusting for differences in the ethnic distribution, no significant differences were reported in the age-sex-school specific mean Systolic Blood Pressure (SBP) or Diastolic Blood Pressure (DBP) levels between SDA or non-SDA children.

**2. Phase II**

In phase II of the study, a subgroup of 3,000 white students were selected from the upper, middle and lower

levels of the phase I BP distributions for each age, sex and school type. One year later, between Janaury and June of 1978, these students were rescreened at the schools. Detailed information on diet and psychosocial factors (3) was obtained, along with height, weight and BP measurements. On a subgroup of 300 students physical fitness was measured by a treadmill test, and the relationship of physical fitness to BP levels was examined (4).

**Sampling Procedure**

The sampling frame for phase II was restricted to all white students, N=4,420, who had been screened in 1977. Based on the distribution of the SBP and DBP-means of the two Physiometric (automated BP measurement device) BP readings a two dimensional sampling array was devised.

For the first dimension, students were separated by school type, SDA or public. For the second dimension, age and sex standardized BP scores or Z scores were computed for the SBP and DBP of each age and sex strata. From the resulting distributions of systolic and diastolic Z scores, 3,000 students were selected using ranked and random sampling procedures to enumerate a group of SDA students and public schools of equal size (1,500 each) whose age and sex distribution were equal.

The phase II sampling procedure employed two strategies, rankwise sampling and random sampling. For example, first 1,500 SDA students were chosen as follows.

**Rankwise sampling:** The goal of the ranked sampling procedure was to sample 1,000 students from the upper and lower extremes of the SBP and DBP distribution, selected on the basis of high and low ranked BP Z scores. Consequently, 500 students were selected on the basis of 250 extreme low SBP Z scores, and 250 extreme low DBP Z scores, then an additional 500 SDA students were selected according to their ranked high SBP Z score and DBP Z score values.

Table 1

PARTICIPATION RATES PHASE I

Loma Linda Child-Adolescent Blood Pressure Study

| | TOTAL | SDA | PUBLIC |
|---|---|---|---|
| Total Schools Selected by Ethnic Representativeness and Geographic Proximity | 31 | 16 | 15 |
| Schools Agreeing to Participate | 29 | 16 | 13 |
| Total Eligible Students in Schools Agreeing to Participate | 10,165 | 3,916 | 6,249 |
| Non-Participation Rate | 1,645 (16.2%) | 485 (12.4%) | 1,160 (18.6%) |
| Parent Refusals* | 202 (1.9%) | 39 (1.0%) | 163 (2.6%) |
| School Absence* | 1,443 (14.2%) | 446 (11.4%) | 997 (15.9%) |
| Participation Rate | 8,520 (83.8%) | 3,431 (87.6%) | 5,089 (81.4%) |
| Unable to read Automatic BP Apparatus | 680 (6.7%) | 272 (6.9%) | 408 (6.5%) |
| Participants Successfully Screened | 7,840 (77%) | 3,159 (81%) | 4,681 (75%) |

* Differences by school type are statistically significant (Chi Square $p < .001$)

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Taken with permission from FitzSimmons (1).

All participants were selected rankwise, rotating between systolic extremes (low and high), then diastolic extremes (low then high), removing eligible participants selected from the pool. The computer algorithm repeated these four rules:

1. The extreme lowest Z score for SBP was selected.
2. Next the extreme highest Z score for SBP was selected.
3. Then the extreme lowest Z score for DBP was selected.
4. And finally, the extreme highest Z score for diastolic was selected.

The selection process continued in sequential fashion until 250 students were drawn from each category. The same procedure was then repeated for the public school children until 1,000 students were similarly selected.

**Random selection:** From the remainder of the SDA and public school sample, roughly the middle 70th percentile of the BP distribution, an additional 1,000 students were selected, again separately for each school group, 500 each. The sampling procedure changed at this point (from a ranked sequence, removing on a rotation basis) to a random selection. For all students remaining in the eligible pool once the 500 low BP extremes and 500 high BP extremes were removed, a random number sequence program was employed to select an additional 500 for each school type. Of this 500, 250 were randomly selected on the basis of systolic Z scores, and 250 sere selected by diastolic Z scores, selected in rotating fashion. The sampling fractions varied according to the number eligible. For example, for SDA students, the sampling fraction was 500/618, and for public students it was 509/1,802. Figure 2 illustrates the ranked and random sampling procedure.

**Participation rates:** Twenty-eight of the original participating 29 schools agreed to phase II anthropometric and blood pressure screens and the administration of dietary and psychosocial questionnaires at their schools. The principal of one of the public high schools refused to participate, objecting to the psychosocial inventories. Table 2 lists participating schools, as well as number and

percentage of non-SDA students attending the 16 SDA schools (5).

Participation rates for phase II data collection activities are listed in Table 3. Participation rates were 75% for the follow-up height, weight and blood pressure screen, 78% for the non-quantitative Food Frequency Questionnaire, 82% for the Psychosocial Inventories, and 76% for the exercise treadmill test. Table 3 lists participation rates by BP group (low, middle, high) and Table 4 presents participation rates for phase II by Z score and religion. The non-participation rates were never detailed from phase II.

**3. Phase III**

From late 1978 to early 1980, a sample of approximately one-half of the parents of phase II participants were screened at their homes. Height, weight and BP measurements as well as demographic, lifestyle, and psychosocial information were obtained from these parents. Also, the participating mothers completed a questionnaire detailing various lifestyle, gestational and dietary characteristics of their offspring. Table 5 lists the phase III Participation Rates for parents of phase II students by BP group (low, middle, high). Participation rates were slightly higher for mothers (59%) than fathers (56%). Very few parents from middle BP group participated due to the deliberate decision by the Loma Linda Child-Adolescent Blood

Pressure Study staff to solicit parent participants of low or high BP group youth.

Data collection form from phases I to III, the Food Frequency Questionnaire and all other questionnaires except psychosocial inventories from which I drew information for this thesis are shown in Appendix III.

