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Ecology of Obesity in West Philadelphia Adolescents

Abstract

The prevalence of obesity among American children and adults has increased substantially over the past few decades. This research used an ecological framework to examine the relationships between biological, dietary, sociocultural and behavioral factors to determine how these factors influenced obesity status during adolescence in West Philadelphia. Correlates, values, and health risks of obesity were addressed. In Phase I of the study, obesity-related attitudes, anthropometric, dietary, and sociodemographic factors were measured for 392 West Philadelphia adolescents (11-15 years). Data were compared to two other groups of Philadelphia adolescents of comparable socioeconomic status and ethnic background measured in the 1960s and 1970s. Phase II was based on 32 matched-pairs of obese (BMI and triceps skinfold \geq 95th percentile of NHANES I) and non-obese (BMI and triceps skinfold between the 15th and 85th percentiles of NHANES I) female adolescents selected from the Phase I sample based on obesity status and matched according to stature and age. Adolescents were compared on the following measures: physical activity, sedentary behavior, dietary intake, eating attitudes, health behavior knowledge, body image, self-esteem, and maturation status. Findings from Phase I include a threefold increase (males) and a fourfold increase (females) in the prevalence of obesity over the last two decades that was not concurrent with an increase in body fat centralization. The West Philadelphia adolescents had macronutrient intakes that were higher than the RDA and higher than age- and sex-specific data from NHANES III (Life Sciences Research Office, 1995). Micronutrient status was excellent, with the exception of calcium, zinc, fiber, and vitamins A and D. In Phase II, physical activity and television watching emerged as the most important contributory factors to obesity status. There were no statistically significant matched-pair differences in macronutrient and micronutrient intakes, self-esteem, eating attitudes, health behavior knowledge, body image, or maturation status of these adolescents. Findings indicate that sociocultural factors in the urban environment may promote obesity for these adolescents. This research suggests that future intervention strategies include attention to physical activity, television watching habits, and sociocultural factors in the urban environment.

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Penny Gordon-Larsen

A DISSERTATION

in

Anthropology

**Presented to the Faculties of the University of Pennsylvania in Partial
Fulfillment of the Requirements for the Degree of Doctor of Philosophy**

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PENNY GORDON-LARSEN

1997



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ABSTRACT**ECOLOGY OF OBESITY IN WEST PHILADELPHIA ADOLESCENTS****Penny Gordon-Larsen****Francis E. Johnston**

The prevalence of obesity among American children and adults has increased substantially over the past few decades. This research used an ecological framework to examine the relationships between biological, dietary, sociocultural and behavioral factors to determine how these factors influenced obesity status during adolescence in West Philadelphia. Correlates, values, and health risks of obesity were addressed. In Phase I of the study, obesity-related attitudes, anthropometric, dietary, and sociodemographic factors were measured for 392 West Philadelphia adolescents (11-15 years). Data were compared to two other groups of Philadelphia adolescents of comparable socioeconomic status and ethnic background measured in the 1960s and 1970s. Phase II was based on 32 matched-pairs of obese (BMI and triceps skinfold \geq 95th percentile of NHANES I) and non-obese (BMI and triceps skinfold between the 15th and 85th percentiles of NHANES I) female adolescents selected from the Phase I sample based on obesity status and matched according to stature and age. Adolescents were compared on the following measures: physical activity, sedentary behavior, dietary intake, eating attitudes, health behavior

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CHAPTER 1

INTRODUCTION

Anthropology is an holistic science concerned with the study of human biological variation and cultural diversity. Anthropologists have focused much of their research on investigating the sources and functional significance of human biological and cultural variation under diverse environmental conditions. One area of physical anthropology particularly relevant to the study of human biological variation is the field of human growth and development, with its focus on the plasticity of growth of children living under various environmental conditions. The importance of the study of human growth for anthropological research lies in understanding the range of variability in human form and the level of growth considered adequate for healthy biological function.

Franz Boas (1912), in one of the most influential growth studies, argued that the environment, rather than genetics, is a critical force in influencing human growth and variability. From this early work, researchers began to address the descriptive and analytic study of growth and development, and ultimately, variability in the human growth process. Future research focused on documenting the magnitude and range of variability in growth of the human form both within and between populations (Tanner et al., 1969; Johnston et al., 1976; Eveleth and Tanner, 1990).

One of the central goals of this body of anthropological research is to determine if

individuals are maintaining levels of growth within a range adequate for normal and healthy biological function. As a result of the plasticity of human growth, the capacity to be influenced by environmental factors (e.g., nutrition, socioeconomic status, infectious disease, and psychosocial stress) during the growth process is significant. Malnutrition (undernutrition and overnutrition) during the growth period can have significant morbidity and mortality outcomes. Thus, growth data may be used as an index for screening populations to identify those at risk for poor health outcome (Tanner, 1986; Cameron, 1991; Durnin, 1991).

Overweight (excess weight) and obesity (excess fat) are associated with a range of adverse health outcomes, including cardiovascular disease, hypertension, adult-onset diabetes, and high cholesterol levels (Berenson, 1980; Garrison et al, 1980; Foster and Burton, 1985; Pi-Sunyer, 1991). Physical anthropologists and others investigating obesity have used biological approaches (e.g., anthropometric and energy expenditure analyses) to assess obesity prevalence under various environmental conditions. Researchers have also investigated the health consequences of obesity (Mueller et al., 1984; Bindon and Baker, 1985; Johnston et al., 1985; Reichley et al., 1987; Rolland-Cachera et al., 1987). In addition, there is a significant body of work relating to the secular increase in overweight and obesity over the past several decades (Malina et al., 1986; Sorensen and Price, 1990; Sugarman et al., 1990; Ernst and Harlan, 1991; Knowler et al., 1991; Shah et al., 1991; Chakraborty et al., 1993; McGarvey et al., 1993; Kuczmarski et al., 1994).

Despite the depth of the anthropological literature related to obesity, there is a lack of research on the determinants (and the interaction between determinants) of obesity.

Although obesity is the result of excess energy intake relative to energy expenditure, there are a multitude of biological and non-biological factors that influence variation in energy intake and energy expenditure. For this reason, the present dissertation used an ecological framework to examine the relationships between biological, dietary, sociocultural and behavioral factors to determine how these factors influence obesity status during adolescence. The ecological perspective has been used to study human disease by assessing biological measures of health status and operationalizing social and cultural variables as stressors (May, 1960; Jerome et al., 1980; Kandel et al., 1980; McElroy and Townsend, 1990; Armelagos et al., 1990; McGrath, 1992). This dissertation used the ecological perspective to analyze obesity within a particular cultural context and to address the correlates, values, and health risks of obesity.

The ecological model used in this dissertation provided a framework for examining the physical, biological, and sociocultural correlates of obesity in the West Philadelphia environment. The interactions among these correlates were viewed within a systems perspective and attention was paid to the flow of influence between all factors. In addition, these interactions were studied in the context of group, rather than individual, outcome. The ecological model used in this dissertation was borrowed from a model of proximate and ultimate determinants used in the context of child survival (Mosely and Chen, 1984). In the present model, proximate determinants, such as diet and physical activity, were conceptualized as operating directly on obesity. In addition, this model also recognized ultimate determinants or underlying factors, such as environmental and sociocultural factors, that operated on proximate determinants to influence health

outcome.

Although obesity is associated with poor health in most segments of American culture, this dissertation endeavored to determine if there were positive psychosocial outcomes of obesity and larger body size for urban West Philadelphia adolescents. Similarly, this work sought to determine if there were positive psychosocial outcomes of physical activity and patterns of dietary intake that influenced obesity status. As this dissertation developed an understanding of the sociocultural context of obesity, it was possible to determine which factors may have predisposed some adolescents to develop obesity. In addition, this work helped to determine which sociocultural, behavioral, and biological factors are candidates for future modification, if modification is desired.

The academically-based community service perspective used in this dissertation strengthened the ecological approach. Academically-based community service is a democratic approach to conducting research (Harkavy and Puckett, 1991; Harkavy et al., 1996; Harkavy, 1996). With this approach, “informants” are actively involved in the development of the research agenda and guide the project towards questions and produce outcomes that benefit their community. Likewise, the investigator becomes a participant in the perceptions and concerns of the community. The direct involvement of West Philadelphia community members in the design of this study allowed the sociocultural, behavioral, and psychological context of obesity in West Philadelphia to be defined by those who live within this geographic community.

This dissertation research aimed to investigate adolescent growth within an urban context. The contextual information provided by the ecological approach helped to define

the urban environmental influences on growth of West Philadelphia adolescents. In addition, the focus on sociocultural, behavioral, and psychological factors that are part of the West Philadelphia urban environment demonstrated the link between these factors and human growth.

Purpose

The present study was designed to accomplish the following goals: 1) to document the prevalence of obesity in West Philadelphia adolescents, 2) to investigate the secular increases in overweight and obesity in Philadelphia over the past four decades, 3) to describe biocultural correlates and consequences of obesity during adolescence, and 4) to examine obesity within a cultural context and to address the behavioral correlates and cultural value of obesity for West Philadelphia adolescents.

Significance

Adolescence is a period of heightened concern for overweight and obesity (Dietz, 1994). The incidence of obesity increases during this age period (Lawrence et al., 1991; Dietz, 1994; Morrison et al., 1994); it is also believed that a significant proportion of adult obesity originates at this time (Johnston, 1981; Stark et al., 1981; Dietz and Bandini, 1992). In addition, ethnic differences in the prevalence of obesity, absent in infancy and childhood, begin to appear during adolescence (Gartside et al., 1984; Gillum, 1987; Gortmaker et al., 1987; Morrison et al., 1994) with an increased prevalence in African-American females relative to white-American females. These differences continue through

late adolescence (Must et al., 1994) and adulthood (Harlan et al., 1988; Shah et al., 1991; Kuczmarski et al., 1994).

Understanding the development of obesity during adolescence is of critical public health concern given the association of obesity with a range of adverse health outcomes. Since the health risks associated with obesity-related chronic degenerative diseases are disproportionately high among African Americans (National Center for Health Statistics, 1993; National Heart, Lung, and Blood Institute, 1994), it is important to monitor changes over time in the prevalence of overweight and obesity. This dissertation research explored the biological, cultural, and behavioral factors that may contribute to the increase in obesity prevalence in urban African-American adolescents.

With the exception of infancy, adolescence is the most rapid period of physical growth (Tanner, 1962) and sociocultural development. This rapid period of growth results in increased energetic and nutrient requirements for adolescents. In addition, adolescence has been characterized as a critical period for the development of obesity (Dietz, 1994). The prevalence of obesity among children and adolescents has increased over the past several decades (Malina et al., 1986; Gortmaker et al., 1987; Ernst and Harlan, 1991; Knowler et al., 1991; Shah et al., 1991; Kuczmarski et al., 1994). Although there is significant evidence that adolescence is a critical period for the development of obesity in African-American females, the literature is lacking biocultural data on the correlates and determinants of adolescent obesity (Kumanyika, 1987). Biocultural data gained from this analysis will be extremely helpful in framing intervention efforts focused on the etiology, treatment, and prevention of obesity and obesity-related chronic

degenerative disease.

The anthropological perspective is important in exploring human-food-environment interactions as they relate to human variability. This dissertation examined cultural and behavioral responses to the environment that may have been nutritionally maladaptive because they resulted in overnutrition and obesity. However, attention was also given to the adaptive significance of over consumption of macronutrients and how this over consumption may have contributed to increased health status in this population. In addition, the investigation of secular changes in obesity in Philadelphia adolescents over the past three decades demonstrated a brief picture of ongoing evolution resulting in changing human shape and form.

Objectives

- 1) To document the prevalence of obesity in urban African-American adolescents living in West Philadelphia.
- 2) To investigate the secular increases in overweight and obesity in Philadelphia over the past four decades.
- 2) To investigate factors related to:
 - a) family environment;
 - b) physical environment;
 - c) sociocultural environment; and
 - d) individual environmentthat interacted to influence diet and physical activity. These factors may

influence obesity status and the risk for development of cardiovascular disease in urban, African-American adolescents. The goal of this research was to increase current understanding of the etiology, treatment and prevention of obesity in this, and similar, populations.

- 3) To investigate obesity within an ecological framework, using biological, psychological, social, cultural, and economic factors to investigate human-food-environment interactions. This approach differed from the clinical or biomedical approach as obesity was defined within a particular cultural context and the causes, values, and health risks of obesity were addressed.**

Hypotheses

- 1) There is a high prevalence of overweight and obesity in urban, African-American schoolchildren from West Philadelphia [as defined by a Body Mass Index (BMI; wt/ht^2) and triceps skinfold thickness \geq 95th percentile of the first phase of the National Health and Nutrition Examination Survey (NHANES I; Must et al., 1991)].**
- 2) Obese adolescents consume 5.0% more of their overall energy intake from total dietary fat per day than non-obese adolescents [figures derived from sample size calculation].**
- 3) Obese adolescents watch 9 or more hours of television per week than non-obese adolescents [figures derived from sample size calculation].**
- 4) The following sociocultural and biological factors may promote overweight and obesity**

in this population (see model, Figure 1):

Family Environment

- a) household composition: large number of siblings
- b) household composition/occupational status: working mother
- c) home ownership and material goods
- d) adult supervision after school
- e) long-term residency in West Philadelphia

Physical Environment

- a) proximity to fast-food restaurants and corner stores (convenience stores)
- b) restriction of “safe” areas for physical activity

Sociocultural Environment

- a) decreased knowledge of risk factors for cardiovascular disease
- b) sociocultural acceptance of obesity
- c) low priority of obesity and cardiovascular disease as health concerns
- d) social value of high-fat, energy-dense fast-foods and snack foods
- e) social value of settings for food consumption that promote high-fat, energy-dense foods, such as fast-food restaurants or corner stores

Individual Environment

- a) post-pubertal status
- b) body image preference that promoted acceptance of a larger body size or shape
- c) low self-esteem

- d) unhealthy attitude towards eating and food**
- e) low level of cardiovascular disease-related knowledge**

Diet

- a) high fat, high protein diet, low in vegetable and fruit consumption**
- b) high frequency of junk-food and fast-food consumption, particularly after school**
- c) meal composition defined by a greater frequency of "snacking" as opposed to structured meals**
- c) attitude toward eating that does not include attention to a low-cardiovascular-risk diet**

Physical Activity

- a) high frequency of sedentary behavior, including television and video viewing**
- b) low frequency of high-intensity physical activity**

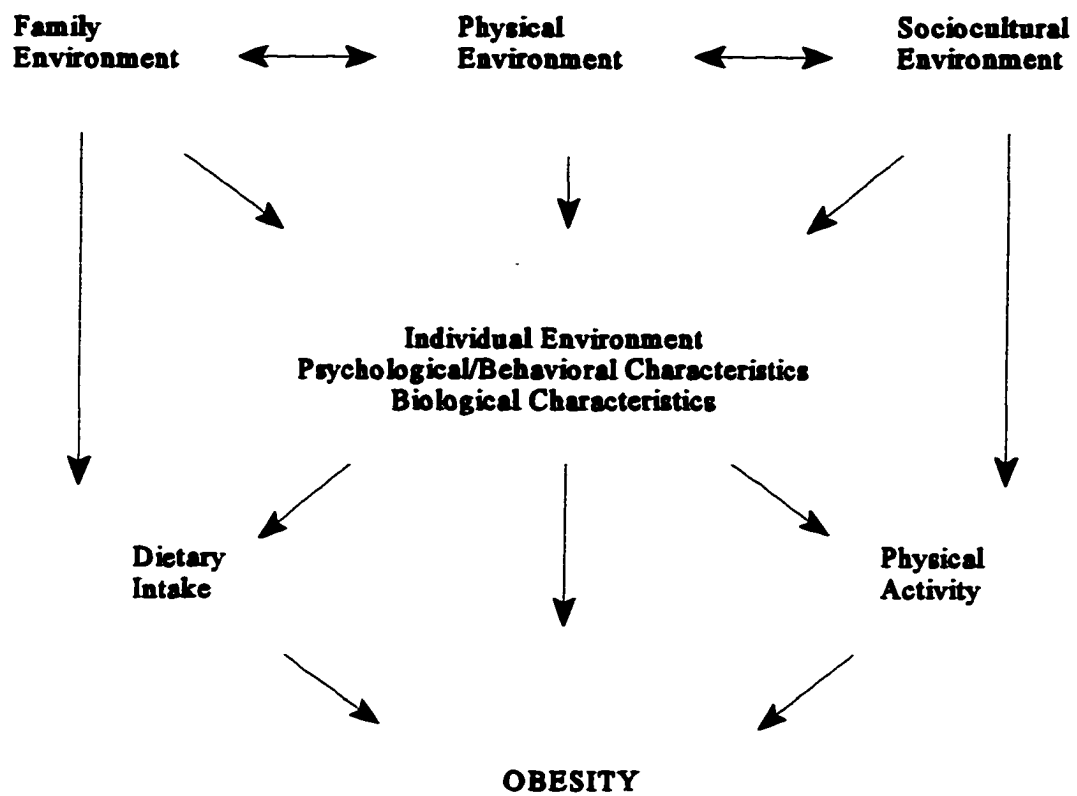


Figure 1. Ecological model of obesity, adapted from Jerome et al. (1980:14).

CHAPTER 2

RELATED LITERATURE

This chapter provides a literature review of biological, dietary, sociocultural, and behavioral factors as they relate to adolescent obesity in an urban context. The chapter begins with a summary of background information related to the topics of ethnicity and obesity, and ecological models in anthropology. This overview is followed by a brief summary of the demographic characteristics of West Philadelphia. The second section of this chapter is a literature review on growth and development, obesity and overweight, dietary influences on obesity, the influence of physical activity on obesity, sociocultural influences on obesity, and academically-based community service.

Background: Ethnicity and Obesity

Much of the obesity literature focuses on ethnic differences in obesity status prompted both by the high prevalence of obesity in minority populations and the association of obesity in minority populations with non-insulin dependent diabetes and unfavorable cardiovascular risk profile (Kumanyika, 1990; Savage and Harlan, 1991). As a result of the strong link between obesity and health status, the majority of studies in the obesity literature place emphasis on biological factors. Biomedical studies are critically important to developing a complete understanding of obesity. However, the biomedical

literature is often reductionist in nature, viewing ethnicity as a discrete biological phenomenon without recognizing the variation within and between ethnic groups. This dissertation used a definition of ethnicity that included a clustering of biological, genetic, socioeconomic, regional, social, and cultural factors. Much of the obesity literature relies purely, and erroneously, on a definition of ethnicity that is not precisely defined, but nonetheless equates ethnicity with biology. With this caveat in mind, the biomedical literature on diet and disease in African-American populations will be presented and discussed.