Figure 2

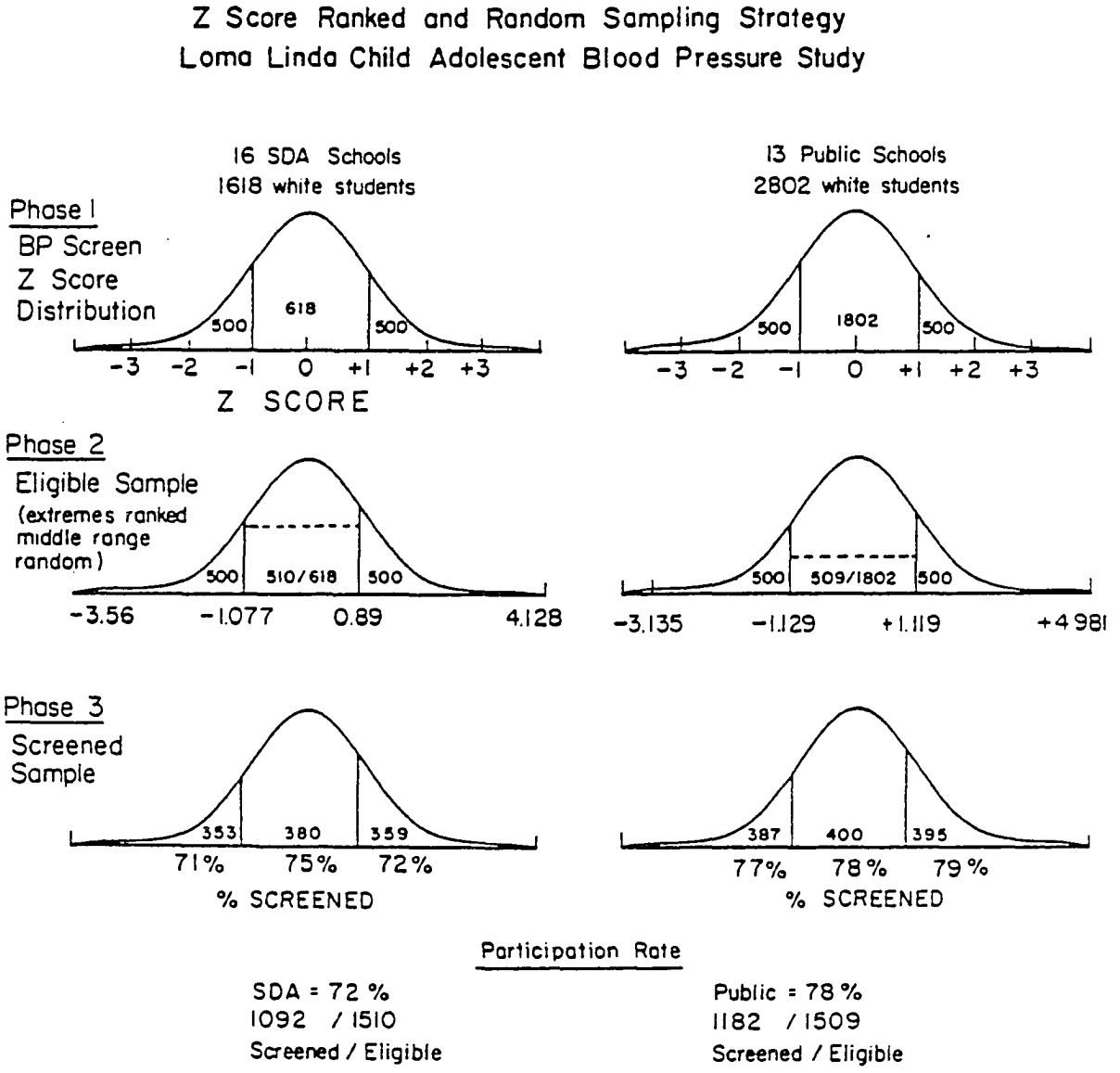
Z Score Ranked and Random Sampling Strategy
Loma Linda Child Adolescent Blood Pressure Study
16 SDA Schools
1618 white students
13 Public Schools
2802 white students
Phase I
BP Screen
Z Score
Distribution
500
618
500
500
1802
500
-3 -2 -1 0 +1 +2 +3
Z SCORE
Phase 2
Eligible Sample
(extremes ranked
middle range
random)
500
510/618
500
500
509/1802
500
-3.56
-1.077
0.89
4.128
-3.135
-1.129
+1.119
+4.981
Phase 3
Screened
Sample
353
380
359
387
400
395
71%
75%
72%
77%
78%
79%
% SCREENED
% SCREENED
Participation Rate
SDA = 72 %
1092 / 1510
Screened / Eligible
Public = 78 %
1182 / 1509
Screened / Eligible

Table 2

LIST OF THE 28 PARTICIPATING SCHOOLS IN PHASE II OF THE STUDY.
Number of Students in SDA Schools by Religious Affiliation *
Academic Year 1977-78

| SDA Schools | Total Students | non-SDA Students |
|---|---|---|
| Redlands Jr. Academy | 173 | 7 |
| Mesa Grande Jr. Academy | 219 | 15 |
| Loma Linda Elementary | 671 | 25 |
| Riverside SDA | 177 | 35 |
| LaSierra Elementary | 527 | 52 |
| Pomona Jr. Academy | 78 | 8 |
| Lynwood Elementary | 169 | 39 |
| East Valley SDA | 143 | 17 |
| White Memorial Elementary | 192 | 19 |
| Lynwood Academy | 238 | 35 |
| Escondido Jr. Academy | 169 | 19 |
| Glendale Academy | 339 | 22 |
| Glendale Elementary | 566 | 37 |
| Orangewood Elementary | 303 | 29 |
| Fairview Jr. Academy | 206 | 22 |
| Los Angeles Union | 339 | 92 |
| Totals..... | 4,509 | 473 |

Percent of non-SDA students in SDA participating schools 10.5%

**Public Schools**

| | |
|---|---|
| Cajon High | Golden Valley Jr. High |
| Mt. Vernon Elementary | Belvedere Elementary |
| Del Rosa Elementary | Del Vallejo Jr. High |
| Muscoy Elementary | Pacific High |
| Thompson Elementary | Muscott Elementary |
| Davidson Elementary | Mitchell Elementary |

* Figures obtained from reference 5.

Table 3

PARTICIPATION RATES PHASE II BY BP GROUP*
Loma Linda Child-Adolescent Blood Pressure Study

| Data | Eligible Sample n | Total Sampled n (Participation Rate) | Low BP n | Middle BP n | High BP n |
|---|---|---|---|---|---|
| SAMPLING FRAME | 3019 | | 1000 | 1019 | 1000 |
| Height, Weight and BP | 3019 | 2274 | 740 | 780 | 754 |
| Dietary | | | | | |
| Food Frequency | | | | | |
| 1 month recall | 2274 | 1765 (78%) | 607 | 522 | 636 |
| 10 years + | 1910 | 1496 (78%) | | | |
| Under 10 years (mother completed) | 364 | 269 (74%) | | | |
| 24 hr. recall | 1765 | 1401 (79%) | | | |
| Psychosocial | | | | | |
| Administered to all successful BP screenees who were aged 10 or more | 1910 | 1569 (82%) | 509 | 531 | 529 |
| A/B Activity Scale | | | | | |
| Social Attitude Scale | | | | | |
| Symptom Checklist | | | | | |
| EPQ - Junior | | | | | |
| Family Climate Inventory | | | | | |
| Gough Adjective Checklist | | | | | |
| Exercise Treadmill Test | 300 | 228 (76%) | | | |
| Randomly selected from low, middle high BP groups. | | | | | |

* Adapted from FitzSimmons.(1)

Table 4

PARTICIPATION RATES PHASE II
by Z Score and Religion
Loma Linda Child-Adolescent BP Study

| | SBP Screened | SBP Eligible | SBP Screened | SBP Eligible | TOTAL SCREENED |
|---|---|---|---|---|---|
| Low Z Score | | | | | |
| SDA (-2.42 to -1.08 | 177 | 250 (71%) | 176 (70%) | 250 | 353 (71%) |
| Public (-2.96 to -1.13) | 196 (78%) | 250 | 191 (76%) | 250 | 387 (77%) |
| Middle Z Score | | | | | |
| SDA | 203 (77%) | 265 | 177 (72%) | 245 | 380 (75%) |
| Public | 208 (81%) | 258 | 192 (77%) | 251 | 400 (78%) |
| High Z Score | | | | | |
| SDA (.89 to 3.82) | 173 (73%) | 250 | 176 (70%) | 250 | 359 (72%) |
| Public (1.12 to 3.51) | 192 (77%) | 250 | 203 (81%) | 250 | 395 (79%) |
| Total | | | | | |
| SDA | 563 (74%) | 764 | 529 (71%) | 745 | 1092 (72%) |
| Public | 596 (79%) | 758 | 586 (78%) | 750 | 1182 (78%) |

* Adapted from FitzSimmons (1)

Table 5

PARTICIPATION RATE PHASE III*
Parent Participation Rates by BP Groups of their Offspring
Child-Adolescent Blood Pressure Study

| | Eligible Sample n | Total Sampled n (Participation Rate %) | | BP Group Low BP n | Middle BP n | High BP n |
|---|---|---|---|---|---|---|
| Students with 6 BPs, diet and psychosocial date | 2274 | (100%) | | 740 | 780 | 754 |
| MOTHERS | 1770 households | | | | | |
| Height, Weight & BP Screen | 1770 | 1046 | (59%) | 466 | 83 | 497 |
| Lifestyle Questionnaire on Youth | 2274 | 1032 | (45%) | 471 | 68 | 493 |
| on Mother | 1770 | 1054 | (54%) | 468 | 87 | 499 |
| FATHERS | 1486 households** | | | | | |
| Height, Weight & BP Screen | 1486 | 838 | (56%) | 369 | 69 | 400 |
| Lifestyle Questionnaire | 1486 | 847 | (57%) | 372 | 72 | 403 |

* Adapted from S. FitzSimmons (1)
** In 86% of households resided two parents (1486/1770). In the remaining 14%, mother is the single parent.