In this dissertation, ethnic categorization follows biomedical precedent. The “African-American” ethnic group includes non-Hispanic African Americans, while “white-American” ethnic group includes non-Hispanic whites who are generally descended from Caucasian or European ancestry. These ethnic classifications are conceptually problematic due to within-group variability and the influence of the multitude of factors associated with ethnicity. In addition, ethnic groupings, as they relate to minority populations, are likely to delineate politically and socially disadvantaged segments of a society that may predict negative health outcome (Reynolds, 1993; Kumanyika, 1994).

Background: Ecological Models in Anthropology

Ecological models focus on the interrelationships between populations of organisms and their environments (Odum, 1971) with direct emphasis on the survival of organisms within a given environment (Bates, 1960). Ecological models have been used in anthropological studies to investigate the adaptive mechanisms of human populations

over time in relation to environmental stressors in their ecosystems. For example, such researchers have investigated the human response to the following stressors: high altitude hypoxia (Frisancho, 1975; 1979), heat stress (Roberts, 1978; Frisancho, 1979; Hanna and Brown, 1979; Hanna et al., 1989), cold stress (Steezman, 1975; Roberts, 1978; Frisancho, 1979; Moran, 1979; Hanna et al., 1989), solar radiation (Loomis, 1967; Frisancho, 1979), illness (Thomas et al., 1988), and nutritional stress (Thomas, 1973; Jerome et al., 1980).

West Philadelphia

There are approximately 232,979 people living in the West Philadelphia area, of whom 70% are African American (U.S. Bureau of the Census, 1990). The majority of Philadelphia children live below the official poverty line (\$12,590 annual income for a family of three; Philadelphia Citizens for Children and Youth, 1995). The major health problems of West Philadelphia residents include hypertension, heart disease, diabetes, cancer, AIDS, asthma, homicide, drug/alcohol abuse, and teen pregnancy (U.S. Bureau of the Census, 1990). West Philadelphia has been designated a medically under-served area, because there are an inadequate number of primary care providers to meet the basic health needs of the community. Health conditions of West Philadelphia citizens are exacerbated by poverty, poor housing conditions, unemployment, and a host of other socioeconomic problems (Philadelphia Citizens for Children and Youth, 1995).

Adolescents in this study attended the Turner Middle School in West Philadelphia. Academic characteristics of the 1994 Turner Middle School population included an 85% daily attendance rate and a rate of between 41% and 60% of students who scored in the

lowest quartile of a comprehensive test of basic skills in mathematics (School District of Philadelphia, 1995). Similar to other urban neighborhoods, the area surrounding the middle school has a high rate of crime and violence (Schwarz et al., 1994) and a significant amount of physical/environmental deterioration (Center for Community Partnerships, 1995).

Growth and Development

All humans share a growth pattern that consists of rapid infant growth followed by a slow and steady period of childhood growth, succeeded by the acceleration characteristic of the adolescent growth spurt. Although this growth pattern is remarkably similar across all human populations, there is variation in the timing of maturational events as the result of the interaction between genetic and environmental influences throughout the growth process. Environmental effects, such as malnutrition, have a significant impact on the childhood growth process. Undernutrition is generally associated with a relatively slow rate of childhood growth and smaller body size, while overnutrition is associated with a relatively fast rate of growth and a larger body mass or weight that is further associated with chronic disease risk later in life. The disparity between the health and nutritional status of children living in developing and developed countries is extensive, resulting primarily from environmental differences (Bielicki et al., 1981; Martorell, 1985; Johnston, 1990). Human growth has been investigated under a range of environmental conditions ranging from the high infectious disease load and chronic environmental stress characteristic of nutritional scarcity to conditions of nutritional plentitude, adequate

sanitation, and sufficient access to health care. These types of investigations are important for health monitoring purposes and for improving current understanding of the growth process.

The adolescent growth spurt is characterized by rapid growth in body size and shape. Maturation is marked by onset of menstruation in females, which exhibits substantial individual and population variation. Age at menarche for white Americans has been reported at 12.8 in 1968 (MacMahon, 1973) and in 1973 in middle class Massachusetts females (Zacharias et al., 1976). Age at menarche in African Americans has been reported at 12.5 in 1968 (MacMahon, 1973) and at 12.4 in Philadelphia adolescents in 1977 (Hediger and Stine, 1987). There is considerable individual variation in the timing of menarche, which is a longitudinal marker for the adolescent growth spurt.

Males and females have substantial growth in stature during the year of peak stature velocity, with males averaging between 7 and 12 cm and females between 6 and 11 cm (Tanner, 1990). In addition, males and females have significant changes in body composition during this period of maturation, resulting in the sexual dimorphism seen in adult males and females. Concurrent with peak stature velocity, males have a marked decrease in subcutaneous fat growth followed by an increase in muscle growth just after peak stature velocity that is followed by a period of increased growth in subcutaneous fat (Tanner, 1990). Conversely, females have a peak in muscle growth closer to the peak stature velocity and a decrease in fat accumulation around the peak stature velocity, followed by a period of increased growth in subcutaneous fat (Tanner, 1990). Females are characterized by a greater percentage body fat than males, both during and after peak

stature velocity. However, there is sexual dimorphism in this body fat patterning; males are more likely to have centralized body fat patterning, with fat primarily distributed over the trunk rather than the extremities. This sexual dimorphism in body fat patterning has been found in all ethnic groups; for example such dimorphism has been found in African Americans (Valleroy, 1987), Mexican Americans (Mueller, 1988), British whites (Buckler, 1990), and African blacks (Cameron et al., 1992) and has cardiovascular-related health implications (Mueller et al., 1984; Bjorntorp, 1985; Kissebah et al., 1988; Larsson, 1988; Osei et al., 1991).

Due to the increased energetic demands of adolescent growth and development, adolescents constitute a group that is sensitive to environmental and nutritional influences. For this reason, studies of adolescent growth under various environmental conditions are particularly relevant to anthropology as they provide information about the range of variability in the human form. In comparative growth studies, stature and weight measures for children and adolescents provide an index of societal public health and overall nutritional status as well as a cumulative measure of the effects of environmental stressors on human growth. In using growth as an indicator of health and well-being, stature is considered an indicator of growth history (Eveleth, 1985:37), whereas weight is considered an indicator of current growth status (Waterlow et al., 1977).

Secular changes in body dimensions reflect the relationship between a population and its environment. A trend toward larger body size and earlier maturation has been recognized for over a century (Bowditch, 1877; Boas, 1911; Tanner, 1973; Cameron, 1979; Roche, 1979). Although the secular trend in stature is slowing down or may have

stopped altogether in the U.S. (Eveleth and Tanner, 1990), secular increases in weight have persisted resulting in the increasing prevalence of overweight and obesity among virtually all U.S. age groups (Gortmaker et al., 1987; Harlan et al., 1988; Shear et al., 1988; Shah et al., 1991; Kuczmarski et al., 1994; Troiano et al., 1995) regardless of ethnicity (Kuczmarski et al., 1994). Secular changes have been linked to improved nutrition, immunization and sanitation, and improved medical care (Eveleth and Tanner, 1990). These changes illustrate the impact of environmental conditions on human growth and the resulting plasticity of the human form.

Obesity and Overweight

Overweight and obesity, resulting from overnutrition, are inextricably linked to the surrounding environmental, sociocultural, and behavioral context. In addition, obesity and overweight are associated with a number of chronic degenerative diseases and a range of adverse health outcomes, including cardiovascular disease, hypertension, adult-onset diabetes, and high cholesterol levels (Berenson, 1980; Garrison et al., 1980; Foster and Burton, 1985; Pi-Sunyer, 1991). Cardiovascular disease is the single largest cause of death in the U.S. (Lawrence et al., 1991) and is a considerable, national economic burden (Colditz, 1992). There is strong evidence that atherosclerosis and coronary heart disease begin in childhood, as evidenced by the presence of coronary artery fatty streaks in adolescents and young adults (Enos, 1953; McNamara, 1971; Newman et al., 1986). Thus, these chronic degenerative diseases can be viewed as the result of long-term biological and environmental influences acting upon the individual throughout childhood,

adolescence, and early adulthood.

In addition to the evidence of adolescent coronary artery plaque, several risk factors for atherosclerosis (weight, cholesterol, lipoproteins, and blood pressure) "track" over time. Thus, over time an individual's risk factors remain within the same percentile rank relative to age- and sex-appropriate reference standards (Berenson et al., 1984). For example, childhood excess adiposity is predictive of excess adiposity throughout adolescence and into adulthood (Johnston, 1981; Stark et al., 1991); adolescent obesity is an even stronger predictor of adult obesity than childhood obesity (Must, 1996). The probability that obese children will become obese adults increases with the persistence of obesity into late childhood (Dietz and Bandini, 1992; Must et al., 1992). Men and women who were overweight as adolescents have been found to be at higher risk for morbidity from coronary heart disease and atherosclerosis (Nieto et al., 1992), without regard to their adult weights (Must et al., 1992). Moreover, the incidence of obesity increases during adolescence (Lawrence et al., 1991; Morrison et al., 1994), leading researchers to designate adolescence a critical period for the development of obesity (Dietz, 1994).

The number of overweight children and adolescents in the U.S. has increased at a faster rate than that for adults (Kuczmarski et al., 1994). Over the past four decades, there has been a significant increase in in both developed and developing countries. Using BMI as a criterion, researchers have found increases in overweight over the past two decades in Samoan adults (McGarvey et al., 1993) and young Pima adults (Knowler et al., 1991) and, in the past decade, in American adults (Shah et al., 1991; Kuczmarski et al., 1994) and children (Campaigne et al., 1994; Troiano et al., 1995), in Navajo

schoolchildren (Sugarman et al., 1990), and Danish young adult males (Sorensen and Price, 1990). A similar secular increase in weight as well as ponderosity, using the ponderal index, was found in the Bogalusa study between 1973 and 1984 (Shear et al., 1988). During the same time period, Chakraborty et al. (1993) found a similar increase in (using skinfold measures) and overweight (using BMI) in Mexican-American children. Also during the same time period, Malina et al. (1986) found an increase in the prevalence of overweight and obesity in Mexican- American schoolchildren, 6 to 17 years-of-age (although the authors did find a decrease in overweight and obesity prevalence in boys between 14 and 17 years-of-age). Similar findings for the past decade also have been found using triceps skinfold (Gortmaker et al., 1987) and using self-reported stature and weights for American adults (Schoenborn, 1988; Chung et al., 1992) and Finnish adult men (Jalkanen et al., 1989).

Obesity is a significant problem for minority populations (Ernst and Harlan, 1991; Kumanyika, 1994) and specifically for African-American women (Gartside et al., 1984; Gillum, 1987; Gortmaker et al., 1987; Kumanyika, 1987; Harlan et al., 1988; Shah et al., 1991; Kuczmarski et al., 1994; Morrison et al., 1994; Must et al., 1994). National weight surveys indicate that 49.5% of African-American women and 31.5% of African-American men weigh 20% or more than their ideal body weight (Kuczmarski et al., 1994). These figures are compared to 33.5% of white-American women, and 32.0% of white-American men, who weigh 20% or more than their ideal body weights (Kuczmarski et al., 1994). In addition, cardiovascular disease rates (U.S. Department of Health and Human Services, 1989; National Center for Health Statistics, 1993; National Heart, Lung, and Blood

Institute, 1994), death rates from heart disease, stroke (Gillum, 1991), cancer, and diabetes (U.S. Department of Health and Human Services, 1985b) are all higher in African Americans.

Ethnic differences in the prevalence of obesity, absent in infancy and childhood, begin to appear during adolescence (Gartside et al., 1984; Gillum, 1987; Gortmaker et al., 1987; Morrison et al., 1994), with increased prevalence in African-American relative to white-American females. These differences continue through late adolescence (Must et al., 1994) and adulthood (Harlan et al., 1988; Shah et al., 1991; Kuczmarski et al., 1994). For example, researchers from the National Heart, Lung, and Blood Institute Growth and Health Study (NGHS) found that as early as 9 and 10 years-of-age, African-American females are more biologically mature, more obese, and have higher blood pressure levels than white-American females of the same age (NGHS Research Group, 1992). Similarly, research on 5,115 young adults from four large cities across the U.S. showed that by 18- to 20 years-of-age, excess obesity was already evident in African-American females (Burke et al., 1990). Due to the fact that the incidence of obesity increases with pubertal maturation, there is likely to be some important factor associated with obesity development and adolescent growth. However, researchers have yet to determine if this factor, or clustering of factors, is biological or sociocultural in nature.

In addition to the excess obesity in African-American females compared to white-American females, there are average differences in fat patterning between the two groups. For example, centralized (or centripetal) fat patterning, defined as excess adipose tissue centralized on the trunk as opposed to the extremities, is more common among African-

American children and women than white Americans (Mueller, 1982; Gillum, 1987; Gortmaker et al., 1987; Kumanyika, 1987). This centralized fat patterning has been linked to cardiovascular disease risk factors (Bjorntorp, 1985; Larsson, 1988), including diabetes (Mueller et al., 1984; Kissebah et al., 1988; Osei et al., 1991), in all ethnic groups. The relationship between centripetal fat patterning and diabetes is of particular relevance in African-American populations because rates of diabetes are very high in this ethnic group in comparison to other populations (U.S. Department of Health and Human Services, 1985b).

The suggestion that ethnic differences in body weight begin to appear during adolescence focuses attention on maturational development. Morrison et al. (1994) investigated the relationship between sexual maturation and obesity in African-American and white- American girls and found that African-American girls were more mature than white- American girls at 9 and 10 years-of-age. The authors found no significant differences in anthropometric measures between African-American and white-American prepubertal girls, except in triceps skinfold, which was significantly larger in white-American girls. However, they found that African-American pubertal premenarcheal girls were significantly taller, heavier, and had larger body mass than white-American pubertal premenarcheal girls.

In addition to maturational differences in the development of obesity, there are also differences in obesity associated with socioeconomic status (SES). SES, however, is strongly associated with ethnicity (U.S. Department of Health and Human Services, 1985a). Among women, there is an inverse relationship between obesity and income level;

for example, women of high SES are less likely to be obese than women of low SES (Garn et al., 1981; Kumanyika, 1987; Sobal and Stunkard, 1989). Obesity prevalence in low-income females has been reported to increase after adolescence (Garn et al., 1981; Garn and Ryan, 1981). However, after controlling for socioeconomic status, the obesity prevalence differences between African-American and white-American women have been demonstrated to persist (Lowenstein, 1976; National Center for Health Statistics, 1981; Van Itallie, 1985; Johnson et al., 1986).

Biocultural Correlates of Obesity

Dietary Influences on Obesity

Dietary factors, in addition to genetic, metabolic, behavioral, and environmental factors, play a fundamental role in the etiology of obesity, both as an independent factor and as an interacting determinant. Dietary factors are inextricably linked to health status. Both overnutrition and undernutrition are associated with a host of associated disorders and diseases. In addition, both overnutrition and undernutrition are mediating influences of the effects of poverty on morbidity and mortality. In West Philadelphia, the major nutritional concern is overnutrition and its association with chronic diseases, such as cardiovascular diseases, non-insulin dependent diabetes, and some cancers.

Although nutrition-related chronic degenerative diseases are largely diseases of adulthood, these types of diseases often have their genesis in childhood. Cardiovascular risk factors, such as dyslipidemia, hypertension, hyperinsulinemia and obesity tend to cluster in children and adolescents (Webber et al., 1979; Khoury et al., 1980; Smoak et al.,

1989) and this clustering effect has been shown to persist from childhood to adulthood (Lauer et al., 1988; Webber et al., 1991; Bao et al., 1994). The long-term health consequences of these risk factors are two times greater in individuals who were overweight as children when compared to those not overweight as children, with greater risk for individuals who were overweight as adolescents (Must, 1996). Anthropological approaches that place obesity within a lifecycle and biocultural perspective can be helpful in determining how obesity prevalence is involved in the long-term health of a group. Examining obesity from a lifecycle perspective allows for recognition of the preventive aspects of the diet-health relationship.

Heart disease and cancer, the two highest causes of death in the U.S., are highly correlated with diet (Crawford, 1988). There is considerable evidence that dietary modifications, such as consumption of a diet low in fat and saturated fat, and high in fruits, vegetables, and whole-grain cereals [20% of energy from protein, 30% from total dietary fat (10% from saturated fat), and 50% from carbohydrates] (American Cancer Society, 1984; National Research Council, 1989a), can reduce risk of premature morbidity and mortality from these chronic diseases (U.S. Department of Health and Human Services, 1988; National Research Council, 1989a). National trends implicate these types of changes in dietary habits as one of the most important factors (Doll and Peto, 1981; Califano, 1987) in the recent decrease in mortality rate for coronary heart disease since the late 1960s (Kimm et al., 1983; Davis et al., 1985).

Several researchers have proclaimed nutrition as the keystone of preventive health care because healthy dietary habits can prevent the development of several chronic

degenerative diseases including diabetes, cardiovascular disease, and atherosclerosis (Coulston and Rosen, 1994; Kretchmer, 1994). In addition, Healthy People 2000 (1990), a broad-based initiative headed by the U.S. Public Health Service, has set national nutrition objectives to improve the health of all Americans through the prevention rather than treatment of major health problems by the year 2000. Nutrition objectives of Healthy People 2000 include the following: reduction of coronary heart disease deaths, reduction of overweight prevalence, reduction of dietary fat and sodium intake, increase of complex carbohydrate and calcium intake in the diet, and increase in number of people engaged in regular physical activity. Of the 300 objectives included in Healthy People 2000, 111 are directly aimed at adolescents and several emphasize the need for further nutritional research on eating patterns of children and adolescents of minority groups.

Although changes in dietary pattern over the past few decades have moved in the direction of healthier consumption, twenty-four hour dietary recall data from NHANES II show that Americans do not generally consume a diet that would lower cancer and heart disease risk (Patterson and Block, 1988). Although dietary fat intake has decreased slightly over the past two decades, it is still approximately 35% of total kilocalories, 5% more than recommended (Nicklas et al., 1995; Posner et al., 1995). Likewise, American children in first through twelfth grades have been reported to have higher intakes of food energy, protein, total fat, saturated fat, and sodium than recommended, although average daily intakes of vitamins and minerals at least meet the U.S. Recommended Daily Allowances (RDA; Devaney et al., 1995). These large scale studies document nutritional trends in dietary intake, however, they focus on diet as an independent factor in the

etiology of obesity, and thereby, remove diet from its biocultural context.