## REFERENCES


1. FitzSimmons SC. Familial and environmental risk factors for elevated blood pressure in youth. Ph.D. Dissertation. University of California, Berkeley, 1985.

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3. Insel PM, Fraser GE, Phillips RL, Williams PM. Psychosocial factors and blood pressure in children. J. Psychosom Res 1981; 25:505-11.

4. Fraser GE, Phillips RL, Harns R. Physical fitness and blood pressure in school children. Circulation 1983; 65:405-12.

5. Office of Education. Southern and Southeastern Conferences of the Seventh-day Adventist church. Personal communication, 1989.

# APPENDIX II

## CORRELATES OF HEIGHT IN SEVENTH-DAY ADVENTIST SCHOOL CHILDREN.

In Phase III of the Loma Linda University Child-Adolescent Blood Pressure Study a sample of approximately one half of the parents of Phase II participants were screened at their home. Height and weight measurements were obtained from these parents in addition to demographic and lifestyle information. Also, participating mothers completed a questionnaire detailing various lifestyle, gestational and dietary characteristics of their offspring. The latter questionnaire included three questions on the meat, poultry and fish consumption habits of the child at the time of the interview and at six and ten years of age.

Based on those questions we developed one algorithm to categorize SDA children into three lifetime dietary patterns: vegetarians, meat eaters and mixed.

A child was considered "Lifetime Vegetarian" if in each one of the time periods (six years, ten years and present) his/her meat, poultry and fish intake was less than once per month.

A child was considered "Lifetime Meat Eater" if at all the same points in time his/her meat intake was at least once per week.

A child was classified into the "Mixed Diet Pattern" if either his/her meat consumption habits changed between the time points or the meat intake had always been higher than once per month but lower than once per week. Thus, the mixed group includes children with a radical shift in meat

consumption patterns, as well as children with a steady intermediate meat consumption.

Table 1 shows the distribution by age, sex and lifetime dietary patterns of SDA children participating in Phase III.

Tables 2 and 3 present mean heights of SDA school girls and boys, respectively by age and diet patterns.

Tables 4 and 5 present the linear regression coefficients for all the independent variables regressed on height of SDA school girls and boys, respectively.

Tables 6 and 7 give the regression coefficients of the final models used to predict the height of SDA boys and girls, respectively.

**Table 1**

**Distribution of SDA School Girls and Boys**

**by Diet Patterns**

| Age (years) | GIRLS (n=293) | | | BOYS (n=252) | | |
|---|---|---|---|---|---|---|
| | Vege | Meat | Mix | Vege | Meat | Mix |
| 7.5 - 8.5 | 10* | 10* | 6 | 5 | 5 | 2 |
| 8.5 - 9.5 | 11 | 8 | 9 | 6 | 7 | 7 |
| 9.5 - 10.5 | 14 | 10 | 14 | 15 | 7 | 8 |
| 10.5 - 11.5 | 6 | 12 | 13 | 11 | 13 | 9 |
| 11.5 - 12.5 | 11 | 7 | 7 | 8 | 8 | 12 |
| 12.5 - 13.5 | 9 | 12 | 5 | 7 | 14 | 14 |
| 13.5 - 14.5 | 11 | 18 | 12 | 11 | 13 | 9 |
| 14.5 - 15.5 | 14 | 10 | 17 | 11 | 7 | 12 |
| 15.5 - 16.5 | 6 | 9 | 9 | 10 | 5 | 5 |
| 16.5 - 17.5 | 5 | 3 | 5** | 3 | 4 | 4 |
| Totals | 97 | 99 | 97 | 87 | 83 | 82 |

* Includes 1 Subject between 6.5 and 7.5 years.
** Includes 2 Subjects between 17.5 and 18.5 years.

Abbreviations:
Vege = lifetime vegetarian
Meat = lifetime meat eaters
Mixed = mixed diet pattern

**Table 2**

**Height of Seventh-day Adventist Girls by Diet Patterns**

| Age (years) | Lifetime Vegetarians Mean (cm) | Lifetime Vegetarians SD | Mixed Diet Pattern Mean (cm) | Mixed Diet Pattern SD | Lifetime Meat Eaters Mean (cm) | Lifetime Meat Eaters SD |
|---|---|---|---|---|---|---|
| 7.5 - 8.5 | 133.6 | 6.0 | 130.5 | 8.5 | 128.8 | 5.8 |
| 8.5 - 9.5 | 133.2 | 4.5 | 134.8 | 6.2 | 131.0 | 6.1 |
| 9.5 - 10.5 | 142.0 | 6.8 | 139.6 | 8.1 | 140.5 | 5.9 |
| 10.5 - 11.5 | 147.3 | 5.1 | 145.7 | 6.4 | 144.6 | 7.2 |
| 11.5 - 12.5 | 153.9 | 5.9 | 148.4 | 4.6 | 151.6 | 10.8 |
| 12.5 - 13.5 | 158.5 | 6.0 | 159.5 | 10.8 | 159.7 | 6.3 |
| 13.5 - 14.5 | 164.8 | 5.7 | 165.3 | 6.4 | 161.3 | 7.1 |
| 14.5 - 15.5 | 167.0 | 7.1 | 162.1 | 6.7 | 163.5 | 3.9 |
| 15.5 - 16.5 | 163.8 | 6.1 | 163.6 | 5.8 | 163.8 | 4.2 |
| 16.5 - 17.5 | 166.5 | 7.7 | 158.1 | 2.8 | 160.7 | 5.5 |

**Table 3**

**Height of Seventh-day Adventist Boys by Diet Patterns**

| Age (years) | Lifetime Vegetarians Mean (cm) | SD | Mixed Diet Pattern Mean (cm) | SD | Lifetime Meat Eaters Mean (cm) | SD |
|---|---|---|---|---|---|---|
| 7.5 - 8.5 | 132.3 | 4.8 | 131.4 | 5.4 | 127.0 | 3.7 |
| 8.5 - 9.5 | 135.9 | 5.4 | 137.8 | 4.5 | 135.7 | 9.5 |
| 9.5 - 10.5 | 140.6 | 5.9 | 141.0 | 5.4 | 140.4 | 4.9 |
| 10.5 - 11.5 | 145.8 | 3.6 | 143.3 | 6.9 | 141.5 | 7.0 |
| 11.5 - 12.5 | 150.1 | 6.4 | 153.2 | 4.7 | 149.5 | 8.7 |
| 12.5 - 13.5 | 159.4 | 10.1 | 157.8 | 9.6 | 157.4 | 8.4 |
| 13.5 - 14.5 | 167.1 | 6.0 | 163.6 | 11.0 | 163.6 | 6.9 |
| 14.5 - 15.5 | 178.1 | 7.6 | 172.3 | 9.1 | 172.5 | 7.2 |
| 15.5 - 16.5 | 178.5 | 6.3 | 174.4 | 12.1 | 173.9 | 7.4 |
| 16.5 - 17.5 | 182.9 | 1.9 | 172.6 | 5.0 | 181.5 | 3.5 |