Attention to variability in dietary intake has allowed researchers to demonstrate that nutritional factors that influence the development of chronic disease are not evenly distributed throughout American society. Instead, dietary and nutritional factors have been suggested to contribute to health disparities, such as higher-than-average rates of obesity, cardiovascular diseases, diabetes, and cancer of minorities relative to whites, resulting in the “morbidity/mortality gap” between ethnic groups (Kumanyika, 1993).

In recognition of the higher rates of chronic degenerative diseases in African-American populations, there is a considerable depth of comparative dietary research by ethnic group. Researchers have found a higher percentage of energy intake from total fat and saturated fat in African-American relative to white-American females (Block et al., 1988; Kimm et al., 1990; Obarzanek et al., 1994). In addition, African Americans measured as part of NHANES II consumed less fruits and vegetables than white Americans (Patterson et al., 1990). Researchers have also found ethnic differences in diet patterns in children as young as six months of age. Nicklas et al. (1987) found higher total fat and cholesterol intakes, but lower sucrose intake, in African-American relative to white-American children (6 months - 4 years-of-age). Similarly, African-American children have been reported to consume more servings of eggs, luncheon meat, pork, poultry, and total protein than white-American children (Frank et al., 1992). Other comparative dietary studies have concluded that cultural dietary habits of African Americans include foods high in saturated fat and cholesterol and low in fiber (Kumanyika, 1987; Hargreaves et al., 1989). These dietary practices may comprise a

significant part of cultural identity and may be reinforced by psychosocial factors, but they may also increase risk for nutrition-related chronic degenerative diseases.

The most frequently used non-biological correlates of obesity and nutrition-related chronic disease are socioeconomic status (SES), education, and income. Education and income have been shown to influence knowledge of nutrition and dietary practices (Ten-State Nutrition Survey, 1972; Cotugna et al., 1992). Low SES children and adolescents have been shown to consume a diet higher in fat and lower in several vitamins and minerals than higher SES youths (Doyle, 1994; Devaney et al., 1995; Rogers et al., 1995).

The influence of socioeconomic factors on ethnic differences in obesity vary over time. In the 1960s, African Americans of low SES were eating a much healthier diet (increased grain, legume, and vegetable consumption) than high and low SES whites, although this trend has reversed over the past three decades (Popkin et al., 1996). Popkin et al. (1996) found that the earlier historical trend was the result of a cultural dietary pattern including traditional foods, such as sweet potatoes, greens, and black eyed peas. This dietary pattern could be described as low-cardiovascular risk. Overall, diets of Americans have changed over the past three decades; in recent years, there has been an increase in packaged and restaurant foods high in fat, saturated fat, and energy, with foods such as eggs, whole milk, cheese, beef, and butter/margarine contributing most to the high intake of cholesterol and saturated fat in adults of all ages (Shea et al., 1993). The increase in these types of foods has occurred despite recommendations for a diet low in fat, saturated fat, cholesterol, sodium, and red meat, and high in fruits, vegetables, grains and legumes (Committee on Diet and Health, National Research Council, 1989a).

Early studies of obesity focused on excessive energy intake as a determinant of obesity. However, several studies have shown no difference in energy intake (kilocalories per day) in obese and non-obese groups (Johnson et al., 1956; Huenemann et al., 1966; Goth, 1973; Baecke et al., 1983; Braitman et al., 1985; Gazzaniga and Burns, 1993). The lack of difference in energy intake between obese and non-obese groups has been shown to be unrelated to under reporting of energy intake by the obese (Baecke et al., 1983; Braitman et al., 1985). Furthermore, there is no evidence that the high prevalence of obesity in African-American women is a function of excess energy intake (National Center for Health Statistics, 1977; Gartside et al., 1984). Recent studies have shown that the relationship between obesity and energy intake is not a simple positive one (Eck et al., 1992; Obarzanek et al., 1994). It has been suggested that excess intake of fat, with its high energy content per gram, is a more important factor than excess intake of other macronutrients (Flatt, 1985; Rolland-Cachera and Bellisle, 1986; Romeiu et al., 1988). Gazzaniga and Burns (1993) suggest that diet composition contributes to childhood obesity independent of total energy intake, resting energy expenditure, and physical activity.

The obesity literature is lacking definitive information about the relationship between dietary intake and obesity. An ecological model, with its systems approach to human-environment-food interactions, has the potential to aid in the discovery of inter-relationships between biocultural correlates of obesity. Other approaches to the obesity-diet relationship, which focus on unidimensional correlates of obesity such as the oxidation of a single nutrient, fail to place obesity within a sociocultural, behavioral, and biological

framework. A broad ecological approach is necessary to answer questions about such a complex phenomenon as obesity.

Anthropological studies of obesity and diet have broadened the biomedical literature by focusing on the evolutionary significance of obesity and the relationship between behavior, health, and disease over time. In an evolutionary perspective, the most significant dietary changes came with the development of agriculture and the resulting reliance on dairy products and grains (Eaton and Konner, 1985; Gordon, 1987; Goodman et al., 1992). The differences between paleolithic and modern diets have significant health implications for the reduction of dietary-related chronic degenerative diseases (coronary heart disease, hypertension, diabetes, and some cancers). For example, the feast and famine hypothesis has been used to explain the high prevalence of obesity and obesity-related chronic degenerative diseases in certain populations. Using this hypothesis, individuals who were able to store energy efficiently (through hyperinsulinemic response to food) during periods of food availability would be more likely to survive periodic food shortages. This hypothesis has been examined in relation to high rates of obesity and diabetes mellitus in Samoans (McGarvey, 1991) and in Pima Indians (Knowler et al., 1983).

After the development of agriculture, a second major dietary shift occurred with the development of industrialization that had direct implications for human growth and development (Schell, 1986; Tanner, 1986; McMichael, 1993). Chronic degenerative diseases are partially due to the effects of industrialization (e.g., reduction of infectious diseases rates and increased life expectancy). However, modernization has also been

shown to be associated with a high saturated fat diet (Connor and Connor, 1972) and decreased physical activity (Sobal and Stunkard, 1989; Kumanyika, 1994), which are also risk factors for obesity-related chronic degenerative diseases. With industrialization, there were changes in diet composition (e.g., decreased wild fruit and vegetable consumption and therefore, decreased fiber intake) that impacted cardiovascular health and nutritional status (Eaton and Konner, 1985).

Industrialization increased health and longevity for the segments of society that could afford adequate health care, housing, and nutrition, but it resulted in poor health outcome for those who could not (Malina et al., 1981; Johnston et al., 1985; Martorell, 1985). SES is a social mediator of health-related stressors such as nutrient availability (Johnston, 1990; Martorell, 1985; Leonard, 1989) that are further associated with nutritional and health status differentials. The socially, economically, and medically vulnerable are at increased risk for poor nutritional status and its resulting conditions.

In addition, urban environment and lifestyle have been associated with an increased prevalence of chronic degenerative diseases. Urbanization is associated with a sedentary lifestyle (Gortmaker et al., 1990), dietary factors such as increased intake of sodium and dietary fat and the resulting increase in blood pressure and unfavorable serum lipids (Dressler, 1984; Pelletier and Hornick, 1986; WHO, 1990), as well as social factors, such as social support (Dressler, 1990) and lifestyle incongruity (Dressler, 1992). Health consequences of an urban environment are of particular importance because by the year 2005, at least one half of the world's population will live in an urban environment (United Nations, 1989).

The study of food and nutrition is a biocultural endeavor. The anthropological perspective has provided substantial information about the critical role of diet in human biological evolution and the effect of historical and present nutritional and environmental constraints on modern human biological variability. Anthropology has also increased current understanding of food and nutrition as an interface between a biological process (nutrient intake and utilization) and a cultural process in which social, economic, and political factors influence the access to, and composition of foods available for consumption.

American adolescents have been found to consume a diet that does not meet dietary recommendations (Kimm et al., 1990; Pennington and Young, 1991; Wright et al., 1991). This, in addition to the increased energy and nutrient requirements of the adolescent growth spurt, has led to the characterization of adolescents as a nutritionally vulnerable subgroup in the U.S. (Hampton et al., 1967; Schorr et al., 1972; Ten-State Nutrition Survey, 1972). Despite the vulnerability of adolescents, the diet and obesity literature is lacking information on regional and cultural influences on adolescent eating behavior. The investigation of adolescent dietary patterns and eating behaviors are necessary components in determining potential areas for nutritional intervention. Dietary health-promotion efforts designed to make positive changes in eating habits during adolescence may serve to protect these adolescents from future development of nutrition-related chronic degenerative diseases.

Given the public health concern with obesity and its consequences, it is important to quantify the nutritional and health status of adolescents from economically

disadvantaged segments of society who may be at greater risk for these diseases. Furthermore, it is important to investigate dietary behaviors and practices of such adolescents so intervention may be framed in culturally appropriate terms.

The Influence of Physical Activity on Obesity

Although much of the biomedical nutrition literature is focused on dietary correlates of obesity, nutritional requirements vary according to factors such as age, sex, body size, stage of growth, and level of physical activity. Although the impact of each of these factors has been recognized within the biomedical literature, there are few studies that examine the influence of several correlates on obesity. The accrual of excess adipose tissue is the outcome of a positive balance between energy intake and expenditure, either through excess intake, reduced expenditure, or some combination of both factors. Thus, the proximate cause of obesity can be seen as energy imbalance.

One of the main factors to prompt researchers to investigate energy expenditure as a determining factor in the etiology of obesity is the lack of difference in energy intake of obese and non-obese groups. Some energy balance studies have demonstrated an inverse relationship between obesity and regular physical activity (Paffenbarger et al., 1978; Folsom et al., 1985; Powell and Dysinger, 1987; Dannenberg et al., 1989; Haskell et al., 1992; DiPietro et al., 1993), while others have not (Stefanik et al., 1959; Wilkinson et al., 1977; Strazzullo et al., 1988). Researchers have also found an inverse relationship between chronic degenerative diseases and physical activity in adults (Fox, 1971; Dawber, 1973; Paffenbarger et al., 1978; Sallis et al., 1988; Powell et al., 1989; Haskell et al.,

1992) and in African-American adolescents (Dyer et al., 1980).

Energy needs are influenced by growth status and, as such, adolescents are in a delicate position due to the high energetic and nutritional demands of the adolescent growth spurt. It is imperative to keep these increased needs in mind when developing nutritional interventions for adolescents. For this reason, it has been suggested that physical activity may be the most appropriate obesity intervention for children and adolescence because it does not have an adverse impact on the growth and development process (Troiano et al., 1995). Promoting physical activity during adolescence is also important for long-term health outcome. Risk-related behaviors, such as physical inactivity, acquired during childhood are likely to persist throughout childhood and into adulthood; thus inactive children are likely to become inactive adults (Moore et al., 1991; Powell and Dysinger, 1987; Thomas and Chess, 1977).

Physical activity behaviors are influenced by lifestyle and cultural factors that serve to either promote or discourage physical activity. American adolescents spend more time engaged in television watching than in physical activity, and consequently physical activity patterns have been shown to fall below Centers for Disease Control goals (U.S. Department of Health and Human Services, 1993; Heath et al., 1994). In addition, the physical fitness of American youth has decreased over the past two decades (Updyke, and Willett, 1989). Physical activity and fitness have been shown to vary by ethnicity. Although there is not much data on ethnic differences in physical activity level during adolescence, studies in adults have demonstrated lower levels of physical activity (National Center for Health Statistics, 1985; Wing et al. 1989) and cardiovascular fitness

(Farrell et al., 1987) among African Americans relative to white Americans.

The importance of television in American society has led to a growing trend of sedentism among American children (Dietz and Gortmaker, 1985; Dietz and Strasburger, 1991; Gortmaker et al., 1987). In the United States, children spend more time watching television than they do in any other activity (Dietz and Strasburger, 1991). Dietz and Gortmaker (1985) have argued that the prevalence of obesity is directly related to time spent watching television. This relationship may vary with SES. For example, the strength of the relationship between television and skinfold thickness (males) and BMI (females) was greater among children of less affluent as opposed to more affluent school districts of Pennsylvania (Shannon et al., 1991). Factors that may explain the relationship between television viewing and obesity include increased energy consumption (while viewing television or through advertisements for energy-dense and high fat foods shown on television), decreased energy expenditure while watching television, or television watching as a replacement activity for physical activity (Dietz and Gortmaker, 1985).

West Philadelphia adolescents may have a lower level of physical activity as a result of the constraints of an urban environment. The high rate of crime and violence in this urban environment may limit the amount of unsupervised outdoor physical activity for its constituents. In addition, economic factors may limit the opportunities for membership in athletic clubs or participation in athletic leagues.

Cultural Influences on Obesity

In addition to the biological influences on obesity, cultural factors such as dietary

knowledge, attitudes, and practices, physical activity patterns, and sociodemographic factors may play a central role in the etiology of obesity (Kumanyika, 1987; McGinnis, 1992; Kuczmarski et al., 1994). However, most research projects examine the etiologic contribution of only one such factor. Although often reduced to socioeconomic differences, the cultural influences on excess female obesity in ethnic groups are more complex than differences in socioeconomic status alone. For example, there is evidence that obesity prevalence differences between African-American and white-American women do not disappear when controlling for socioeconomic status (Kumanyika, 1987; Dawson, 1988). These and similar findings have led researchers to examine the role of culture in the development of obesity.

Societal influences on body image have a strong impact on the prevalence of obesity in children and adolescents. Western society maintains an "intense preoccupation with the body" focused on a societal preference for thinness that is reinforced through sociocultural influences, such as the social value of attractiveness and psychological factors, such as body image and self worth (Rodin, 1993:643). However, because obesity is culturally defined; some cultures may view large body size as the optimal sign of beauty (Brown and Konner, 1987). Thus, there is likely to be intra- as well as inter-cultural variation in body image preference.

Variation in sociocultural correlates of obesity are likely to be influenced by SES (Sobal and Stunkard, 1989). The societal preference for thinness, so prevalent in middle and upper-SES white-American culture (Rand and Kuladau, 1990), may be less pervasive in African-American culture. For example, it has been demonstrated that although

overweight African-American women were weight conscious, they had relatively positive body images and did not feel the effect of strong social pressures to be thin (Kumanyika et al., 1993). It has been suggested that these attitudes persist throughout adolescence (Anderson and Hay, 1985; Desmond et al., 1990; Wadden et al., 1990; Felts et al., 1992; Wilson et al., 1994) and into old age (Stevens et al., 1994).

Several researchers have suggested that African-American adolescents are less likely to experience and to be persuaded by societal pressures for thinness than white-American adolescents (Anderson and Hay, 1985; Desmond et al., 1990; Wadden et al., 1990; Felts et al., 1992). For example, Felts et al. (1992) found that white-American female adolescents were more likely than their African-American counterparts to perceive themselves to be overweight and to actively undertake weight-reduction activities. In a study of African-American and white-American adolescents' perceptions of their weight, Desmond et al. (1989) found that the majority of African-American female adolescents perceived themselves as thinner than actual body size, while white-American females perceived themselves to be fatter than their actual body size (Desmond et al., 1989). Consequently, rates of eating disorders such as anorexia and bulimia have been found to be lower among African Americans than white Americans (Andersen and Hay, 1985; Hsu, 1987).

There is evidence that African-American women are as likely to try to lose weight as white-American females (Dawson, 1988; Bennett, 1991). However, the two ethnic groups have different perceptions of overweight status, with increased acceptance of larger body size more common among African-American women. Weight-loss treatment

strategies have been shown to have "lower-than-average effectiveness for African Americans" (Kumanyika et al., 1991: 1637S). Constraints to weight reduction and weight control in African Americans include less stigmatism against obesity (Kumanyika, 1987; Wadden and Stunkard, 1987); cultural and economic constraints, such as the cost of participation in commercial weight-loss programs, cost of child care, cost of energy-, sodium-, or fat-modified foods, and the preference for certain high-fat, high-sodium foods in the African-American community (Kumanyika and Adams-Campbell, 1991); and comparison of current body size to a culturally based reference of heavier body weight (Dawson, 1988).

Research has shown that there are psychosocial differences between obese and non-obese children and adolescents; obesity has been associated with lower self-esteem, poor self-concept, depression, and behavioral problems (Dietz, 1981; Mendelson and White, 1982; Carey et al., 1988; Strauss et al., 1985; Baum and Forehand, 1984). However, with cultural acceptance of a larger body size, obese African-American children and adolescents may be less exposed to sociocultural stress associated with the "drive for thinness". Thus, obese African-American youths may experience less obesity-related psychosocial stress. Consequently, African-American, urban obese children have been shown to have higher self-esteem than their non-obese counterparts (Kaplan and Wadden, 1986; Casper and Offer, 1990; Fisher et al., 1994; Fisher et al., 1996).

The cultural concept of beauty, particularly as it relates to body shape and size, has a direct impact on physiology and health outcome. There are likely to be positive psychosocial outcomes of obesity and larger body size that may promote the development

of obesity. Likewise, there are also likely to be positive psychosocial outcomes of physical activity and patterns of dietary intake that influence obesity status. Furthermore, the strong influence of culture is likely to impact development of obesity in West Philadelphia adolescents.

Academically-based Community Service

The discipline of anthropology, like other social sciences, eschews practice-based work and rewards theoretical advances; knowledge is pursued for its own sake. Research findings are presented in the form of academic publications that are intended to advance knowledge that will benefit society in the long run. In general, practice is seen as non-academic and outside of the realm of the theoretical, and thus, the academy. In contrast to this strictly academic approach, many researchers have taken the position that anthropology should play an active role in making substantial improvements in those communities in which research is undertaken (Tax, 1975; Chambers, 1987; Blakey et al., 1994; Rappaport, 1994). It is argued that “engagement, particularly with the disorders that disrupt the lives of those among whom we study and learn, decreases our distance from them, makes participation fuller, and makes knowledge gained from participation truer” (Rappaport, 1994:289). Furthermore, this type of research helps anthropologists to fulfill the central mission of anthropology, “to promote social justice and reaffirm the value of diversity” (Forman, 1994:20).