Table 4

**Bivariate (Controlled for Age) Linear Regression Coefficients for Various Predictors of Height (cm) in 293 Seventh-day Adventist School Girls.**

| Term | Regression Coefficient | (SE) | p-value |
|---|---|---|---|
| Birthweight (3000, >3000 grams | 1.21 | (0.92) | 0.19 |
| Breast Feeding Weeks ≤3, ≥4 | 0.77 | (0.78) | 0.32 |
| Solid Foods Started ≤8 wk, >8 wk | -0.93 | (0.75) | 0.22 |
| Mother Smoke During Pregnancy. No, Yes | 0.36 | (0.30) | 0.23 |
| Passive Smoking at Home. No, Yes | 0.98 | (1.46) | 0.50 |
| Sleeping Hours ≤ 8/d, ≥ 9 hr | -0.54 | (0.95) | 0.57 |
| Father's Religion- SDA, Other | -0.52 | (1.19) | 0.66 |
| Mother's Religion- SDA, Other | -0.90 | (1.64) | 0.58 |
| Mother's Marital Status. Married, Other | 0.55 | (1.01) | 0.58 |
| Family Income <$14,999, ≥$15,000 | -1.23 | (1.09) | 0.25 |
| Father's Occupation Blue Collar, White Collar | 0.93 | (0.87) | 0.28 |
| Mother' Occupation | | | |
| Blue Collar, White Collar, | 1.18 | (0.99) | 0.24 |
| Blue Collar, Homemaker | 1.10 | (0.91) | 0.23 |
| Father's Education (years) | 0.30 | (0.41) | 0.026 |
| Mother's Education (years) | 0.39 | (0.16) | 0.017 |
| Father's Height (cm) | 0.29 | (0.06) | <0.0001 |
| Mother's Height (cm) | 0.38 | (0.06) | <0.0001 |
| Lifetime Diet | | | |
| Meat Eaters, Vege. | 2.29 | (0.91) | 0.012 |
| Meat Eaters, Mixed | 0.11 | (0.91) | 0.90 |

Table 5

**Bivariate (Controlled for Age) Linear Regression Coefficients for Various Predictors of Height (cm) in 252 Seventh-day Adventist School Boys.**

| Term | Regression Coefficient | (SE) | p-value |
|---|---|---|---|
| | | | 0.05 |
| Birthweight (3000, >3000 grams | 2.40 | (1.26) | |
| | | | 0.38 |
| Breast Feeding Weeks ≤3, ≥4 | 0.83 | (0.94) | |
| | | | 0.35 |
| Solid Foods Started ≤8 wk, >8 wk | -0.84 | (0.90) | |
| | | | 0.57 |
| Mother Smoke During Pregnancy. No, Yes | -0.21 | (0.37) | |
| | | | 0.15 |
| Passive Smoking at Home. No, Yes | -2.69 | (1.86) | |
| | | | 0.08 |
| Sleeping Hours ≤ 8/d, ≥ 9 hr | -1.87 | (1.08) | |
| | | | 0.76 |
| Father's Religion- SDA, Other | -0.43 | (1.43) | |
| | | | 0.030 |
| Mother's Religion- SDA, Other | -4.51 | (1.91) | |
| | | | 0.49 |
| Mother's Marital Status. Married, Other | 0.89 | (1.28) | |
| | | | 0.09 |
| Family Income <$14,999, ≥$15,000 | 2.21 | (1.30) | |
| | | | 0.38 |
| Father's Occupation Blue Collar, White Collar | 0.89 | (1.00) | |
| Mother's Occupation | | | 0.60 |
| Blue Collar, White Collar | -0.59 | (1.12) | 0.99 |
| Blue Collar, Homemaker | 0.01 | (1.17) | |
| | | | 0.20 |
| Father's Education (years) | 0.19 | (0.15) | |
| | | | 0.07 |
| Mother's Education (years) | 0.37 | (0.21) | |
| | | | <0.0001 |
| Father's Height (cm) | 0.44 | (0.08) | |
| | | | <0.0001 |
| Mother's Height (cm) | 0.40 | (0.07) | |
| Lifetime Diet | | | 0.005 |
| Meat Eaters, Vege | 3.09 | (1.10) | 0.60 |
| Meat Eaters, Mixed | 0.59 | (1.12) | |

**Table 6**

**Final Linear Regression Model Predicting Height of**

**165 Seventh-day Adventist Boys.**

| Term | Estimated Effect in cm | (SE) | p-value |
|---|---|---|---|
| Age (years) | 6.14 | (0.19) | <0.001 |
| Mother's Height (cm) Father's | 0.32 | (0.09) | <0.001 |
| Height (cm) | 0.26 | (0.09) | 0.005 |
| Family Income + | 1.34 | (1.89) | 0.477 |
| Lifetime Vegetarian* | 3.32 | (1.21) | 0.007 |
| Mixed Diet Pattern # | 1.06 | (1.29) | 0.417 |
| Constant | -22.65 | (18.24) | 0.216 |

+ >$15,000 versus ≤$14,999.

* Lifetime vegetarian versus lifetime meat eaters.

# Mixed diet pattern versus lifetime meat eaters.

**Table 7**

**Final Linear Regression Model Predicting Height of**

**182 Seventh-day Adventist School Girls**

| Term | Regression Coefficients | (SE) | p-value |
|---|---|---|---|
| Age (years) | 11.62 | (0.82) | <0.001 |
| Age cubed ($y^3$) | -0.014 | (0.002) | <0.001 |
| Mother's Height (cm) | 0.33 | (0.074) | <0.001 |
| Father's Height (cm) | 0.29 | (0.061) | <0.001 |
| Family Income + | -1.99 | (1.68) | 0.238 |
| Mother's Education (years) | 0.06 | (0.204) | 0.755 |
| Father's Education (years) | 0.55 | (0.157) | 0.760 |
| Lifetime Vegetarian* | 2.22 | (1.07) | 0.040 |
| Mixed Diet Pattern # | 1.64 | (1.10) | 0.139 |
| Pregnancy Smoking ** | -0.59 | (0.477) | 0.222 |
| Passive Smoking ++ | 3.61 | (1.70) | 0.036 |
| LT Vege x Passive Smoking | -6.37 | (4.20) | 0.132 |
| LT Vege x Preg Smoke | 1.57 | (0.69) | 0.024 |
| Mixed DP x Preg Smoke | 2.18 | (0.82) | 0.009 |
| Mixed DP x Passive Smoking | -10.66 | (5.68) | 0.062 |
| Constant | -64.14 | (15.21) | <0.001 |

* Lifetime vegetarian versus lifetime meat eaters.
+ >$15,000 versus ≤$14,999.
# Mixed diet pattern versus lifetime meat eaters.
** Mother smoked during pregnancy compared to mother did not smoke.
++ Exposed to passive smoking at home versus non-exposed.

# APPENDIX III

## ANTHROPOMETRIC DATA COLLECTION FORMS AND QUESTIONNAIRES

DATA FORM for . . . CHILD ADOLESCENT BLOOD PRESSURE STUDY
LOMA LINDA UNIVERSITY, LOMA LINDA, CALIF.
(714) 824-0800, Ext. 3738

PHASE I DATA COLLECTION

**1. IDENTIFICATION:** **PLEASE check to be sure the information below is correct.**
**Notify the person at the checkout station of any corrections needed.**

T C

☐☐ NAME : _____

☐☐ ADDRESS : _____

☐☐ TELEPHONE : _____

☐☐ AGE : _____

☐☐ BIRTH DATE : _____

☐☐ SEX : _____

☐☐ TODAY'S DATE : _____

☐☐ HOUR OF DAY : _____

**2.** Please CLEARLY PRINT the names of the adults who are in charge of the home you live in.

☐☐ MAN IN CHARGE : _____ (First Name) _____ (Middle Name) _____ (Last Name)

☐☐ WOMAN IN CHARGE : _____ (First Name) _____ (Middle Name) _____ (Last Name)