There are many anthropologists who have called for a committed and engaged anthropology, one that “is concerned with the relationships between anthropological

knowledge and the uses of that knowledge in the world beyond anthropology” (Chambers, 1987:309). These anthropologists have focused their efforts on several variations of practice-based anthropology, ranging from a tremendous variety of applied anthropological work (Foster, 1969; Chambers, 1987; Poggie et al., 1992; Van Willigen, 1993; Bennett, 1996) to action anthropology (Tax, 1975). Elements of this significant body of work are helpful for the present project. Of particular relevance are the following concepts: generating knowledge that works towards solving social problems (Tax, 1975; Rappaport, 1993); placing control of research in the hands of those being researched (Tax, 1964; Whyte, 1991; Warry, 1992; Blakey et al., 1994); focusing on issues critical to American society (Rappaport, 1993); and a strong focus on the integration of theory and practice (Baba, 1994).

For nearly a century, anthropological work has mirrored public concern for national social problems. Nearly a century ago, Franz Boas used biological anthropology to investigate the influence of environment on physical growth (Boas, 1910). This work had great social consequence, as Boas used his research to forward his critique of the eugenics movement to promote his concept of variability (rather than homogeneity) of human ethnic groups (Stocking, 1979; Chambers, 1985). Similarly, Margaret Mead was active in policy research during World War II and used her anthropological knowledge to serve on various committees to address policy related to nutritional problems of wartime (Mead, 1979). In more recent years, applied anthropologists have worked with agencies such as the World Health Organization, United States Agency for International Development, and the Food and Agricultural Organization. In physical anthropology,

there are obvious links to public policy in the area of child health (Martorell et al., 1975; Johnston et al., 1976; Pelto et al., 1983; Johnston, 1990; Cameron, 1991). For example, the growth status of children has been used as a powerful indicator of health and nutritional status (Eveleth and Tanner, 1990). On a broader scale, "optimal or suboptimal growth" may be used to characterize the habitability of environments, such as in studies of auxological epidemiology (Tanner, 1981; 1986; Schell, 1986). This dissertation research progresses beyond the identification of suboptimal environments to the strategic improvement of those conditions, which is a central tenet of academically-based community service (Harkavy and Puckett, 1991; Harkavy et al., 1996; Harkavy, 1996).

Summary

Adolescence is a critical period for the development of obesity, as its incidence increases during this time period (Lawrence et al., 1991; Dietz, 1994; Morrison et al., 1994) and a significant proportion of adult obesity has been shown to originate during this time (Johnston, 1981; Dietz and Bandini, 1992). In addition, ethnic differences in the prevalence of obesity, absent in infancy and childhood, begin to appear during adolescence (Gartside et al., 1984; Gillum, 1987; Gortmaker et al., 1987; Morrison et al., 1994) with an increased prevalence in African-American relative to white-American females. These differences continue through late adolescence (Must et al., 1994) and into adulthood (Harlan et al., 1988; Shah et al., 1991; Kuczmarski et al., 1994).

Adolescence is also a critical period for the development of behavioral factors that impact obesity. For example, dietary behaviors (Lauer et al., 1988; Webber et al., 1991;

Bao et al., 1994), physical activity patterns (Moore et al., 1991; Powell and Dysinger, 1987; Thomas and Chess, 1977), as well as body image attitudes (Anderson and Hay, 1985; Desmond et al., 1990; Wadden et al., 1990; Felts et al., 1992; Wilson et al., 1994) develop during adolescence and have the potential to persist through adulthood. Placing adolescent obesity into a biocultural perspective allows the investigation of important correlates of obesity, such as body image and attitudes (Kumanyika, 1987; Desmond et al., 1990; Rand and Kuladau, 1990) and weight-loss attitudes and behaviors (Dawson, 1988; Bennett, 1991; Kumanyika et al., 1991).

Obesity is a major public health concern due to the recent increase in its prevalence among virtually all U.S. age groups (Gortmaker et al., 1987; Harlan et al., 1988; Shear et al., 1988; Shah et al., 1991; Kuczmarski et al., 1994; Troiano et al., 1995). The increasing prevalence of obesity is associated with increased risk for several chronic degenerative diseases. Since the health risks associated with obesity-related chronic degenerative diseases are disproportionately high among African Americans (National Center for Health Statistics, 1993; National Heart, Lung, and Blood Institute, 1994), it is of critical importance to monitor changes over time in the prevalence of overweight and obesity in African-American groups. Nutritional factors that influence the development of chronic degenerative disease are not equitably distributed throughout American society and specific attention should be given to particularly vulnerable subgroups of society, such as urban youth.

CHAPTER 3

METHODS

The present study was designed to describe the context of obesity in West Philadelphia adolescents by documenting the prevalence of obesity and describing the nutritional intake of West Philadelphia adolescents. In addition, this research was also designed to investigate the secular increases in overweight and obesity in Philadelphia over the past four decades. Furthermore, this study was designed to investigate the biocultural influences on obesity, and as such, to investigate several factors within the family environment, physical environment, sociocultural environment, and individual environment which interact to influence diet and physical activity and which may influence the development of obesity in urban, African-American adolescents. In this dissertation, obesity was investigated within an ecological framework, using biological, psychological, social, cultural, and economic factors to investigate human-food-environment interactions. This approach differed from the clinical or biomedical approach in that obesity was described within a particular historical and cultural context and the correlates, values, and health risks of obesity were addressed.

The Ecology of Obesity Project was divided into two phases. Phase I of the project consisted of an anthropometric, dietary, and sociodemographic survey. The aim of this phase of the study was to document the prevalence of obesity in urban, West

Philadelphia African-American adolescents, and to describe the nutritional intake of these adolescents. Phase II of the project consisted of data collection on matched-pairs of obese and non-obese female adolescents from the Phase I survey. The Phase II adolescents were selected based on obesity status. These females were matched by age and stature, such that each obese female was matched with a non-obese female of similar age and stature. The matched-pairs were contrasted on several biological and sociocultural variables.

Sample

The Phase I sample consisted of 392 West Philadelphia middle school students enrolled in sixth, seventh, and eighth grades (203 males; 189 females) between the ages of 11 and 15 years (Table 1). These adolescents were measured between September 1994 and January 1995. The adolescents were grouped into age categories with the whole year as the midpoint; thus, chronological age groupings represented age intervals of ± 0.5 of that year. In other words, the group of 12 year-olds included adolescents aged 11.50 to 12.49 years, with a 12.0 mean age for the group.

The sample was drawn from urban, African-American students who attended a West Philadelphia middle school that was part of a joint community/university-sponsored project entitled the West Philadelphia Improvement Corps (WEPIC) Program. WEPIC is a school-based community revitalization program founded in 1985 to serve the local geographic community through a community-oriented, concrete problem solving approach to fill the needs of the community. The goal of the WEPIC program is to produce comprehensive, university-assisted community schools that will function as the educational

and service delivery hub for the community. Turner Middle School, one of several WEPIC schools, serves an economically disadvantaged population with over 84% of students from low-income families; all students are eligible for free breakfast and lunch under Chapter I funding (School District of Philadelphia, 1995).

Student enrollment at Turner Middle School during the 1993-1994 academic year included a total of 1,004 students (54% male) and 99% of the Turner students defined themselves as African Americans (Philadelphia City Planning Commission, 1994). The WEPIC program at Turner, which was conceptualized as a school-within-a-school, consisted of 18 classrooms of 540 students. The Ecology of Obesity Project was developed with, and supported by, school administration and included data collection for this dissertation project as well as participation in a nutrition education and extracurricular program. The Ecology of Obesity Project sample was drawn from this pool of 540 students based on teacher and student willingness to participate. From this pool of students, 73% enrolled in the project. The total Phase I study sample was comprised of 392 youths (203 males; 189 females) between the ages of 11 and 15 years

This project was not only a research project designed to benefit the community, but it also actively involved students in the research process. Students assisted the researcher with collection of data from their peers. The students learned about the design of the project, participated in data collection, and followed the project through its completion and were thus able to see the results of their input. The results of the study were presented to the students in the form of classroom presentations and discussions so that students could be made aware of their own health status in comparison to their peers

and in relation to other U.S. adolescents. Stature and weight status were also distributed to the school nurse and to parents of these children. Thus, this project had an immediate goal of increasing nutrition education within the school. The long-term goal of this project was to aid in the development of a comprehensive and collaborative nutrition education and health-promotion program tailored to the Turner Middle School context.

Phase I

Data Collection

Phase I of the study included collection of anthropometric data (stature, weight, triceps and subscapular skinfold measures), dietary data (single 24-hour dietary recall), and sociodemographic data (sociodemographic questionnaire). In addition, focus group interviews were conducted on a subsample of males and females to elucidate cultural concepts of obesity and obesity-related behaviors.

The adolescents in Phase I of the study were examined once. Examinations were conducted between 10:00 a.m. and 1:00 p.m. in a science lab that was converted into a nutrition monitoring center at the middle school. This study was part of the Turner Nutritional Awareness Project, for which parental consent forms were already obtained. Negative consent forms were sent to parents or guardians prior to the measurement period which allowed parents or guardians to dismiss their child from participation in the study. In addition, a child consent form was given to each student prior to his or her enrollment in the study. Students were assigned an identification number to promote confidentiality of answers. Data were computerized and analyzed by identification number.

Measurements of Physical Growth

The following anthropometric measures were taken according to standardized techniques: stature, weight, upper arm circumference, triceps and subscapular skinfold (Cameron, 1978; Lohman et al., 1988). All measurements were made and recorded in triplicate and the average of three measurements was used for analysis. Anthropometric equipment is moderately inexpensive and the method is relatively time efficient. However, anthropometric measurements have been criticized because of the wide inter-observer variability in measurement technique. In this study the anthropometrists were required to do the following: 1) undertake reliability testing as part of their training and 2) achieve technical errors of measurement within internationally acceptable limits (Cameron, 1984). Once anthropometric data were collected, the following ratios were calculated: Body Mass Index (weight/stature squared), a measure of weight independent of stature, and Centripetal Fat Ratio (subscapular/ (subscapular + triceps skinfold thickness)), a measure of upper trunk relative to upper limb subcutaneous fat.

Measurements for the Ecology of Obesity Study were taken by the author and four University of Pennsylvania undergraduate students working as research assistants (Caren Kurtz, Tamara Dubowitz, Jessica Finkelstein, and Kristen Jacobs). Training for the measurements for the Ecology of Obesity Study was completed under the supervision of Dr. Babette Zemel, Director of the Nutrition and Growth Laboratory of the Children's Hospital of Philadelphia (CHOP). All measurements were taken by the author and research assistants as follows: Caren Kurtz (stature assistant), Tamara Dubowitz (arm circumference assistant), Jessica Finkelstein (data recorder), and Kristen Jacobs (weight

recorder). The author was the sole measurer of skinfold thickness. The research assistants and author completed standardized reliability training consisting of duplicate readings on 25 students and monthly readings during the measurement period. All measures were taken between 10:00 a.m. and 1:00 p.m.

1. Body weight, in kilograms, was taken on a digital Seca Scale, Model 770.

Children were measured in T-shirts and shorts or pants with shoes removed. Any extra clothing or accessories were removed. No adjustment was made for weight of clothing. Body weight values were logarithmically transformed for some of the analyses in order to correct for the skewed distribution characteristic of weight measures.

2. Stature, in centimeters, was taken with a Schorr Infant/Child/Adult Height

Measuring Board. Stature was measured as the distance from the baseboard of the Schorr Measuring Board to the highest point on the head with the subject in the standard erect position with the subject's head in the Frankfurt horizontal plane.

3. Upper arm circumference, in millimeters, was measured with a Creative Health

Products fiberglass millimeter measurement tape. The left arm was used for measurement and the tape was applied to permit skin contact without compression of the underlying tissues.

4. Triceps and subscapular skinfold thickness were measured to the nearest

millimeter with a Lange Skinfold Caliper. Triceps skinfold was measured at the back of the left upper arm over the triceps muscle half-way between the acromial and olecranon processes. Subscapular skinfold thickness was measured below the tip of the left scapula. Skinfold thickness values were logarithmically transformed for some of the analyses in order to correct for the skewed distribution characteristic of skinfold measurements.

Stature and weight measurements were made by two trained observers and recorded as the average of three measurements. Skinfold measurements were taken by a single observer and again recorded as the mean of three observations. Data collection was preceded by a one-month training session and technical error of measurement was calculated from 25 blinded replicate measurements taken one day apart during the training session. Technical errors of measurement ($TEM; \sigma_e = \sqrt{\sum d^2/2n}$) in the present study were compared to those from the U.S. Health Examination Survey (Johnston et al., 1974) and from selected published data for adolescents (Zavaleta and Malina, 1982; Brown, 1984) for intra-observer technical errors of measurement (Table 2) and from Lohman et al. (1975) and Buschang (1980) for inter-observer technical errors of measurement (Table 3). Intra-, inter-observer, and total ($\sqrt{[TEM(\text{intra})^2 + TEM(\text{inter})^2]}$) technical errors of measurement were within acceptable limits, defined by Ulijaszek and Lourie (1994) for each dimension (Table 4).

Measurement of Obesity Status

Growth is used as an indicator, or index, of health in the diagnosis, prediction, and prevention of morbidity and mortality associated with overnutrition. Reference norms for children and adolescents provide a comparative basis from which measures of growth status of individual children, or groups of children, can be evaluated (Hamill, 1977). Obesity is defined as excess fat and overweight is defined as excess weight relative to age- and sex-specific reference curves. Overweight is most commonly assessed by using the BMI as an index of body mass corrected for stature. Obesity is most commonly measured using triceps skinfold, which is highly correlated with overall body fat. In this dissertation, obesity was conservatively defined as both a BMI and triceps skinfold greater than, or equal to, the 95th percentile of the first National Health and Nutrition Examination Survey (NHANES I; Must et al., 1991).

A recent expert panel suggested that the BMI is the most appropriate index for assessing overweight during adolescence (Himes and Dietz, 1994). The rationale for using both BMI and triceps skinfold was that the BMI is an inferred measure of overweight. The BMI reflects leg length and frame size and does not differentiate between fat and lean body compartments (Lohman, 1992). In addition, the BMI may not provide a reliable measure of fatness for adolescents due to differences in maturational development (Killeen et al., 1978; Schey et al., 1984; Kuczmarski, 1993).

Using triceps skinfold alone to assess obesity is problematic. Although triceps skinfold thickness is an appropriate estimate of subcutaneous body fat, it is subject to

moderate levels of measurement error, particularly when used during the developmental changes of adolescence (Ulijaszek and Lourie, 1994). Using both BMI and triceps skinfold measures removed some of the uncertainty of using BMI due to differences in muscle mass and pubertal development, and using triceps skinfold due to measurement error.

Secular Change in Anthropometric Measures

Secular changes in stature, weight and fatness in three groups of urban, Philadelphia adolescents were assessed. All the three groups of adolescents were between 11 and 15 years-of-age and were of comparable socioeconomic status, ethnic background, and region. Adolescents from the Ecology of Obesity Project (EOP90s) were compared to two other groups of Philadelphia adolescents measured in the 1960s and 1970s.

The 1970s sample was measured in 1977 as part of the Philadelphia Blood Pressure Project (PBPP70s), a follow-up study of the Philadelphia branch of the National Collaborative Perinatal Project of the National Institute of Neurological and Communicative Diseases and Stroke (U.S. Department of Health, Education, and Welfare, 1972). From the available records, a sample of 553 youths (aged 11-15 years) were selected from the first year (1977) of this follow up study (291 males; 262 females). Stature, weight, and skinfolds were measured using standard techniques (Tanner et al., 1969) and instrumentation (Holtain Stadiometer, Holtain skinfold calipers, and the Holms beam-balance scale; Eveleth et al., 1979).

The 1960s data consisted of stature and weights taken from the published means

and standard deviations of 729 youths (372 males, 357 females; aged 11-15 years) measured between the years 1956 and 1965 by the Philadelphia Center for Research in Child Growth (PCRCG60s; Krogman, 1970). The stature and weights of these youths were similar to those reported by Malina (1986) for youths measured in 1965-1996 and are, thus, likely to be typical of Philadelphia adolescents during this time period. Again, standard procedures (Tanner et al., 1969) and instrumentation (Martin Anthropometer, Lange skinfold calipers, and beam-balance scale) were used. These data have been previously compared to the PBPP70s data (Eveleth et al., 1979). All three samples were comparable in terms of socioeconomic status, ethnic composition and adherence to standard measuring techniques. No pregnant females were included in any of the samples.

Analysis

No single method for investigating secular changes in anthropometric measures is sufficiently comprehensive. Thus, three different approaches to exploring secular changes in stature, weight, fatness, overweight and obesity among adolescents were used. First, Student's t-tests and two-way Analysis of Variance (ANOVA) were used to compare age and group differences between the three samples. Second, the samples from the 1990s and 1970s were compared to U.S. National Center for Health Statistics, National Health and Nutrition Examination Survey (NHANES I) reference standards for percentile distributions of those adolescents characterized as overweight and obese (Must et al., 1991). Third, standard normal deviate scores (Z-scores) for stature and weight were calculated relative to the NCHS reference standards using the U.S. Centers for Disease

Control (CDC) Anthropometric Software Program (CASP; CDC, 1990). Weight-for-stature Z-scores were calculated using Cole's method (Cole, 1993). Z-scores provide a normalized score relative to a reference population which allows the classification of measurements outside of the usual range of percentiles. Standard normal deviate scores are particularly useful when comparing two different samples that have different distributions. These three methods for investigating secular changes in anthropometric measures allowed a comprehensive view of the changes in nutritional and health status of a group of urban, Philadelphia adolescents over the past three decades.

Stature and weight of the EOP90s and PCRCG60s samples were compared using Student's t-tests by age and sex due to the limitations of having only summary statistics for the PCRCG60s sample. The Bonferroni correction was used to correct for repeated t-tests. Body weight and fatfold measures were logarithmically transformed to normalize the distribution of these soft tissue measures. Stature, log weight, body mass index, and log of the triceps and subscapular skinfolds of the EOP90s and PBPP70s samples were compared using two-way ANOVAs (age vs. group). Post-hoc tests for specific within-age comparisons contrasting marginal means from the residual matrix were analyzed for males and females separately. All statistical analyses were carried out using the SYSTAT statistical software (SYSTAT, Inc., 1992).