**DO NOT WRITE BELOW THIS LINE**

School Day Period Check Student

ID NUMBER : ☐☐ ☐☐☐ ☐☐

GRADE : 1 2 3 4 5 6 7 8 9 10

GROUP : W B S O oth

CUFF SIZE : I C A L T

Arm Length (cm) : ☐☐.☐

Arm Circ (cm) : ☐☐.☐

Skinfold (mm) : ☐☐.☐ obs ☐

Pulse (15 sec) : ☐☐

Height (in) : ☐☐.☐

Weight (lbs) : ☐☐.☐

Phys Disc 1 : ☐ obs ☐ which disc good ☐

Phys Disc 2 : ☐ obs ☐ which disc good ☐

RANDOM ZERO 1 : $K_1$ ☐ $K_4$ ☐☐☐ $K_5$ ☐☐☐ zero ☐☐ obs ☐

RANDOM ZERO 2 : $K_1$ ☐ $K_4$ ☐☐☐ $K_5$ ☐☐☐ zero ☐☐ obs ☐

SPECIAL RANDOM ZERO 1 : $K_1$ ☐ $K_4$ ☐☐☐ $K_5$ ☐☐☐ zero ☐☐ obs ☐

SPECIAL RANDOM ZERO 2 : $K_1$ ☐ $K_4$ ☐☐☐ $K_5$ ☐☐☐ zero ☐☐ obs ☐

DATA FORM FOR: Child-Adolescent Blood Pressure Study
Loma Linda University, Loma Linda, CA
(714)824-0800, Ext. 3738

PHASE II
SCHOOL DATA FORM

DO NOT WRITE ON THIS FORM (FOR STAFF USE ONLY)

IDENTIFICATION:

PHASE II BLOOD PRESSURE SCREEN

Youth ID
Youth NAME
ADDRESS

PHONE
Youth BIRTHDATE
Youth FATHER
MOTHER

AGE: GRADE LEVEL:

TEACHER: HEIGHT (in): WEIGHT (lbs):
(Gr. 2—6 only)

What time does your father get home from work? _____ (AM) (PM)

Does your mother work outside the home? YES NO

If yes, what time does she get home from work? _____ (AM) (PM)

DAY 1

DATE: ___ ___ ___
mo day yr

Phys Disc 1 : obs

BP 1 K1 K4 K5

BP 2 K1 K4 K5 2 : obs

DAY 2

DATE: ___ ___ ___
mo day yr

Phys Disc 1 : obs

BP 1 K1 K4 K5

BP 2 K1 K4 K5 2 : obs

## FOOD FREQUENCY QUESTIONNAIRE

INSTRUCTIONS: We want to know how often you eat different kinds of food. Look at the chart in the front of the room to see what 1, 2, 3 and 4 mean. Then circle the number that comes closest to telling how often you eat each food.

| | FOOD | HOW OFTEN | | | |
|---|---|---|---|---|---|
| | | NEVER | EVERY MONTH (Sometimes) | EVERY WEEK (Often) | EVERY DAY (Very often) |
| 1 | Chocolate milk | 1 | 2 | 3 | 4 |
| 2 | Regular milk | 1 | 2 | 3 | 4 |
| 3 | Orange juice, (fresh or frozen) | 1 | 2 | 3 | 4 |
| 4 | Other juice, (fresh or frozen) | 1 | 2 | 3 | 4 |
| 5 | Punch (any kind) | 1 | 2 | 3 | 4 |
| 6 | Dry cereal (any kind) | 1 | 2 | 3 | 4 |
| 7 | Cooked cereal (any kind) | 1 | 2 | 3 | 4 |
| 8 | Biscuit | 1 | 2 | 3 | 4 |
| 9 | English muffin | 1 | 2 | 3 | 4 |
| 10 | Muffin | 1 | 2 | 3 | 4 |
| 11 | Burrito | 1 | 2 | 3 | 4 |
| 12 | Taco | 1 | 2 | 3 | 4 |
| 13 | Tostada | 1 | 2 | 3 | 4 |
| 14 | Pizza | 1 | 2 | 3 | 4 |
| 15 | Doughnut | 1 | 2 | 3 | 4 |
| 16 | Sweet roll | 1 | 2 | 3 | 4 |
| 17 | Pancakes | 1 | 2 | 3 | 4 |
| 18 | French toast | 1 | 2 | 3 | 4 |
| 19 | Waffles | 1 | 2 | 3 | 4 |
| 20 | Chips--any kind (Potato chips, corn chips, etc.) | 1 | 2 | 3 | 4 |
| 21 | Crackers (any kind) | 1 | 2 | 3 | 4 |

GO TO NEXT PAGE

| | FOOD | HOW OFTEN | | | |
|---|---|---|---|---|---|
| | | NEVER | EVERY MONTH (Sometimes) | EVERY WEEK (Often) | EVERY DAY (Very often |
| 22 | Apple | 1 | 2 | 3 | 4 |
| 23 | Orange, grapefruit or tangerine | 1 | 2 | 3 | 4 |
| 24 | Banana | 1 | 2 | 3 | 4 |
| 25 | Other fresh fruit | 1 | 2 | 3 | 4 |
| 26 | Canned fruit | 1 | 2 | 3 | 4 |
| 27 | Raisins or other dried fruit (any kind) | 1 | 2 | 3 | 4 |
| 28 | Nuts | 1 | 2 | 3 | 4 |
| 29 | Peanut butter | 1 | 2 | 3 | 4 |
| 30 | Carrot sticks and celery sticks | 1 | 2 | 3 | 4 |
| 31 | Vegetable salad | 1 | 2 | 3 | 4 |
| 32 | Cottage cheese | 1 | 2 | 3 | 4 |
| 33 | Cheese (any kind) | 1 | 2 | 3 | 4 |
| 34 | Eggs (any kind) | 1 | 2 | 3 | 4 |
| 35 | French-fried potatoes | 1 | 2 | 3 | 4 |
| 36 | Other fried potatoes | 1 | 2 | 3 | 4 |
| 37 | Other potatoes (not fried) | 1 | 2 | 3 | 4 |
| 38 | Soup | 1 | 2 | 3 | 4 |
| 39 | Stew | 1 | 2 | 3 | 4 |
| 40 | Chili | 1 | 2 | 3 | 4 |
| 41 | String beans or green beans | 1 | 2 | 3 | 4 |
| 42 | Refried beans | 1 | 2 | 3 | 4 |
| 43 | Other beans | 1 | 2 | 3 | 4 |
| 44 | Cooked vegetables (any kind) | 1 | 2 | 3 | 4 |
| 45 | Macaroni | 1 | 2 | 3 | 4 |
| 46 | Noodles | 1 | 2 | 3 | 4 |

GO TO NEXT PAGE

| | FOOD | HOW OFTEN | | | |
|---|---|---|---|---|---|
| | | NEVER | EVERY MONTH (Sometimes) | EVERY WEEK (Often) | EVERY DAY (Very often) |
| 47 | Spaghetti | 1 | 2 | 3 | 4 |
| 48 | Vegeburger on bun | 1 | 2 | 3 | 4 |
| 49 | Real hamburger on bun | 1 | 2 | 3 | 4 |
| 50 | Unmeat wieners (hot dogs) | 1 | 2 | 3 | 4 |
| 51 | Real wieners (hot dogs) | 1 | 2 | 3 | 4 |
| 52 | Unmeat pattie | 1 | 2 | 3 | 4 |
| 53 | Real hamburger pattie | 1 | 2 | 3 | 4 |
| 54 | Unmeat chunks (Tender Bits, Skallops, etc.) | 1 | 2 | 3 | 4 |
| 55 | Unmeat steak (Dinner Cut, Staklet, etc.) | 1 | 2 | 3 | 4 |
| 56 | Real steak | 1 | 2 | 3 | 4 |
| 57 | Nut meat (Nuteena, Proteena, Numete) | 1 | 2 | 3 | 4 |
| 58 | Roast beef | 1 | 2 | 3 | 4 |
| 59 | Unmeat chicken | 1 | 2 | 3 | 4 |
| 60 | Real fried chicken | 1 | 2 | 3 | 4 |
| 61 | Other real chicken | 1 | 2 | 3 | 4 |
| 62 | Unmeat bacon (Stripples, Breakfast strips, etc.) | 1 | 2 | 3 | 4 |
| 63 | Real bacon | 1 | 2 | 3 | 4 |
| 64 | Unmeat sausage (Little Links, Prosage slices) | 1 | 2 | 3 | 4 |
| 65 | Real sausage links or slices | 1 | 2 | 3 | 4 |
| 66 | Unmeat sandwich slices (Wham and other) | 1 | 2 | 3 | 4 |
| 67 | Real bologna | 1 | 2 | 3 | 4 |
| 68 | Real ham | 1 | 2 | 3 | 4 |
| 69 | Pork chops | 1 | 2 | 3 | 4 |
| 70 | Unmeat fish | 1 | 2 | 3 | 4 |
| 71 | Real fish (any kind) | 1 | 2 | 3 | 4 |