Prevalence of overweight (using BMI) and obesity (using both BMI and triceps skinfold) among adolescents from the EOP90s and PBPP70s samples were characterized using the sex- and age-specific 95th percentiles of NHANES I as recommended by a recent expert committee on adolescent overweight (Himes and Dietz, 1994). This study

followed the recommendations of the expert committee (Himes and Dietz, 1994) and considered those adolescents with BMI (and triceps skinfold) greater than the 95th percentile to be overweight (and obese), while adolescents with BMI (and triceps skinfold) greater than the 85th percentile were considered to be “at risk” for overweight (and obesity). In this study, an individual had to have both a BMI and triceps skinfold at or above the 95th percentile to be considered obese and both a BMI and triceps skinfold at or above the 85th percentile to be considered “at risk” for obesity.

The EOP90s and PBPP70s samples were compared to U.S. National Center for Health Statistics, National Health and Nutrition Examination Survey (NHANES I) reference standards in terms of percentile distributions (Must et al., 1991). Fat distribution of the two samples, described by the Centripetal Fat Ratio (CFR), was defined as subscapular skinfold divided by subscapular plus triceps skinfold values. Fat distribution was also described by the Relative Fat Distribution (RFD) which was based on the standardized residual scores from the regression analysis within each sex of subscapular skinfold on triceps skinfold measures.

In addition, secular changes in body fatness in urban, Philadelphia adolescents between the late 1970s (PBPP70s) and mid-1990s (EOP90s) were also examined. First, anthropometric and fat patterning data from the two samples were compared. Triceps and subscapular skinfold data, CFR, and RFD were compared using Student's t-tests, two-way ANOVAs, and post-hoc tests for specific comparisons contrasting marginal means from the residual matrix. Analyses of skinfold thickness were performed on logarithmically transformed data. Second, regression models were used to examine the variability in CFR

and RFD associated with age, sex, stature, weight, and group differences in the two samples.

Dietary Analysis

Nutritional intake was based on single standard 24-hour recall assessments of dietary intake for 345 youths (171 males; 174 females) from the Ecology of Obesity Project. Dietary recalls were collected by the author between September, 1994 and January, 1995. Dietary recall interviews were conducted as part of an individual interview in a science lab that was converted into a nutritional monitoring center at the middle school. The 24-hour recall method was used to estimate the average usual nutrient intakes (Gibson, 1990) of this group of urban, West Philadelphia adolescents. The recalls were spread across the school week to reduce the possibility of a systematic day of the week effect.

The Nutrition Consulting Enterprise Food Portion Visual (Posner and Morgan, 1981) was used during data collection to improve portion size quantification. The Food Portion Visual is a validated method for obtaining accurate dietary information that was originally developed for telephone surveys (Posner et al., 1982). The Food Portion Visual has also been used in an interview setting and has been determined to produce quality data comparable to other dietary assessment methods (Posner et al., 1992). Models of commonly eaten snack foods such as chips and tastykakes snack cake wrappers and juice bottles were used to improve portion size quantification of snack foods. Students were also asked where they obtained each food item eaten (e.g., home, vending machine, school

lunch, or convenience store).

While the 24-hour recall method is not accurate for quantifying dietary intake of individuals, the method is appropriate for assessing group patterns of dietary intake (Emmons and Hayes, 1973; Frank, 1991; National Research Council, 1989b; Stein et al., 1991). The 24-hour recall method has been used in an urban context to determine the intake of fruits and vegetables in relation to National Cancer Institute recommendations (Basch et al., 1994). The 24-hour recall method has also been used to describe dietary intake of children and adolescents in several large studies, such as the Bogalusa study (Nicklas et al., 1987) and the National Health and Nutrition Examination Surveys (NHANES II, 1981 and NHANES III, 1988-1991). Thus, there is adequate dietary intake reference data for comparisons of adolescents in the Ecology of Obesity Study with other samples of American adolescents.

The Nutritionist IV nutrient database was used for nutritional analyses (N-squared Computing, 1994). Data were assessed for nutritional adequacy relative to age- and sex-appropriate 1989 U.S. Recommended Daily Allowances (RDA), with a focus on nutrients of current public health concern because of their association with diet-related chronic degenerative diseases, including coronary heart disease, stroke, certain cancers, and non-insulin dependent diabetes (National Research Council, 1989b). Data were also compared to national surveillance data reported in the Third Report on Nutrition Monitoring in the U.S. [NHANES III; 1988-1991] (Life Sciences Research Office, 1995). In addition, energy requirements were estimated using equations for predicting resting energy expenditure from body weight as well as body weight and stature (WHO, 1985). These

results were and multiplied by an activity factor (energy cost of activity) which reflected typical age- and sex-appropriate activity patterns for U.S. adolescents (WHO, 1985). The WHO (1985) suggests that the activity factor for school children be comprised of a blend of light and moderate classes of activity. Estimated energy requirements for the West Philadelphia adolescents were compared to comparable data from reference adolescents (National Research Council, 1989b). Estimated energy requirements for these adolescents were also compared to reported energy intake. Under reporting of energy intake was calculated by subtracting reported energy intake from estimated energy expenditure.

Student's t-tests and the Mann-Whitney Two-Sample Statistic were used to test sex differences in nutrient intake. Data were tested for skewness and then transformed using the Box-Cox transformation to correct for skewing characteristic of dietary intake data. Student's t-tests were used on the transformed data to test for sex differences in nutrient intake. The Bonferroni correction was used to correct for repeated tests.

Sociodemographic Data Collection

A sociodemographic questionnaire developed by the author and the Activity Rating Scale developed by Sallis et al. (1988b) were administered by interview during the Phase I data collection. The author and the four research assistants administered this survey. The first portion of the sociodemographic questionnaire related to household characteristics, household composition, region of birth of student and parents, occupational status of parents, and household material goods. These questionnaire data were analyzed by tabulating the answers to all questions.

The second portion of the questionnaire related to after-school snacking habits, physical activity, and sedentary behavior. Students were asked to estimate the number of hours per week spent in light, moderate, or hard physical activity. Light activity was considered any physical activity done for less than 20 minutes or any physical activity done for less than three times per week. Moderate activity was considered any physical activity done for a total of 20 or more minutes three or more times per week. Students were also asked if they participated in a team sport. In addition, students were asked to estimate the number of hours spent watching television per day. Again, questionnaire data were analyzed by tabulating the answers to all questions.

The final portion of the questionnaire was the Activity Rating Scale, a one-item scale for characterizing physical activity (Sallis et al., 1988). Students were asked the following question: "Compared to others your of your age and sex, how much physical activity do you get?" (Sallis et al., 1988: 935). Students responded on a five-point scale, ranging from one, "much less than others" to five, "much more than others". The Activity Rating Scale has demonstrated validity through significant associations between activity rating and cardiovascular fitness and physiological measures associated with activity (Sallis et al., 1988). In addition, the Activity Rating Scale has demonstrated high test-retest reliability in children as young as the fifth grade (Sallis et al., 1993). However, children tended to overestimate their activity level using this scale (Sallis et al., 1993). The Activity Rating Scale produced a relative ranking of physical activity level of these adolescents.

Focus Groups

Focus groups are discussions that use group interaction to explore a set of issues (Morgan, 1988). A focus group format is used to generate a large number of hypotheses in a limited amount of time (Morgan, 1988). Focus groups have been used successfully among urban adolescents (Stanton et al., 1993). In addition, focus groups have been determined to be effective in generating information to be used for understanding health behaviors (Basch, 1987; Shanklin et al., 1992). Focus group discussions are designed to be loosely structured and to encourage contrasting viewpoints by participants through a permissive and non-threatening environment (Krueger, 1994). As such, the method is culturally sensitive. Focus group discussions were used for this dissertation research to elucidate cultural concepts of obesity. In addition, information from the focus group discussions was used to determine cultural- and age-appropriateness of the questionnaire surveys to be used in Phase II of this study.

Twelve focus groups were conducted with same-sex groups of eight to twelve Turner Middle School students in accordance with guidelines set by Morgan (1988) and Krueger (1994). Students were selected based on class enrollment in the WEPIC program and from classrooms of those teachers who were willing to have their students participate. Students were randomly selected from participating classrooms. Sessions were conducted in a quiet and private room and were audiotaped. Field notes were collected by the focus group moderator, and additionally, by an assistant. Data were analyzed using note-based analysis (Krueger, 1994), field notes served as the primary source of information. In addition, audiotape was used to verify specific quotes and to transcribe specific segments

of the focus group discussions. Topics of focus groups included a series of open-ended questions related to dietary habits and attitudes, body image attitudes, physical activity patterns, health concerns, and connections between diet and cardiovascular disease. In addition, photographs from magazines were used to elicit information about body size and shape and physical attractiveness.

Phase II

Phase II of the Ecology of Obesity Project was conducted on a subsample of obese and non-obese matched-pairs drawn from the larger Phase I sample according to procedures described below. The subsamples were contrasted on several biological and sociocultural variables. Phase II of the study included data collection of the following variables: physical activity (Seven-Day Physical Activity Recall; Sallis et al., 1985), sedentary behavior (Television Viewing Recall; Obarzanek et al., 1994), dietary intake (three consecutive 24-Hour Dietary Recalls; Posner and Morgan, 1992), eating attitudes (Children's Eating Attitudes Test; Garner et al., 1983b), health behavior knowledge (Child Health Behavior Knowledge Scale; Vega et al., 1987), body image (Body Image Assessment; Veron-Guidry and Williamson, 1996), self-esteem (Piers-Harris Self-Concept Scale; Piers and Harris, 1969); and maturation status (Menarcheal Age Recall). Differences in each measure were assessed by obesity status using paired t-tests and the Wilcoxon matched-pairs signed-ranks test. To address reliability using the Phase II survey data, a subsample (n=31) was given the Children's Eating Attitudes Test, Child Health Behavior Knowledge Scale, Body Image Assessment, Piers-Harris Self-Concept Scale and

Menarcheal Age Recall a second time and differences between the two samples were assessed using paired t-tests.

Sample

The Phase II sample was comprised of 32 obese and non-obese matched-pairs, or a total of 64 females drawn from Phase I of the study. Obesity status was determined using body mass index and triceps skinfold values relative to national reference values. Obese females were characterized as having BMI and triceps skinfold values at or greater than the age- and sex-appropriate 95th percentile, and non-obese females between the 15th and 85th percentiles, of National Health and Nutrition Examination Survey I reference values (NHANES I; Must et al., 1991). These adolescents were measured between April 1995 and October 1995.

Prior to selection of adolescents for Phase II of the study, a sample size calculation (Kraemer and Thieman, 1987; Rosner, 1990) was performed using the Phase I sample size of approximately 400 students. The sample size calculation was used to determine how many subjects were needed to test the central hypothesis that obese adolescents consume five percentage more of their overall energy intake from total dietary fat per day than non-obese adolescents. These figures were based on figures derived from 24-hour recall data from Gazzaniga and Burns (1993) on diet composition of obese and non-obese children and data from NHANES III (McDowell et al., 1994) on percentage of energy intake from total dietary fat for African-American females aged six to 15 years. Using the most liberal estimate [SD=6] (Gazzaniga and Burns, 1993), a sample size of 24 obese and 24 control

subjects was estimated as necessary to find a detectable difference in percentage of energy from total dietary fat between obese and non-obese adolescent females. However, using a more conservative estimate [$SD=9$] (McDowell et al., 1994), a sample size of 52 obese and 52 control subjects was estimated as necessary to find a detectable difference in percentage fat intake between groups. For this project the target study population fell between these two estimates and included a standard deviation of eight and, therefore, 32 obese and 32 non-obese adolescents. Within this range of sample sizes, the secondary hypothesis that obese adolescents watch nine or more hours of television per week than non-obese adolescents was estimated to be detectable.

Using the rate of obesity in this population, 23.5% (Johnston and Hallock, 1994), and the sample size of approximately 400 students, the potential obese subjects numbered 94. From this, approximately 2/3 of those obese students would be female and the potential obese subjects would number 63. Estimating a consent rate of 80%, the potential number of obese subjects would equal 50. A control group, matched for chronological age and stature, was selected using females whose measures fell between the 25th and 75th percentiles for BMI, weight-for-age, and triceps skinfold. In both the obese and the non-obese sample, all pregnant females were excluded.

Data collection permitted selection of 32 obese and non-obese matched-pairs, or a total of 64 females. The larger estimate of 50 adolescents was not achieved due to lack of parental consent, smaller than expected number of females between the 15th and 85th percentiles of NHANES I (Must et al., 1991), and difficulties in matching the obese females with non-obese females of similar chronological age and stature. However, the

final sample size of 32 pairs exceeded the smallest estimate acceptable for the present study, which was 24 pairs. Thus, with the Phase II sample size of this study, it was theoretically possible to find a detectable difference in intake of percentage fat (five percent) and television viewing (between six and nine hours) in obese relative to non-obese adolescent females if such a difference existed.

Data Collection

The adolescents in Phase II of the study were examined at least three times to complete all of the measures. The consent process for this phase of the project included signed consent forms sent to parents or guardians prior to the measurement period allowing parents or guardians to prevent their child from participating in the study. In addition, another child consent form was given to each student prior to her enrollment in Phase II of the study. Again, students were assigned an identification number to promote confidentiality of answers and data were computerized and analyzed by identification number. All students included in Phase II of the study completed the entire schedule of measures.

Three Day Repeated 24-Hour Dietary Recall

Methodology for the three-day repeated 24-hr-hour dietary recall was exactly the same as described above for a single dietary recall. However, the recall was repeated over three days to estimate average food intake of an individual over a longer time period (Gibson, 1990). Again, dietary recalls were spread across the school week to reduce the

possibility of a systematic day of the week effect. All dietary recalls were collected in a personal interview format (described above) by the author using the Food Portion Visual (Posner and Morgan, 1981) and snack food and juice models for each individual. Dietary recall interviews were randomly completed over a two-week period.

The repeated 24-hour recall is a recommended methodology for measuring food consumption patterns in the U.S. (National Research Council, 1989b). This method also assists in estimating the distribution of usual nutrient intakes among individuals (Gibson, 1990). Relative to single 24-hour dietary recalls, this method improves the precision of estimating dietary intake.

Data were assessed for reliability, or variability, using the coefficient of variation (1 standard deviation/sample mean) multiplied by 100 as suggested by Quant (1986). Data were examined in terms of total coefficients of variation, inter-individual and intra-individual variation, and the ratio between intra- and inter-individual variation. These data were compared to published coefficients of variation (Beaton et al., 1979).

Data were analyzed as average values from the three dietary recall assessments for the total sample (N=64), obese subsample (N=32) and non-obese subsample (N=32). In addition, energy requirements were estimated using equations for predicting resting energy expenditure from body weight as previously described. Estimated energy requirements for the West Philadelphia adolescents were compared to reference adolescents (National Research Council, 1989b). Estimated energy requirements for these adolescents were also compared to reported energy intake. Under reporting of energy intake was calculated by subtracting reported energy intake from estimated energy expenditure.

Student's t-tests and the Mann-Whitney Two-Sample Statistic were used to test differences in nutrient intake by obesity status. Data were tested for skewness and then transformed using the Box-Cox transformation to correct for skewing characteristic of dietary intake data. Student's t-tests were used on the transformed data to test for differences in nutrient intake by obesity status. The Bonferroni correction was used to correct for repeated tests.

Physical Activity

Students in Phase II of the study were given an interview-administered, seven-day Physical Activity Recall (PAR) originally developed by Blair et al. (1985) and modified by Sallis et al. (1985) for Anglo- and Mexican-American children and adolescents from the Five-City Project. The seven-day PAR is a questionnaire which elicits the recall of both leisure- and work-related activities over a seven day period. The seven-day PAR has demonstrated adequate test-retest reliability in adults (Sallis et al., 1985). The PAR has also demonstrated adequate validity in comparison to electronic monitoring (Sallis et al., 1993; Taylor et al., 1984). Durkin (1989:46) states that "moderately precise data" based on semi-objective measures may be used to place children in some sort of rank (very active versus very inactive), which is adequate for the comparison of individuals characterized as obese and non-obese.

The seven-day PAR includes questions regarding physical activity over the past seven days prior to the interview. Students were given cards listing examples of light, moderate, and hard activities and were asked to recall the number of half-hours spent

involved in each activity. The author led the students through their activities during the morning, afternoon, and evening to aid in recall of physical activity sessions lasting over 15 minutes.

The seven-day physical activity recall has been widely used in several populations; however, there are no published data for urban, African-American children or adolescents using this physical activity recall (Sallis, personal communication). Given that the physical activity recall has been widely used, results from this study may be generalized to previous findings. As in other methodologies using individual recall, the physical activity recall is respondent-driven. The examples of light, moderate, and hard activities were based on information gathered from focus group interviews with Turner Middle School students, and were thus tailored to the urban adolescent context.

Television Viewing

Using the television viewing recall survey, students were asked to complete a recall of the shows and hours of television and videos watched per day to estimate the total number of hours of television watched per week as an indicator of sedentary behavior. Obarzanek et al. (1994) developed a methodology for the recall of television viewing behavior which uses a list of all television shows on television during a specific period, generally a week. It is suggested that this methodology is superior to simply asking children to provide a list of television shows watched over the past week (Obarzanek et al., 1994). Thus, this dissertation research used a list of television shows on all Philadelphia television stations for each half-hour period for each day of the week

from 3:00 p.m. to 12:00 a.m. on weekdays and from 6:00 a.m. to 1:00 a.m. on weekends. The survey was interview-administered in such a way that enabled the author to check off each television show watched by an adolescent on each day. In addition, students were asked to list the total number of videos and cable television shows watched on each day as well as the total number of hours engaged in playing video games.

Maturation Status

The assessment of maturation was used to provide an index of status within the pubertal process to place biocultural characteristics of these adolescents within the context of maturation. The incidence of obesity has been shown to increase during adolescence (Morrison et al., 1994; Lawrence et al., 1991), particularly in African-American females (Kumanyika, 1987; Shear et al., 1988; Wadden et al., 1990). In addition, pubertal stage has been associated with hormonal and physical changes which, in turn, exert an influence on fat patterning (Kozinetz, 1988). Maturation age is a more precise term than chronological age, as maturational age accounts for the large variation in individual "tempo of growth" (Boas, 1892). Without a maturational assessment of these adolescents, it would have been impossible to determine whether or not there was an association between the development of obesity and adolescent maturation in this population.