GO TO NEXT PAGE

| | FOOD | HOW OFTEN | | | |
|---|---|---|---|---|---|
| | | NEVER | EVERY MONTH (Sometimes) | EVERY WEEK (Often) | EVERY DAY (Very often) |
| 72 | Candy bars | 1 | 2 | 3 | 4 |
| 73 | Other candy | 1 | 2 | 3 | 4 |
| 74 | Cookies (any kind) | 1 | 2 | 3 | 4 |
| 75 | Breakfast bars or granola bars | 1 | 2 | 3 | 4 |
| 76 | Pop Tart/Toastette | 1 | 2 | 3 | 4 |
| 77 | Twinkie, Zinger, Sno Ball Koo Koo, etc. | 1 | 2 | 3 | 4 |
| 78 | Cake (any kind) | 1 | 2 | 3 | 4 |
| 79 | Pie or cobbler (any kind) | 1 | 2 | 3 | 4 |
| 80 | Pudding | 1 | 2 | 3 | 4 |
| 81 | Yogurt | 1 | 2 | 3 | 4 |
| 82 | Ice cream in-a-dish | 1 | 2 | 3 | 4 |
| 83 | Frozen yogurt in-a-dish | 1 | 2 | 3 | 4 |
| 84 | Ice cream bar or sandwich | 1 | 2 | 3 | 4 |
| 85 | Popsicle | 1 | 2 | 3 | 4 |
| 86 | Ice cream cone | 1 | 2 | 3 | 4 |
| 87 | Frozen yogurt cone or Push-up | 1 | 2 | 3 | 4 |
| 88 | Regular soda pop | 1 | 2 | 3 | 4 |
| 89 | Diet soda pop | 1 | 2 | 3 | 4 |
| 90 | Milkshake | 1 | 2 | 3 | 4 |
| 91 | Vitamin or mineral supplement | 1 | 2 | 3 | 4 |
| 92 | How often do you eat breakfast? | 1 | 2 | 3 | 4 |
| 93 | How often do you eat a snack between lunch and school out? | 1 | 2 | 3 | 4 |
| 94 | How often do you eat a snack between school out and dinner? | 1 | 2 | 3 | 4 |
| 95 | How often do you eat a snack between dinner and bedtime? | 1 | 2 | 3 | 4 |

GO TO NEXT PAGE

| | | | |
|---|---|---|---|
| 96 | Do you usually add sugar or honey to dry cereal? | YES | NO |
| 97 | Do you usually add sugar or honey to cooked cereal? | YES | NO |
| 98 | Do you usually add salt to these foods when you eat them? | | |
| | Melon | YES | NO |
| | Sliced tomatoes | YES | NO |
| | Salad | YES | NO |
| | Baked potato | YES | NO |
| | Cooked vegetables | YES | NO |
| | Fried egg | YES | NO |
| | Tomato juice | YES | NO |
| | French-fried potatoes | YES | NO |

Check to be sure every question is answered, and that only one mark shows for each question. If you have any comments, write them here. Thank you.

THE END

PAGE 5

E. INFORMATION ABOUT YOUR CHILD

The following questions should be answered in reference to your child, _____.

ID# ☐☐☐☐☐☐☐

1. What is your relationship to this child? (IF ANY ANSWER GIVEN OTHER THAN BIOLOGICAL MOTHER, SKIP QUESTIONS 5--7 ) (HAND CARD 4)

| | |
|---|---|
| biological mother | ☐ a |
| foster mother | ☐ b |
| adoptive mother | ☐ c |
| step mother | ☐ d |
| grandmother | ☐ e |
| other relative | ☐ f |
| other_____ (SPECIFY) | ☐ g |

2. What is the relationship of the man of the house to this child? (HAND CARD 5)

| | |
|---|---|
| biological father | ☐ a |
| foster father | ☐ b |
| adoptive father | ☐ c |
| step father | ☐ d |
| grandfather | ☐ e |
| other relative | ☐ f |
| other_____ (SPECIFY) | ☐ g |

3. How long has this child lived with you?

| | |
|---|---|
| all her life | ☐ |
| years | ☐☐ |

4. (IF ANSWER TO 3 IS NOT "ALL HER LIFE") At what ages has she lived with you?

| | |
|---|---|
| _____ | ☐☐ |
| NA | ☐ |

5. Did a physician ever tell you that you had toxemia, pre-eclampsia or high blood pressure during any pregnancy?

| | |
|---|---|
| yes | ☐ a |
| no | ☐ b |
| don't know | ☐ c |
| NA | ☐ d |

6. What was your SON/daughter's weight at birth?

| | |
|---|---|
| | lbs. oz. |
| lbs. and oz. | ☐☐☐☐ |
| don't know | ☐ dn |
| NA | ☐ |

7. For how long did you breast feed him/her?

| | |
|---|---|
| not at all | ☐ a |
| weeks | ☐☐ |
| months | ☐☐ |
| NA | ☐ b |

8. How old was he/she when weaned (i.e., no longer regularly took milk from breast or bottle)?

| | |
|---|---|
| | mos. |
| months | ☐☐ |
| don't know | ☐ |

9. What type of formula did you use? (HAND CARD 6)

| | |
|---|---|
| evaporated milk formula | ☐ a |
| commercial milk formula (such as Enfamil, Similac) | ☐ b |
| commercial non-milk formula (such as soy or other non-milk) | ☐ c |
| other_____ | ☐ d |
| never used any | ☐ e |
| don't know | ☐ f |

10. What type of baby food did you feed him/her until weaned?

| | |
|---|---|
| more than 50% commercial products | ☐ a |
| or | |
| more than 50% prepared by mother | ☐ b |
| other_____ | ☐ c |
| don't know | ☐ d |

11. At what age did you start to feed him/her solid food, such as baby fruits or cereals?

| | |
|---|---|
| weeks | ☐☐ |
| don't know | ☐ |

12. At what age did you start to feed him/her food from the table?

| | |
|---|---|
| months | ☐☐ |
| don't know | ☐ |

13. How often does he/she currently eat the following foods? (HAND CARD 7) (SEE LETTERED CODE BELOW)

| | |
|---|---|
| licorice | ☐ |
| candy other than licorice | ☐ |
| baked desserts (SUCH AS CAKES, COOKIES, OR PIES) | ☐ |
| other sweets (SUCH AS ICE CREAM, FROZEN BARS, OR PUDDING) | ☐ |
| fatty foods (SUCH AS FRENCH FRIES, FRIED MEATS, OR GRAVY) | ☐ |
| spicy foods (SUCH AS CHILI SAUCE, BLACK PEPPER, OR BBQ SAUCE) | ☐ |
| salty foods (SUCH AS CHIPS, SALTED CRACKERS, OR PICKLES) | ☐ |

a. never
b. less than once per month
c. 1--3 times per month
d. 1--6 times per week
e. daily
f. don't know

ASK #14 and #15 to DAUGHTERS ONLY:

14. Has she started to menstruate? (IF NO, SKIP TO 16)

- yes ☐
- no ☐

15. How old was she when she had her first menstrual period? Please be as accurate as possible, and give years and months. (IF RESPONDENT HAS DIFFICULTY REMEMBERING, ASK:
   a. What grade was she in?
   b. Where was she living at that time?
IF RESPONDENT CANNOT REMEMBER YEARS AND MONTHS, e.g., 13 yrs., 6 mos., ACCEPT JUST YEARS)

- years and months — yrs. ☐☐ mos. ☐☐
- (CHECK IF EXACT) ☐ ☐
- don't know ☐
- NA ☐

THE NEXT 3 QUESTIONS REFER TO WHEN YOUR SON/DAUGHTER WAS 6 YEARS OLD

16. At age 6, was your son/daughter shorter than, the same height as, or taller than most other girls/boys of the same age?

- shorter ☐ a
- same height ☐ b
- taller ☐ c
- don't know ☐ d
- NA ☐ e

17. At age 6, was your son/daughter lighter than, the same weight as, or heavier than most other boys/girls of the same age?

- lighter ☐ a
- same weight ☐ b
- heavier ☐ c
- don't know ☐ d
- NA ☐ e

18. When he/she was 6 years old, how many of his/her meals per WEEK included fish, poultry, and other meat? (HAND CARD 8)

| | |
|---|---|
| no meals | ☐ a |
| less than 1 meal per week | ☐ b |
| 1--4 meals per week | ☐ c |
| 5--9 meals per week | ☐ d |
| 10--14 meals per week | ☐ e |
| 15 or more meals per week (i.e., more than 2 meals per day) | ☐ f |
| don't know | ☐ g |

19. How old is he/she in years and months? (IF LESS THAN 10, SKIP QUESTIONS 20, 21, 22) years

yrs. ☐☐ mos. ☐☐

THE NEXT 3 QUESTIONS REFER TO YOUR son/DAUGHTER WHEN HE/SHE WAS 10 YEARS OLD

20. At age 10, was your son/daughter shorter than, the same height as, or taller than most other girls/boys of the same age?

| | |
|---|---|
| shorter | ☐ a |
| same height | ☐ b |
| taller | ☐ c |
| don't know | ☐ d |
| NA | ☐ e |

21. At age 10, was your son/daughter lighter than, the same weight as, or heavier than most other girls/boys of the same age?

| | |
|---|---|
| lighter | ☐ a |
| same weight | ☐ b |
| heavier | ☐ c |
| don't know | ☐ d |
| NA | ☐ e |

22. When he/she was 10 years old, how many of his/her meals per WEEK included fish, poultry and other meat? (HAND CARD 8)

- no meals ☐ a
- less than 1 meal per week ☐ b
- 1--4 meals per week ☐ c
- 5--9 meals per week ☐ d
- 10--14 meals per week ☐ e
- 15 or more meals per week (i.e., more than 2 meals per day) ☐ f
- don't know ☐ g

23. Which phrase best describes your son's/daughter's eating habits <u>at present</u>? (HAND CARD 9)

- eats meat/poultry weekly ☐ a
- eats meat/poultry once or twice a month ☐ b
- eats meat/poultry not more than several times a year ☐ c
- eats milk products and eggs, but not meat or poultry ☐ d
- never eats animal products ☐ e
- don't know ☐ f

24. Does your son/daughter eat refried beans? (IF NO, OR DON'T KNOW, SKIP TO 26)

- yes ☐
- no ☐
- don't know ☐

25. (IF YES) With which kind of fat are they prepared?
(HAND CARD 9a)

| | |
|---|---|
| vegetable shortening | ☐ a |
| oil | ☐ b |
| lard | ☐ c |
| other_____ | ☐ d |
| don't know | ☐ e |
| NA | ☐ f |

26. At home, does the person who prepares the meals usually add salt to these foods before serving them?

| | yes | no | NA |
|---|---|---|---|
| melon | ☐ | ☐ | ☐ |
| sliced tomatoes | ☐ | ☐ | ☐ |
| salad | ☐ | ☐ | ☐ |
| cooked vegetables | ☐ | ☐ | ☐ |
| fried egg | ☐ | ☐ | ☐ |
| French-fried potatoes | ☐ | ☐ | ☐ |

27. Does your son/daughter usually have butter or margarine on sandwiches?

| | |
|---|---|
| yes | ☐ |
| no | ☐ |
| don't know | ☐ |

28. Which type of spread do you usually buy for table use? (HAND CARD 10)

- stick margarine ☐ a
- soft or tub margarine ☐ b
- dairy butter ☐ c
- other _____ (write in type) ☐ d
- no one type ☐ e
- don't know ☐ f

29. Which type of spread do you usually buy for preparation of food, i.e., for flavoring vegetables, rice, etc.? (HAND CARD 10)

- stick margarine ☐ a
- soft or tub margarine ☐ b
- dairy butter ☐ c
- other _____ (write in type) ☐ d
- no one type ☐ e
- don't know ☐ f

30. Which type of milk product or substitute does your son/ daughter usually put on cereal? (HAND CARD 11)

- regular whole milk (fresh or powdered) ☐ a
- lowfat (2%) milk (fresh or powdered), e.g., Milkman ☐ b
- nonfat milk (fresh or powdered) ☐ c
- non-dairy creamer (such as Richening or Mocha Mix) ☐ d
- half and half or other cream ☐ e
- other _____ (write in type) ☐ f
- don't know ☐ g
- NA ☐ h

31. Which type of frozen milk dessert does your son/daughter have at home most often? (HAND CARD 12)

| | |
|---|---|
| ice milk | ☐ a |
| ice cream | ☐ b |
| frozen yogurt | ☐ c |
| other _____ (write in type) | ☐ d |
| don't know | ☐ e |
| NA | ☐ f |

32. How often does your son/daughter experience the following conditions? (HAND CARD 13)

| | |
|---|---|
| nose bleeds | |
| *daily* | ☐ a |
| *weekly* | ☐ b |
| *monthly* | ☐ c |
| *once or twice a year* | ☐ d |
| *never* | ☐ e |
| headaches | |
| *daily* | ☐ a |
| *weekly* | ☐ b |
| *monthly* | ☐ c |
| *once or twice a year* | ☐ d |
| *never* | ☐ e |

37. Since January 1977, has your son/daughter taken any drugs or medications not listed here? (HAND CARD 15) (IF NO, SKIP TO #39)

- yes ☐
- no ☐
- don't know ☐

38. (IF YES) What drugs or medications has he/she taken?

_____ ☐☐☐
_____ ☐☐☐
_____ ☐☐☐
_____ ☐☐☐

NA ☐

39. On school days, how many hours of sleep does your son/daughter usually get?

hrs. min. ☐☐ ☐☐

40. On school days, what time does your daughter/son usually go to bed at night?

☐☐ ☐☐

41. On school days, what time does he/she usually get up in the morning?

☐☐ ☐☐

42. (IF OTHER THAN BIOLOGICAL MOTHER, SKIP TO #45) Did you smoke cigarettes while you were pregnant with this child? (IF NO, SKIP TO #45)

- yes ☐
- no ☐
- NA ☐

43. (IF YES) What was the usual number per day? (HAND CARD 16)

- 1--4 ☐ a
- 5--14 (½ pack) ☐ b
- 15--24 (1 pack) ☐ c
- 25--34 (1½ packs) ☐ d
- 35--44 (2 packs) ☐ e
- 45+ (2½+ packs) ☐ f
- NA ☐ n

44. Were the cigarettes filter or nonfilter tip?

| | |
|---|---|
| filter tip | ☐ a |
| nonfilter tip | ☐ b |
| some of each | ☐ c |
| don't know | ☐ d |
| NA | ☐ e |

45. Has your child ever regularly sucked her thumb or finger? (IF NO, END INTERVIEW)

| | |
|---|---|
| yes | ☐ |
| no | ☐ |
| dk | ☐ |

46. (IF YES) How often? Was it . . .