The standard approach for the assessment of physical maturation is the Tanner puberty staging method. Using this method, children are examined by a trained medical examiner and rated according to stage of pubertal development: pubic hair development

(males and females), breast development (females) and genital development (males) (Tanner, 1962). However, this method of assessing pubertal development was considered too invasive by the school administration. Instead, a self-administered rating scale for pubertal development, developed by Carskadon and Acebo (1993), called Physical Development Items, was used to determine menarcheal age recall. The rating scale was used to assess pubertal status without pictorial representations or interviews. The rating scale included questions about growth in stature, body hair, and breasts, as well as skin changes and menarche. The Physical Development Items have been shown to be internally consistent and reliable (Carskadon and Acebo, 1993). In the present study, analyses used age at menarche which was recalled and recorded by month, day, and year.

Self-esteem

The Piers-Harris Children's Self-Concept Scale (Piers and Harris, 1969; Piers, 1984) is an 80-item self-report instrument. The self-concept scale elicits information on the following six factors: behavior, intellectual and school status, physical appearance and attributes, anxiety, popularity, and happiness and satisfaction. A high score reflects high self-esteem. The Piers-Harris Self-Concept scale has demonstrated adequate convergent and discriminant validity (Franklin et al., 1981). The Piers-Harris scale has been used with children and adolescents (Webster et al., 1994; Austin and Huberty, 1993; Folk et al. 1993) and with African-American children and adolescents (Kaplan and Wadden, 1986; Benson and Rentsch, 1988; Williams et al., 1987; Wolf, 1982; Harris and Braun, 1971). In addition, the Piers-Harris has been used as the standard in studies of construct validity in

the development of new scales (Austin and Huberty, 1993; Karnes and Wherry, 1982).

The Piers-Harris Children's Self-Concept Scale was administered to all of the females in Phase II of the study.

Eating Attitudes

The Children's Eating Attitudes Test (ChEAT; Maloney et al., 1989) is a 26 item, six point, self-report measure that assesses eating attitudes, dieting behaviors, and food preoccupation in children. The ChEAT is a modified version of the Eating Attitudes Test (EAT; Garner et al., 1983a) that is designed to discriminate between normal dieters and individuals with obesity, anorexia and bulimia (Garner et al., 1985). The EAT is a 40-item scale that has demonstrated concurrent and predictive validity, reliability, and high sensitivity and specificity (Garner et al., 1983b; Mann et al., 1983). The Children's Eating Attitudes Test is an adaptation of the EAT that uses simpler, age-appropriate synonyms to replace specific words on the EAT (Maloney et al., 1989). A score of 20 or above is generally considered to be consistent with the diagnosis of an eating disorder. The ChEAT has 25 items which have been determined to be both reliable and valid in children between 8 and 13 years-of-age (Maloney et al., 1988; 1989). The ChEAT was administered to all of the females in Phase II of the study.

Body Image

The most common methodology for assessing preference for body shape was developed by Massara and Stunkard (1979) and uses a series of photographs that are

systematically altered to show a female ranging in fatness level from thin to heavy. These photographs are shown and respondents asked which photograph they would most like to look like and which they look like at present. Later, line-drawn silhouettes were developed which have been widely used (Stunkard et al., 1983). However, the silhouettes developed by Stunkard et al.(1983) are white, drawn in black, and have been said to resemble Caucasian figures (Williamson, 1990). In order to make the silhouettes more culturally relevant for use with all ethnic groups, Williamson et al.(1985) created a the Body Image Assessment procedure using a series of similar silhouettes drawn completely in black. The Body Image Assessment has been adapted for use with adolescents (Veron-Guidry and Williamson, 1994).

The Phase II adolescents completed the Body Image Assessment according to procedures described by Williamson (1990) using the Body Image Assessment for adolescents (Veron-Guidry and Williamson, 1994). Students were given a series of nine body image cards that corresponded to female preadolescents and adolescents. Each body image card had a black and white line-drawn silhouette of a female in various stages from very thin to obese (the cards were randomized). Students were asked to indicate which drawing most resembled their current figure (Current Body Size) and the figure they wished most to resemble (Ideal Body Size). Each response was scored on a nine-point scale, ranging from one for the thinnest figure to nine for the largest figure. A body dysphoria score was derived from the discrepancy between current and ideal figures.

A sample of 106 males was asked to complete the Body Image Assessment using the previously described figures for females. The procedure was the same as described

above except these males were asked to indicate which drawing most resembled what they conceived to be the ideal body size for a female of their same age. Each response was again scored on a nine-point scale, ranging from one for thinnest figure to nine for the largest figure. Results from the male sample were compared to the results from the Phase II females.

Health Behavior Knowledge

The Child Health Behavior Knowledge Scale is a 9-item instrument that assesses "behavioral capability" related to cardiovascular health-related diet and exercise behaviors (Vega et al., 1987: 696). The Child Health Behavior Knowledge Scale has demonstrated acceptable reliability in assessing of knowledge related to dietary sodium, fat, and exercise among children (Vega et al., 1987). The Child Health Behavior Knowledge Scale has been used in Anglo- and Mexican-American fifth and sixth graders. The Health Behavior Knowledge Scale was administered to all of the females in Phase II of the study.

Data Analysis

Statistical analyses were carried out using the STATA statistical package (StataCorp, 1997). Data from Phase I of the study were used to generate descriptive statistics that were used to document the prevalence of obesity and to characterize dietary intake in urban, African-American West Philadelphia adolescents in comparison to national reference norms (NCHS and NHANES I, II, and III).

Data from Phase II of the study were analyzed using multiple regression analysis,

logistic regression analysis, analysis of variance, and multivariate analysis of variance.

These analyses were used to help elucidate the factors that interacted to influence diet and physical activity and which may have influenced the development of obesity in these urban African-American adolescents. For example, using the two central hypotheses of the study, 1) obese adolescents eat five percentage total fat per day more than non-obese adolescents; and 2) obese adolescents watch nine or more hours of television per week than non-obese adolescents, paired t-tests and Wilcoxon matched-pairs signed-ranks tests were used to determine the difference between the obese and non-obese females in total dietary fat consumption and hours of television viewing. Multiple regression models were used to investigate variation in adiposity within the obese and non-obese groups (using adiposity as the dependent variable and group membership as an independent variable). Logistic regression analyses were used to determine which factors predict adiposity. Analyses of variance and multivariate analyses of variance were used to investigate the relationships between variables, such as age, socioeconomic status, and BMI.

Table 1

Composition of Phase I Sample, by Age and Sex

MEAN AGE*	MALE	FEMALE
11	21	29
12	52	49
13	66	49
14	43	50
15	21	12
TOTAL = 392	203	189

*Chronological Age groups represent ± 0.5 of the mean age, i.e., 12 years-of-age = 11.50-12.49

Table 2

Intra-Observer Technical Error of Measurement and Reliability Coefficients for West Philadelphia Adolescents (males and females) Relative to Published Data, by Age

Age (years)	Technical Error of Measurement	Reliability	Reference
<i>Stature</i>			
11-15	0.4	0.99	West Philadelphia
9-14	0.5	0.99	Zavaleta and Malina, 1982
12-17	0.3		Brown, 1984
<i>Arm Circumference</i>			
11-15	0.2	0.99	West Philadelphia
9-14	0.4	0.98	Zavaleta and Malina, 1982
12-17	0.4		Brown, 1984
<i>Triceps Skinfold</i>			
11-15	0.6	0.99	West Philadelphia
9-14	0.5	0.97	Zavaleta and Malina, 1982
12-17	1.6		Brown, 1984
12-17	0.8		Johnston et al., 1974
<i>Subscapular Skinfold</i>			
11-15	0.7	0.99	West Philadelphia
9-14	0.6	0.96	Zavaleta and Malina, 1982
12-17	3.4		Brown, 1984
12-17	1.8		Johnston et al., 1974

Table 3

**Inter-Observer Technical Error of Measurement and Reliability for West Philadelphia
Adolescents (males and females) Relative to Published Data, by Age**

Age (years)	Technical Error of Measurement	Reliability	Reference
<i>Stature</i>			
11-15	0.5	0.99	West Philadelphia
6-13	0.7	0.99	Lohman et al., 1975
6-14	0.2		Buschang, 1980
<i>Arm Circumference</i>			
11-15	0.3	0.99	West Philadelphia
6-14	0.3		Buschang, 1980

Table 4

Intra-Observer, Inter-Observer, and Total Technical Error of Measurement and Reliability Coefficients for Anthropometric Measures for West Philadelphia Adolescents, by Sex

Measure	Intra-observer TEM	Reliability	Inter-observer TEM	Reliability	Total TEM
<i>Females</i>					
Stature	0.36	0.994	0.46	0.994	0.59
Arm Circumference	0.21	0.999	0.26	0.994	0.33
Triceps Skinfold	0.64	0.995			
Subscapular Skinfold	0.77	0.997			
<i>Males</i>					
Stature	0.46	0.998	0.51	0.998	0.68
Arm Circumference	0.21	0.998	0.26	0.996	0.33
Triceps Skinfold	0.60	0.998			
Subscapular Skinfold	0.63	0.998			

PHASE I

CHAPTER 4
RESULTS: ANTHROPOMETRY, OBESITY PREVALENCE,
AND SECULAR CHANGE

Anthropometry

Means and standard deviations for stature, body weight, BMI, triceps and subscapular skinfold, and centripetal fat ratio by age and sex are presented in Tables 5 through 10. In general, these measures increased over the ages shown, indicating increasing size with advancing age in these growing children. Whereas males were taller than females (Table 5) throughout the ages shown, females were heavier (Table 6) and had higher BMI values (Table 7) than males. Similarly, females had higher skinfold values (Tables 8 and 9) than males throughout all ages. Males had higher centripetal fat ratios than females at 13, 14, and 15 years-of-age (Table 10).

Means and standard deviations of Z-scores for stature, weight (Centers for Disease Control, 1990a), and stature-for-weight (Cole, 1993) are presented by sex and age in Table 11. Stature Z-scores for the West Philadelphia adolescents remained close to zero over all ages. However, 12 year-old females and 11 year-old males had mean Z-scores between 0.6 and 0.7 standard deviations above the mean, perhaps due to an earlier onset of puberty. The average stature Z-score of the total sample was 0.28. However, mean weight and weight-for-stature Z-scores were between 0.5 and 1.19 over the ages shown,

with a mean total Z-score of 0.64 for both weight and weight-for stature. Mean Z-scores are also presented for stature (Figure 2), weight (Figure 3), and weight-for-stature (Figure 4).

Stature and weight of West Philadelphia adolescents were compared to National Center for Health Statistics reference data (NCHS; Hamill et al., 1977). Although the substantive results were similar to the Z-scores for stature and weight, the raw values were presented to provide additional information. Median values were used to correct for the skewed distribution characteristic of weight measurements. Females (Figure 5) had median stature values that fell between the NCHS 50th and 95th percentiles at 11 and 12 years, closer to the NCHS 50th percentile at 13 and 14 years, and below the NCHS 50th percentile at 15 years. Males (Figure 6) had median stature values that were greater than the NCHS 50th percentile at 11 and 12 years, closer to the NCHS 50th percentile at 13 and 14 years, and just below the NCHS 50th percentile at 15 years-of-age. A different pattern emerged for body weight. Females (Figure 7) had median weights that were consistently between the 50th and the 95th percentiles over all ages. Males (Figure 8) had a similar pattern for weight, although these values were not as large as those for females.

The body mass index values of these West Philadelphia adolescents were compared to age- and sex-specific NHANES I reference data for African Americans due to ethnic differences in body mass (Must et al., 1991). Females had similar median BMI values to those for weight. Median BMI values were again between the NHANES I African-American 50th and 95th percentiles (Must et al., 1991) and values increased with age (Figure 9). Males had median BMI values that were closer to the NHANES I

African-American 50th percentile over all ages (Figure 10).

Median triceps skinfold thickness was compared to the NHANES I African-American reference data due to ethnic differences in body composition (Must et al., 1991). Median triceps skinfold values for females were between the NHANES I African-American 50th and 95th percentiles (Figure 11). Values increased with age, with median skinfolds approaching the 95th percentile by 15 years-of-age. Median triceps skinfold values for males were near the NHANES I African-American 50th percentile over all ages (Figure 12).

Mean Centripetal Fat Ratio [CFR; $\text{subscapular skinfold}/(\text{subscapular} + \text{triceps skinfold})$] for both sexes are shown in Figure 13. Males and females had similar CFR values at 11 and 12 years-of-age. However, after 12 years-of-age, male CFR values continued to increase. Females had CFR values that increased at 13 and 14 years-of-age, but decreased slightly at 15 years. These cross-sectional data suggest that subcutaneous fat may redistribute toward the trunk with age in both sexes, although this effect was greater in males than in females.

According to a recent expert panel, BMI is the most appropriate index for assessing overweight during adolescence (Himes and Dietz, 1994). In this study, obesity status was conservatively defined as both a BMI and triceps skinfold greater than, or equal to, the 95th percentile of NHANES I (Must et al., 1991). Using this definition of obesity, 16% of females and 15% of males were characterized as obese. Overweight and obesity were also calculated as follows: using BMI and triceps skinfold separately, using different sets of total sample (all ethnic groups combined) and African-American reference norms,

and using both the 95th and 85th percentiles for females (Table 12) and males (Table 13). Although the NHANES I 95th percentile represents the most appropriate set of reference data given published recommendations, other reference data (including total sample reference norms) were used to facilitate comparisons with published data for obesity prevalence.

Using these different sets of reference norms, there were differences in the percentages of adolescents characterized as overweight and obese. In general, more adolescents were characterized as obese using triceps skinfold as compared to figures using the BMI. Using both BMI and triceps skinfold gave a more conservative estimate of overweight and obesity than using either measure alone. Males had higher obesity prevalence estimates using the African-American reference norms relative to total sample reference norms (except the 95th percentile of Cronk and Roche, 1982). Female obesity prevalence varied with each different set of reference data. The range in obesity prevalence shown here for the West Philadelphia adolescents illustrates the difficulty in characterizing obesity. However, examining the full range of obesity prevalence estimates using these different reference data allows comparison of obesity prevalence in this sample to published data using different definitions of obesity.

Secular Changes in Anthropometric Measures

Although the secular increase in stature has slowed, or stopped, in the U.S. (Eveleth and Tanner, 1990), secular increases in weight have persisted resulting in the increasing prevalence of overweight and obesity in virtually all U.S. age groups

(Gortmaker et al., 1987; Harlan et al., 1988; Shear et al., 1988; Shah et al., 1991; Kuczmarski et al., 1994; Troiano et al., 1995). Secular trends in anthropometric measures were investigated to determine if there has been an increase in obesity prevalence in Philadelphia adolescents over the past several decades.

The Ecology of Obesity Project sample (EOP90s) was compared to two other groups of Philadelphia adolescents measured in the 1960s (PCRCG60s; Krogman, 1970) and 1970s (PBPP70s; U.S. Department of Health, Education, and Welfare, 1972). The sample sizes for each age-sex grouping for the PCRCG60s, PBPP70s, and the EOP90s studies are shown in Table 14. Sample sizes varied depending on age and study; however, the sample sizes for each age-sex grouping were comparable for each of the three samples with an average of 50 adolescents in almost all age groups. There were relatively smaller sample sizes for the EOP90s sample for the age-sex groups of 11 and 15 year-olds and the PBPP70s sample for 11 year-old females. Chronological age groupings represented age intervals of ± 0.5 of that year. In other words, the group of 12 year-olds included adolescents aged 11.50 to 12.49 years, with a 12.0 mean age for the group.

The EOP90s and PBPP70s samples were compared using Student's t-tests by age and sex for stature and logarithmically transformed weight, triceps, and subscapular skinfold measures to assess sample differences in these measures. Results of these t-tests are shown in Table 15. After the Bonferroni correction, significant differences between the two samples were found for log of the triceps skinfold for females at 13, 14, and 15 years-of-age ($p \leq 0.0001$) and for males at 13 years ($p \leq 0.0001$). There were no significant differences found for stature for males and females between the ages of 13 and

15 years, weight at 11, 13, and 14 years (females) and 15 years (males), BMI at 12, 14, and 15 years (females) and 11 and 15 years (males), and log of subscapular skinfold at 11 and 12 years (males and females).

The EOP90s and the PCRCG60s samples were also compared using Student's t-tests by age and sex for stature and weight. These t-tests were computed using summary statistics from the PCRCG60s sample (Malina, 1968); results are shown in Table 16.

After the Bonferroni correction for repeated t-tests, significant differences between the EOP90s and the PCRCG60s samples were found for stature for females at 12 ($p \leq 0.0001$) and 13 years ($p \leq 0.0006$) and for males at 11 and 12 years-of-age ($p \leq 0.0001$).

Although these were the only statistically significant differences in stature, there were biologically substantial differences in stature (1.8 - 4.3 cm) between the two samples at other ages. Significant differences between the EOP90s and PCRCG60s samples were found for weight for females at 11, 12, 13 ($p \leq 0.0001$), and 14 years-of-age ($p \leq 0.0003$) and for males at 11 and 12 years ($p \leq 0.0001$).

In addition, the EOP90s and PBPP70s samples were compared using two-way ANOVAs to determine whether the two samples differed by age and group. Age was significant ($p \leq 0.007$) in all models, except for the skinfold measures for males, which indicated increasing size with advancing age in these growing children. There were no significant age-group interaction effects in any of the measures; thus the magnitude of the differences in anthropometric measures between the two groups were consistent across all ages.

Mean stature values for the EOP90s, PBPP70s, and PCRCG60s samples are

shown in Figures 14 (females) and 15 (males) and in Table 17. Females from all three samples had relatively similar mean stature values. Differences ranged from 1.8 cm at 14 years to 6.3 cm at 12 years, with decreased differences between the three samples at 14 and 15 years (Figure 14). EOP90s females had higher mean stature values than the other two samples at all ages, except at 11 years when mean stature of the PBPP70s females exceeded values for the EOP90s females. Males from all three samples had comparable mean stature values, with differences ranging from 1.8 cm at 13 years to 7.3 cm at 11 years (Figure 15). EOP90s males had greater mean stature values than the other two samples, except at 15 years, when PBPP70s males had an average stature value 1.2 cm greater than the EOP90s males.

Two-way ANOVAs were used to examine whether the two samples differed by age and group. There were no significant group effects using stature data for females from the PBPP70s and the EOP90s. Post-hoc tests for specific within-age comparisons showed a significant difference between the two samples for stature only at 12 years-of-age ($p \leq 0.009$). Males had a similar pattern for stature. The two-way ANOVA and post-hoc test results for stature of males from the PBPP70s and the EOP90s studies were identical to those for females, with no significant group effect and no significant within-age differences between the two samples (using post-hoc tests) except at 12 years ($p \leq 0.006$). There were numerical differences in stature between the two samples (0.5-5.4 cm); however, these differences were only statistically significant at 12 years-of-age.