| | |
|---|---|
| only occasionally, i.e., about once a day | ☐ |
| OR frequently, i.e., more than once a day | ☐ |
| NA | ☐ |

47. Thinking back to the time when your child was thumbsucking, when was it done?

| | yes | no | dk |
|---|---|---|---|
| when going to bed | ☐ | ☐ | ☐ |
| when watching TV | ☐ | ☐ | ☐ |
| when emotionally upset | ☐ | ☐ | ☐ |
| after being disciplined or punished | ☐ | ☐ | ☐ |
| when tired | ☐ | ☐ | ☐ |
| NA | ☐ | | |

48. At what age did your child quit thumbsucking? (HAND CARD 17) (IF THEY HAVE NOT QUIT, END INTERVIEW)

| | |
|---|---|
| before one year | ☐ a |
| 2--4 years | ☐ b |
| 5--6 years | ☐ c |
| 7--9 years | ☐ d |
| 10 or more years | ☐ e |
| has not quit yet | ☐ f |
| NA | ☐ g |

49. How did he/she stop thumbsucking? (HAND CARD 18)

| | |
|---|---|
| on her own | ☐ a |
| coersion by parents or others | ☐ b |
| ointments or coatings | ☐ c |
| dental block | ☐ d |
| other_____ | ☐ e |
| NA | ☐ f |

FINISHING TIME:_____

CHILD ADOLESCENT BLOOD PRESSURE STUDY
HOME INTERVIEWER BLOOD PRESSURE DATA FORM

**PARENT BLOOD PRESSURE SCREEN**

INTERVIEWER'S #: ☐☐ DATE: _____

ID #: ☐ ☐☐☐ ☐☐

**Mother/Father NAME**

BP (1) $K_1$ ☐☐☐ $K_4$ ☐☐☐ $K_5$ ☐☐☐

BP (2) $K_1$ ☐☐☐ $K_4$ ☐☐☐ $K_5$ ☐☐☐

HEIGHT: (INS.) ☐☐☐☐ WEIGHT: (LBS.) ☐☐☐

CHILD-ADOLESCENT BLOOD PRESSURE STUDY
HOME INTERVIEW QUESTIONNAIRE FOR MOTHERS OR FATHERS

MOTHER/FATHER LIFESTYLE QUESTIONNAIRE

Starting time:_____ Date

C. IDENTIFICATION MOTHER/FATHER INFORMANT ID NUMBER

YOUTH STUDY PARTICIPANTS: CHILD ID NUMBER

CHILD ID NUMBER

CHILD ID NUMBER

INTERVIEWER ID NUMBER -

D. INFORMATION ON MOTHER / FATHER

As we have explained in our letters to you, previous studies have suggested that many factors in a person's total life experience may be related to blood pressure. I am now going to ask you some questions about yourself.

1. How long have you lived at your present address?

less than one year a

1--5 years b

more than 5 years c

2. How many times have you moved in the last 5 years?

0 a

1--3 b

more than 3 c

3. Has a physician ever told you that you had a stroke? (SEE DEFINITION IN NOTES)

yes

no

4. Have you ever had heart disease, such as a myocardial infarct or angina, diagnosed by a physician?

yes

no

ASK ONLY TO MOTHER:

5. Have you on repeated occasions been told by a physician that you had high blood pressure, other than when you were pregnant?

yes ☐
no ☐

6. a) Are you now taking medication for high blood pressure?

yes ☐
no ☐

(IF YES, AND THE ANSWER TO 5 WAS NO)

b) Since you indicated that a physician has not told you that you have high blood pressure, yet you are taking medication for high blood pressure, what is the purpose of this medication?

QUESTIONS # 7 to # 11 ASKED ONLY TO MOTHERS:

7. Are you currently taking an oral contraceptive? (IF NO, SKIP TO QUESTION 11)

yes ☐
no ☐

8. (IF YES) Which one? _____

_____

☐☐
NA ☐

9. How long have you been taking it? (IN WEEKS)

wks. ☐☐☐
NA ☐

10. (IF ANSWER TO 9 IS FOUR WEEKS OR LESS) Which one were you taking previously?

_____

☐☐
none ☐
NA ☐

11. How old were you when you started to menstruate? Please answer in years and months.

(IF RESPONDENT HAS DIFFICULTY REMEMBERING, ASK:
a. What grade were you in?
b. Where were you living at that time?
TRY TO GET YEARS AND MONTHS, E.G., 13 YEARS, 6 MONTHS, BUT ACCEPT JUST YEARS).

yrs. mos.

age ☐☐ ☐☐

(CHECK IF EXACT) ☐ ☐

don't know ☐

12. How many years of school have you completed? (CIRCLE THE CORRECT YEAR OR DEGREE)

1 2 3 4 5 6 7 8 9 10 11

12 13 14 15 16 B M D Other_____ ☐☐

13. What is your present main or usual occupation?

_____ ☐☐

14. What are your main duties at this occupation?

_____ ☐☐

15. Which category describes your current marital status? (HAND CARD 1)

M ☐ a

D ☐ b

sep ☐ c

W ☐ d

never married ☐ e

other_____ ☐ f

16. (IF EVER MARRIED) At what age were you first married?

years ☐☐

NA ☐

17. What is the total number of years you have been married?

years ☐☐

NA ☐

18. How many times have you been married?

(IF ANSWER IS "ONE," ANSWERS TO QUESTIONS 17 AND 19 SHOULD AGREE)

times ☐☐

NA ☐

19. (IF PRESENTLY MARRIED) How long have you been married to your current spouse?

years ☐☐

NA ☐

20. Which of the following categories describes your total annual family take-home income? (HAND CARD 2)

<$10,000 ☐ a

10-14,999 ☐ b

15-19,999 ☐ c

20-24,999 ☐ d

≥$25,000 ☐ e

21. What is your religious preference? (HAND CARD 3)

Roman Catholic ☐ a

Seventh-day Adventist ☐ b

other protestant ☐ c

Jewish ☐ d

other_____ ☐ e

none ☐ f

THE FOLLOWING QUESTIONS ARE ABOUT SMOKING

22. Is your family doctor <u>now</u> a cigarette smoker?

- yes ☐ y
- no ☐ n
- have no family MD ☐ a
- don't know ☐ b

23. As far as you are aware, has cigarette smoking affected the health of anyone you personally know, such as a family member, friend, yourself, someone at work, or some other acquaintance?

- yes ☐ y
- no ☐ n
- don't know ☐ d

24. Are you currently . . . (HAND CARD 3b)

(IF NON-SMOKER, OR SMOKES OTHER FORMS OF TOBACCO, <u>END INTERVIEW</u>)

- smoking cigarettes ☐ a
- smoking other forms of tobacco ☐ b
- a former smoker ☐ c
- a non-smoker (never smoked regularly) ☐ d

25. About how many times would you say you made a fairly serious attempt to stop smoking cigarettes entirely? (IF "0," <u>END INTERVIEW</u>) (HAND CARD 3c)

- 0 ☐ a
- 1--4 ☐ b
- 5--9 ☐ c
- 10 or more ☐ d
- NA ☐ e

26. Thinking back to the last time you stopped smoking cigarettes for at least a while (entirely), did you cut down all at once, or did you do it gradually?

| | |
|---|---|
| all at once | ☐ a |
| gradually | ☐ b |
| don't remember | ☐ c |
| NA | ☐ d |

27. At the time you had completely quit, how hard did you find it to stop smoking cigarettes? (HAND CARD 3d)

| | |
|---|---|
| very easy | ☐ a |
| fairly easy | ☐ b |
| fairly hard | ☐ c |
| OR very hard | ☐ d |
| NA | ☐ e |

28. What were the two major reasons why you attempted to stop (or stopped) smoking?

1. _____ ☐☐
2. _____ ☐☐
NA ☐

FINISHING TIME: _____