Mean body weights of the EOP90s, PBPP70s, and PCRCG60s samples are shown in Figures 16 (females) and 17 (males) and in Table 18. Differences between the three

samples for weight were more marked than those for stature, with highest mean weight values for the EOP90s sample. Females from all three samples (Figure 16) differed most at 11 (8.2 kg) and 15 years (12.3 kg). Males from the EOP90s sample had markedly greater body weight than the other two samples at all ages (Figure 17). Differences between the three samples were greatest at 12 years (8.1 kg) and smallest at 15 years (7 kg).

Females showed a highly significant group effect using the two-way ANOVA (PBPP70s and EOP90s); log weights of the adolescents from the EOP90s sample were significantly greater than those from the PBPP70s sample ($p \leq 0.001$). Post-hoc tests for specific within-age comparisons showed significant within-age differences between the EOP90s and the PBPP70s samples at 12 and 13 years ($p \leq 0.02$). Males from the EOP90s sample had much greater log weights than those from the PBPP70s sample ($p \leq 0.001$). Post-hoc tests showed significant within-age differences between the EOP90s and PBPP70s samples between 11 and 14 years-of-age ($p \leq 0.03$).

Differences in BMI between the EOP90s and PBPP70s are shown in Figures 18 (females) and 19 (males). Differences between the two samples were similar to those seen for weight. The females from the EOP90s had consistently greater mean BMI values than those from the PBPP70s ($p \leq 0.001$), with no overlap in standard errors of the mean (Figure 18). These differences increased with age ($p \leq 0.001$). The post-hoc tests for specific within-age comparisons showed significant within-age differences between the EOP90s and the PBPP70s samples at 13 and 15 years ($p \leq 0.02$). Similarly, males (Figure 19) from the EOP90s sample had greater BMI values than those from the PBPP70s

sample ($p \leq 0.001$). These differences increased with age ($p \leq 0.005$). The post-hoc tests for specific within-age comparisons showed significant differences between the EOP90s and PBPP70s samples from 12 through 15 years ($p \leq 0.02$).

There was a dramatic difference in mean triceps skinfold thickness for females (Figure 20) and males (Figure 21) in the EOP90s and the PBPP70s samples. Females (Figure 20) from the EOP90s sample had significantly greater log triceps skinfold values than females from the PBPP70s sample ($p \leq 0.001$). These differences increased with age ($p \leq 0.007$). The post-hoc tests for specific within-age comparisons showed significant differences between the EOP90s and the PBPP70s samples at all ages with highly significant differences at 13, 14, and 15 years ($p \leq 0.0001$). Males (Figure 21) from the EOP90s sample had significantly greater log triceps skinfold values than males from the PBPP70s sample ($p \leq 0.001$). However, mean triceps values for males did not increase significantly with age. The post-hoc tests for specific within-age comparisons showed significant differences between the EOP90s and the PBPP70s samples at all ages, with a highly significant difference between the two samples at 13 years ($p \leq 0.0001$).

There was a significant difference in mean subscapular skinfold thickness between the EOP90s and the PBPP70s samples for females (Figure 22) and males (Figure 23). Females (Figure 22) from the EOP90s had markedly greater log subscapular skinfold values than those from the PBPP70s sample ($p \leq 0.001$). There was a significant age effect ($p \leq 0.002$). The post-hoc tests for specific within-age comparisons showed significant differences between the EOP90s and the PBPP70s samples at 13 ($p \leq 0.003$), 14, and 15 years ($p \leq 0.04$). Males (Figure 23) from the EOP90s sample had significantly

greater mean subscapular skinfold values than those from the PBPP70s sample ($p \leq 0.0001$), although values for males did not increase significantly with age. The post-hoc tests for specific within-age comparisons showed significant differences between the EOP90s and the PBPP70s samples at 13 ($p \leq 0.02$), 14 ($p \leq 0.002$), and 15 ($p \leq 0.02$) years.

Mean stature Z-scores for females and males from the PBPP70s study are shown in Figure 24. Mean stature Z-scores for males were close to or just below zero across all ages, whereas Z-scores for females were between 0.2 and 0.6 standard deviations above the mean at 11 through 13 years, but closer to zero at 14 and 15 years. Mean weight Z-scores for PBPP70s females and males (Figure 25) were also close to zero across all ages; however, males were just under zero and females were between 0.1 and 0.4 standard deviations above the mean for most of the ages shown. Thus, the Philadelphia adolescents measured in the 1970s were of comparable stature and weight relative to the national reference standards. Z-score values for adolescents from the EOP90s study are shown in Figures 2 and 3.

The percentage of the EOP90s and PBPP70s samples to fall above sex- and age-specific 85th and 95th percentiles of NHANES I are presented in Table 19. Over the past two decades there has been an increase in the percentage of adolescents characterized as overweight and obese as measured by BMI alone and by both BMI and triceps skinfold measures. The percentage of males characterized as overweight (BMI > 95th percentile) from the EOP90s study (17.0%) was significantly greater ($\chi^2 = 15.5$; $P = 0.0001$) than for the PBPP70s study (6.0%). Similarly, the percentage of females characterized as

overweight from the EOP90s study (18.0%) was significantly greater ($\chi^2=7.6$; $P = 0.006$) than from the PBPP70s study (9.0%). The greatest increase in percentage of adolescents characterized as obese from the 1970s and 1990s was seen for males “at risk” for obesity, defined as those having both BMI and triceps skinfold measures above the 85th percentile of NHANES I (Must et al., 1991), which increased from 3.0% in the PBPP70s study to 24.0% in the EOP90s study.

The percentage of adolescents characterized as overweight in the EOP90s study was also compared to data from the first phase of NHANES III, based on the 85th and 95th percentiles for BMI from Cycles II and III of the National Health Examination Survey (Troiano et al., 1995) for males and females, 12 to 17 years-of-age (Table 19). The percentage of males characterized as overweight (BMI > 95th percentile) from the EOP90s study (17.0%) was significantly greater ($\chi^2=16.1$; $P = 0.0001$) than African Americans from NHANES III (9.3%; Troiano et al., 1995). However, the percentage of females characterized as overweight (BMI > 95th percentile) from the EOP90s study (18.0%) was not significantly greater ($\chi^2=1.89$) than found for African Americans from NHANES III (14.4%; Troiano et al., 1995). Whereas Philadelphia females had comparable estimated obesity prevalence relative to NHANES III adolescents, obesity prevalence was higher among Philadelphia males.

Secular Changes in Fat Patterning

Differences in Centripetal Fat Ratio (CFR), subscapular skinfold divided by subscapular plus triceps skinfold values, between the PBPP70s and EOP90s samples are

shown in Figures 26 (females) and 27 (males). Females from both samples (Figure 26) exhibited a slight increase in centralization over the ages shown, although EOP90s females showed a decrease in centralization at 13 years. Females from the PBPP70s sample had higher CFR values than those from the EOP90s sample, although the difference between the two samples diminished at 14 years. The two-way ANOVA showed a significant group ($p \leq 0.0001$) and age ($p \leq 0.03$) effect. The post-hoc tests for specific comparisons showed significant differences at 11 ($p \leq 0.04$), 12, and 13 years ($p \leq 0.002$).

Relative to the females, males from both samples (Figure 27) demonstrated a marked increase in centralization over the ages shown. Males from the PBPP70s sample had higher CFR values than those from the EOP90s sample at earlier ages, although CFR values for the EOP90s sample slightly exceeded those from the PBPP70s sample at 14 and 15 years. The two-way ANOVA showed a significant age ($p \leq 0.024$) and group ($p \leq 0.0001$) effect, with significant age-group differences at 12 and 13 years ($p \leq 0.04$).

Relative Fat Distribution (RFD) was calculated for females (Figure 28) and males (Figure 29) based on the standardized residual scores from the regression analysis within each sex of subscapular skinfold on triceps skinfold measures. Females (Figure 28) from the PBPP70s had greater mean RFD values than the EOP90s females at all ages, with significant differences at 11 ($p \leq 0.02$), 12, and 13 years ($p \leq 0.001$). Again, females exhibited a decrease in centralization at 13 years. Differences between the two samples decreased at 14 and 15 years, although RFD values for females from the PBPP70s study exceeded those from the EOP90s study. There were significant age ($p \leq 0.02$) and group ($p \leq 0.001$) differences between the two samples.

In contrast to the females, males (Figure 29) from both samples had a relatively similar pattern for mean RFD and there were no significant differences between the two samples at any age. Results were similar to those for CFR. Males from the PBPP70s had higher mean RFD values from 11-13 years; however, males from the EOP90s had higher mean RFD values at 14 and 15 years. ANOVA results showed significant age ($p \leq 0.0001$), but not group differences, between males from the PBPP70s and EOP90s.

The contribution of subscapular and triceps skinfold thickness to centralized fat patterning is shown in Figures 30 and 31. Females (Figure 30) from the PBPP70s had considerably lower skinfold values than the EOP90s females. Females from the EOP90s sample had consistently higher triceps relative to subscapular skinfold values. Females from the PBPP70s sample had similar triceps and subscapular skinfold distributions over all ages, with slightly greater subscapular than triceps skinfold measures, except at 11 and 13 years-of-age. As a result, CFR was considerably elevated in the females from the PBPP70s sample compared to females from the EOP90s sample.

Similarly, males (Figure 31) from the EOP90s study had higher skinfold values than those from the PBPP70s study at all ages. However, the magnitude of this difference was not as great as that seen for females. Skinfold distribution for males from the PBPP70s sample was similar over all ages shown. Conversely, males from the EOP90s study had higher triceps relative to subscapular skinfold values between 11 and 14 years-of-age. Again, CFR was considerably elevated in adolescents from the PBPP70s as compared to those from the EOP90s, except at 14 and 15 years when CFR values for the PBPP70s sample slightly exceeded those for the EOP90s sample.

Regression analyses were used to explore the proportion of variance explained in CFR and RFD by selected variables. For the final regression analyses, three models were fit, two for CFR and one for RFD (Table 20 and Figures 32-34). The model for CFR for males as a function of stature, sample assignment, and the interaction between stature and sample assignment accounted for a total R^2 of 0.116. Variability was associated with stature ($p \leq 0.0001$), sample assignment ($p \leq 0.006$), and stature-sample interaction ($p \leq 0.012$), with sample differences most marked among shorter males (Table 20). The regression curves for this model (Figure 32) suggest that the difference between the two groups may represent a maturation effect, because the males from the PBPP70s sample were developmentally “younger” at earlier ages, but they “catch up” to the EOP90s sample at 14 and 15 years-of-age. Exploratory models demonstrated that stature had a greater association with CFR than age, indicating that stature explained the biological variation in CFR better than age.

Using RFD as the outcome variable, the pattern of association was similar to that seen for CFR, although weight was a more important source of variation than stature. In this model, RFD was associated with weight ($p \leq 0.0001$), sample assignment ($p \leq 0.0001$), and weight-sample interaction ($p \leq 0.006$), with a total R^2 of 0.212 (Table 20). The regression curves for this model (Figure 33) showed that at higher body weight, males from the EOP90s sample had greater RFD than those from the PBPP70s sample. Thus, sample differences were most marked among males of lower body weight.

The only model to produce significant results for females used weight and sample assignment to predict CFR. This model (Table 20) accounted for a total R^2 of 0.106, and

variability was associated with weight ($p \leq 0.0001$) and sample assignment ($p \leq 0.000$). Weight was the most important source of variation in CFR for females. The regression curves (Figure 34) showed greater CFR values in females from the PBPP70s sample and those with higher weights. Females from the EOP90s sample had lower CFR values for given weight relative to females from the PBPP70s sample. None of the models for RFD for females were significant.

Summary

There was an increased prevalence of obesity in these West Philadelphia adolescents. Females were heavier, had higher body mass, and greater skinfold thickness than males. There were sex differences in fat patterning, with greater centripetal fat ratio in males. A secular trend analysis of anthropometric measures of these adolescents relative to urban Philadelphia adolescents measured in the 1960s and 1970s indicated that there has been a marked increase in obesity prevalence over the past three decades. Although obesity has increased, adipose tissue centralization has not increased simultaneously due to increased triceps relative to subscapular skinfold thickness, particularly in females. Centralized fat patterning varied with stature, sample assignment and weight, which suggests a possible size/maturation effect.

Table 5

Stature (cm) of Philadelphia Adolescents, by Age and Sex

Age	Sample Size	Mean	Standard Deviation
<i>Females</i>			
11	29	148.88	8.10
12	49	155.87	5.85
13	49	158.34	6.19
14	50	161.63	7.32
15	12	163.28	7.47
<i>Males</i>			
11	21	149.06	6.18
12	52	152.53	8.29
13	65	156.71	9.12
14	43	163.49	9.21
15	20	167.39	8.96

Table 6

Body Weight (kg) of Philadelphia Adolescents, by Age and Sex

Age	Sample Size	Mean	Standard Deviation
<i>Females</i>			
11	29	46.22	11.13
12	49	52.26	14.09
13	49	56.18	13.74
14	50	61.91	17.03
15	12	67.98	23.28
<i>Males</i>			
11	21	44.67	10.82
12	52	47.05	13.39
13	66	52.59	16.70
14	43	58.72	14.49
15	20	63.26	18.68

Table 7

Body Mass Index (wt/ht²) of Philadelphia Adolescents, by Age and Sex

Age	Sample Size	Mean	Standard Deviation
<i>Females</i>			
11	29	20.69	4.00
12	49	21.42	5.60
13	49	22.30	4.82
14	50	23.71	6.28
15	12	25.43	8.06
<i>Males</i>			
11	21	20.02	4.19
12	52	19.92	4.09
13	65	21.24	5.24
14	43	21.81	4.37
15	20	22.42	5.76

Table 8

Triceps Skinfold Thickness (mm) of Philadelphia Adolescents, by Age and Sex

Age	Sample Size	Mean	Standard Deviation
<i>Females</i>			
11	29	18.22	8.76
12	49	19.22	10.76
13	49	22.35	13.48
14	50	25.97	17.19
15	12	31.47	21.52
<i>Males</i>			
11	21	15.14	11.50
12	52	14.54	10.96
13	65	17.10	14.15
14	43	15.27	13.37
15	21	15.57	15.83

Table 9

Subscapular Skinfold Thickness (mm) of Philadelphia Adolescents, by Age and Sex

Age	Sample Size	Mean	Standard Deviation
<i>Females</i>			
11	27	15.10	9.12
12	45	15.57	10.60
13	40	19.40	13.92
14	43	22.60	16.87
15	11	25.42	19.61
<i>Males</i>			
11	21	12.71	11.14
12	52	12.46	12.54
13	63	13.87	13.27
14	43	14.08	11.34
15	20	16.21	16.84

Table 10

**Centripetal Fat Ratio (Subscapular/(Subscapular + Triceps Skinfold Thickness))
of Philadelphia Adolescents, by Age and Sex**

Age	Sample Size	Mean	Standard Deviation
<i>Females</i>			
11	27	0.45	0.06
12	45	0.44	0.06
13	40	0.43	0.06
14	43	0.47	0.06
15	11	0.46	0.05
<i>Males</i>			
11	21	0.45	0.07
12	52	0.44	0.07
13	63	0.45	0.07
14	43	0.49	0.07
15	20	0.50	0.99

Table 11

Mean Z-Score Values, Stature, Weight, and Weight-for-Stature of Philadelphia

Adolescents, by Age and Sex

Age	HtZ*	SD	WtZ*	SD	Ht-Wt-Z**	SD
<i>Females</i>						
11	0.37	1.14	0.77	1.19	0.71	1.29
12	0.71	0.84	0.97	1.48	0.67	1.73
13	0.19	0.92	0.82	1.23	0.90	1.38
14	0.26	0.99	0.99	1.46	1.0	1.71
15	0.22	1.07	1.16	1.94	1.19	2.07
<i>Males</i>						
11	0.65	0.85	0.91	1.22	0.64	1.52
12	0.37	1.15	0.61	1.14	0.51	1.36
13	0.04	1.07	0.59	1.59	0.87	1.88
14	0.03	1.05	0.56	1.28	0.78	1.53
15	-0.18	1.03	0.57	1.62	0.92	1.95
Total Sample	0.28	1.1	0.64	1.3	0.64	1.5

*Stature and weight Z-scores calculated using the Centers for Disease Control Anthropometric Software Program (CASP; Centers for Disease Control 1990a).

**Stature for weight Z-scores calculated using Cole's method (Cole, 1993).

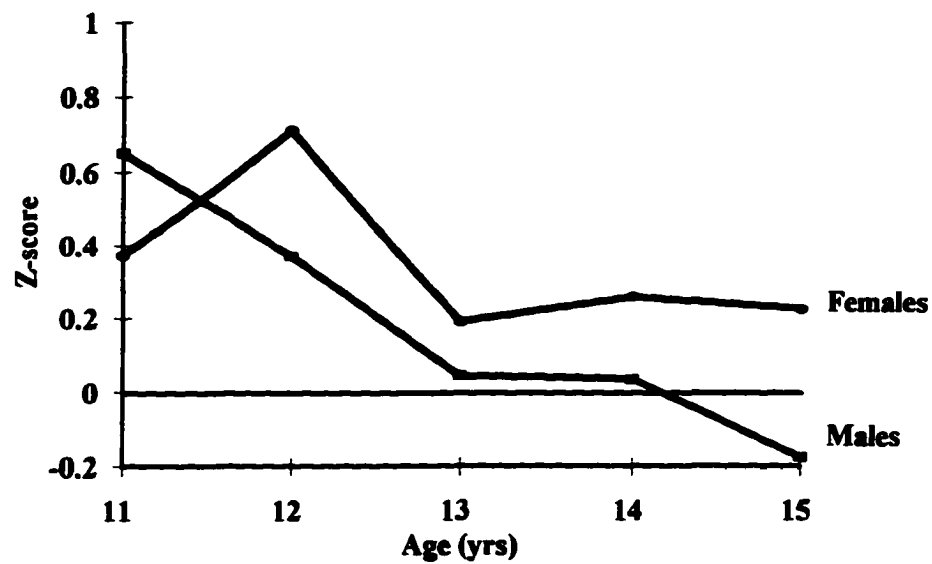


Figure 2. Mean stature Z-scores for West Philadelphia adolescents by age relative to NHANES I reference data (CDC, 1990a). Mean stature Z-scores were between 0.37 and 0.71 standard deviations above the mean at 11 and 12 years, perhaps due to earlier maturation than the reference sample, but remained closer to zero from ages 13-15 years.

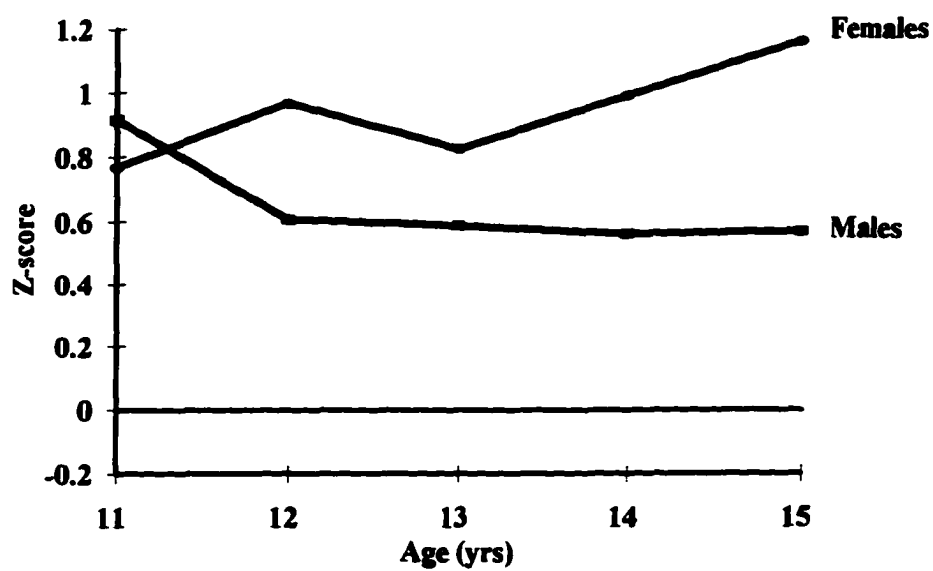


Figure 3. Mean body weight Z-scores for West Philadelphia adolescents by age relative to NHANES I reference data (CDC, 1990a). Mean weight Z-scores were consistently between 0.5-1.19 standard deviations above the mean over all ages.



Figure 4. Mean weight-for-stature Z-scores for West Philadelphia adolescents by age relative to NHANES I reference data (Cole, 1993). Mean weight-for-stature Z-scores increased with age and were consistently between 0.5-1.19 standard deviations above the mean over all ages.

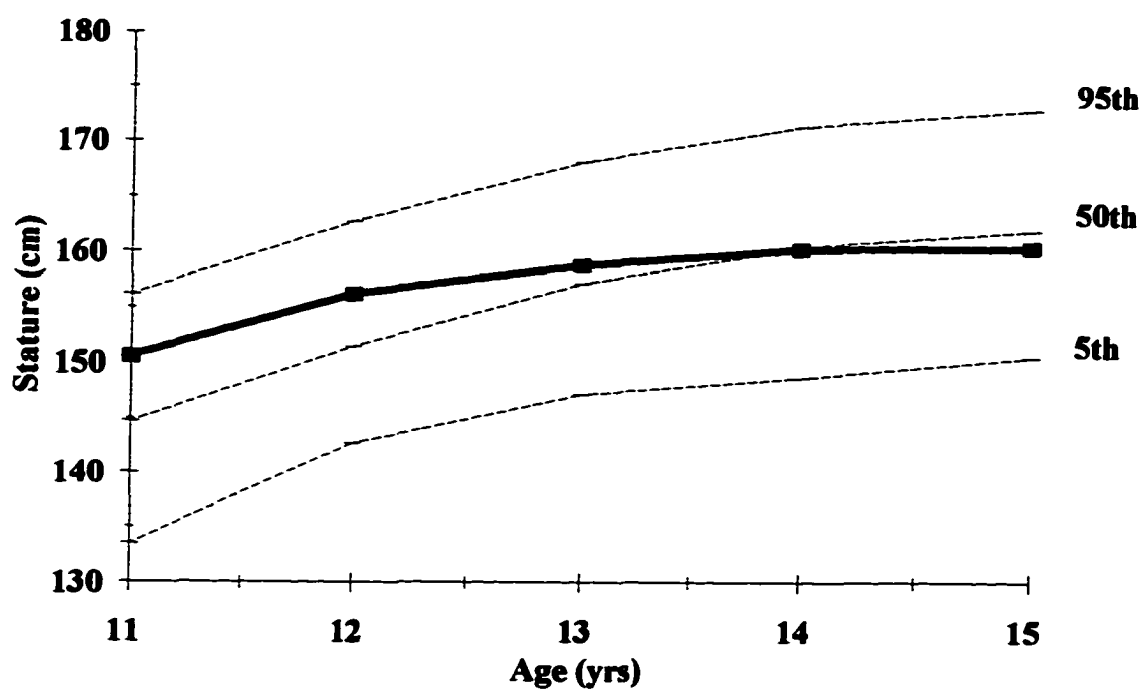


Figure 5. Median stature of West Philadelphia female adolescents by age relative to NCHS reference data. Median stature was between the 50th and 95th NCHS percentiles for stature at ages 11 and 12 years, closer to the 50th percentile at ages 13 and 14, and below the NCHS 50th percentile at 15 years-of-age.

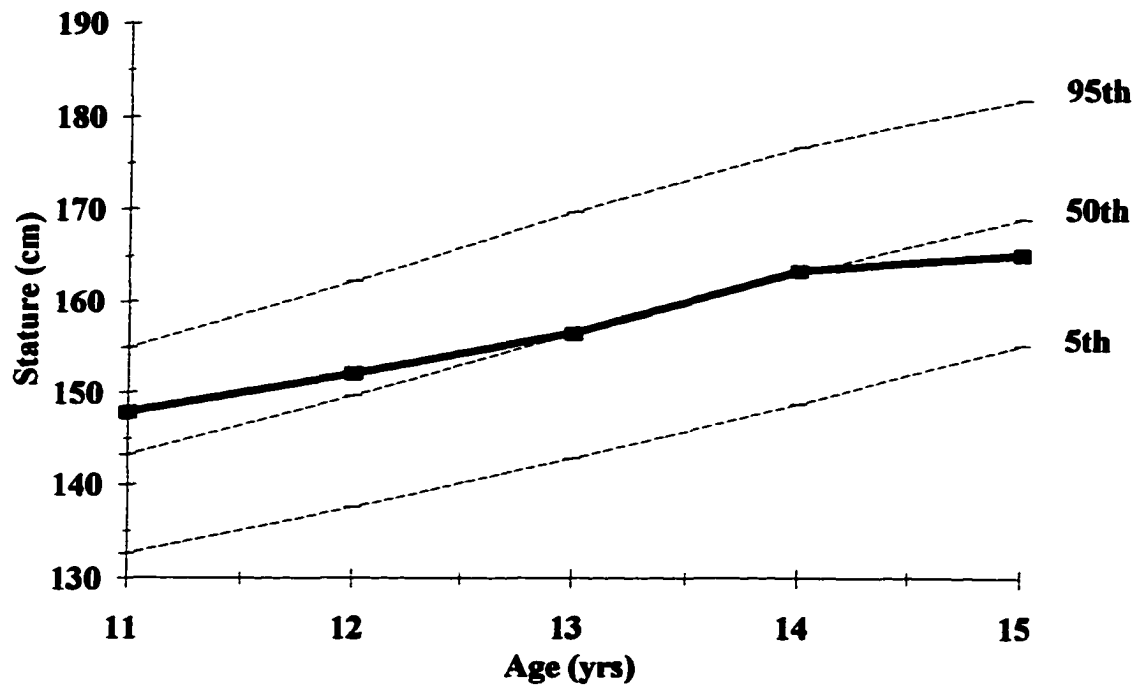


Figure 6. Median stature of West Philadelphia male adolescents by age relative to NCHS reference data. Median stature was between the 50th and 95th NCHS percentiles for stature at ages 11 and 12 years, at the 50th percentile at ages 13 and 14 years, and just under the 50th percentile at 15 years.

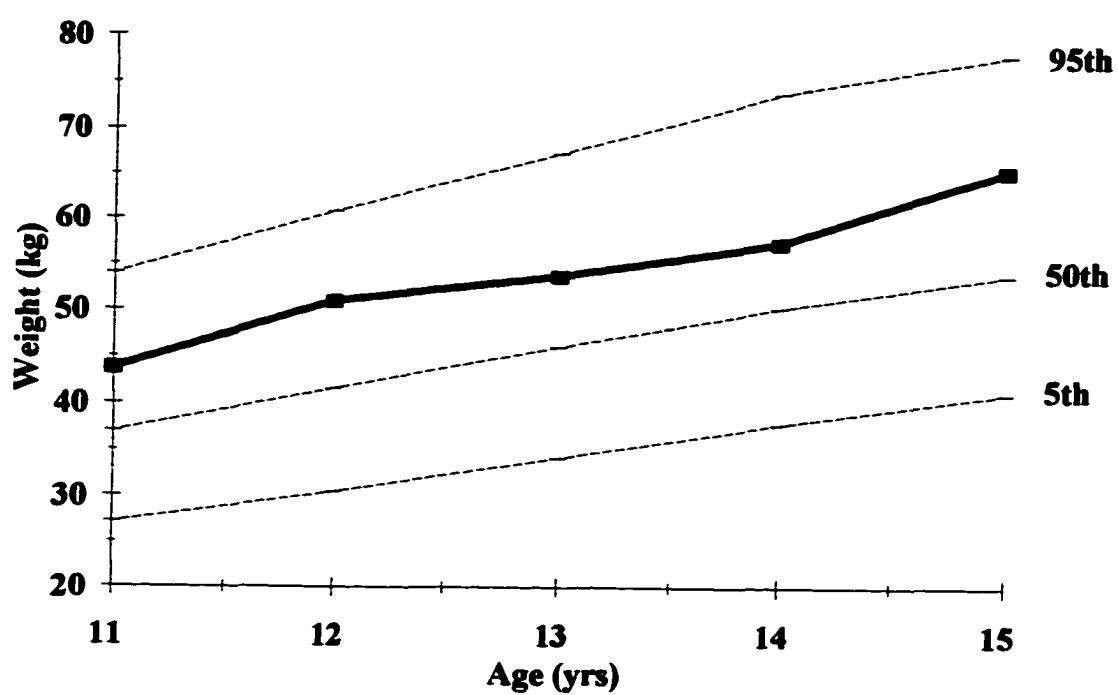


Figure 7. Median body weight of West Philadelphia female adolescents by age relative to NCHS reference data. Median weight was between the 50th and 95th NCHS percentiles for weight at all ages.

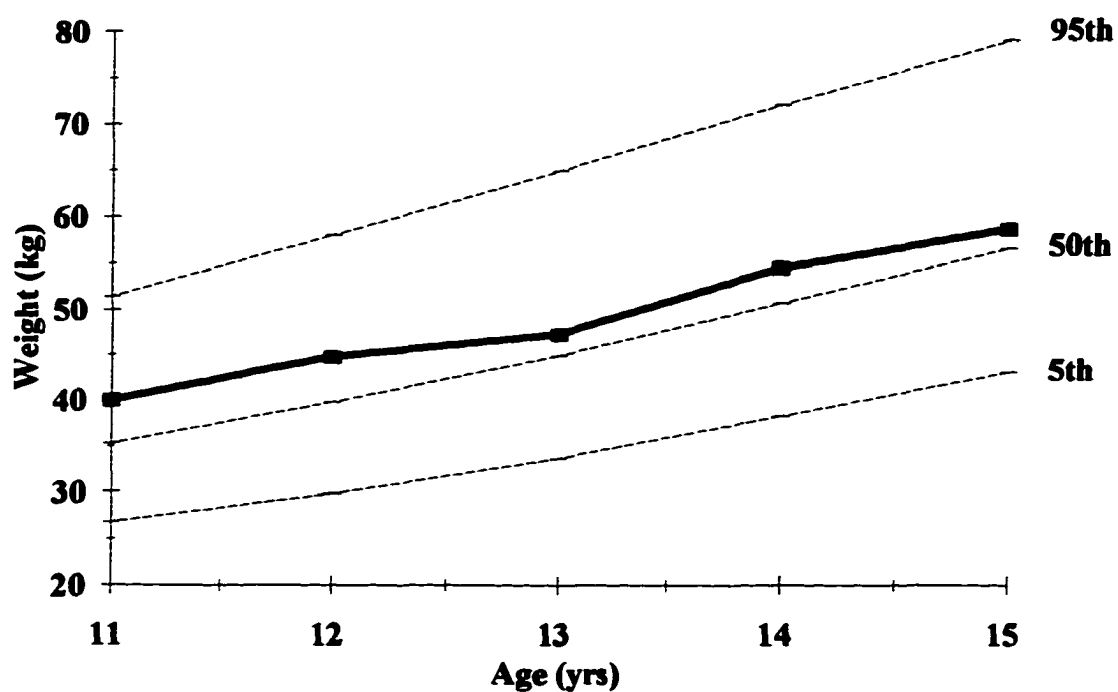


Figure 8. Median body weight of West Philadelphia male adolescents by age relative to NCHS reference data. Median weight was just above the 50th NCHS percentile for weight at all ages.

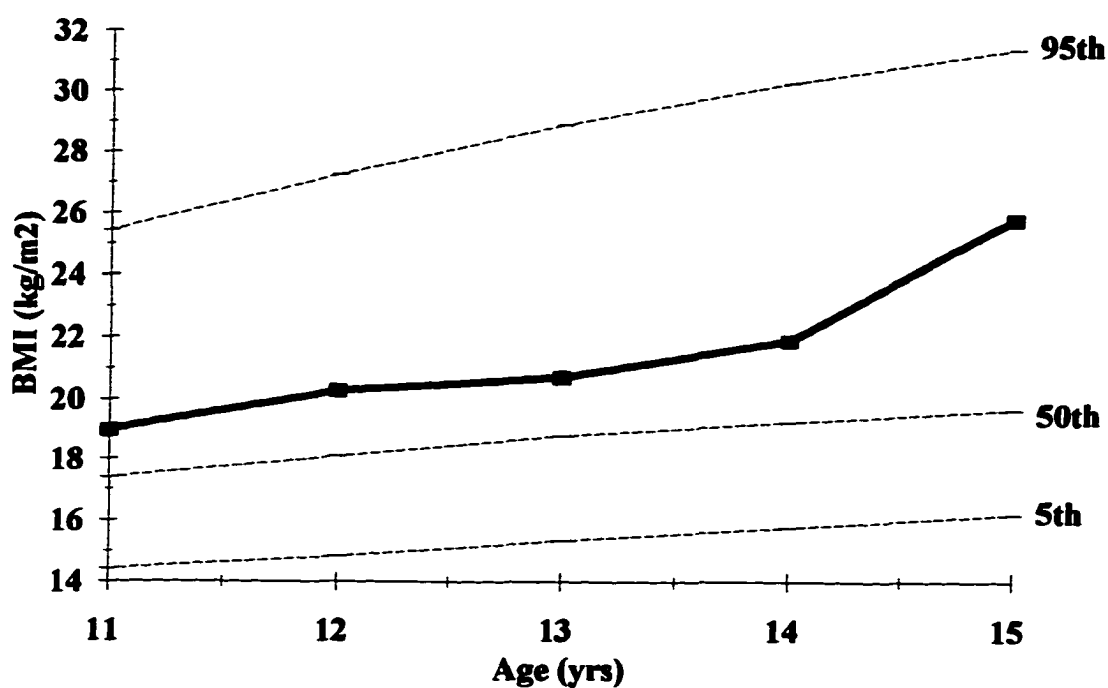


Figure 9. Median BMI of West Philadelphia female adolescents by age relative to NHANES I African-American reference data (Must et al., 1991). Median BMI was between the 50th and 95th NHANES I percentiles over all ages, and closer to the 95th percentile at age 15 years.

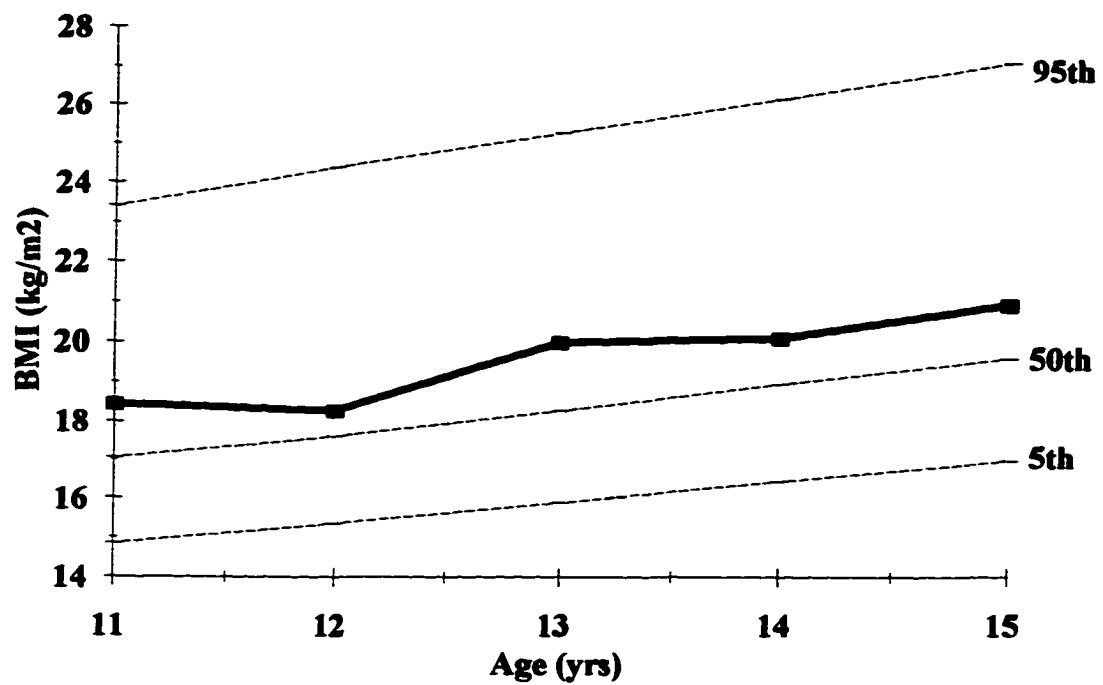


Figure 10. Median BMI of West Philadelphia male adolescents by age relative to NHANES I African-American reference data (Must et al., 1991). Median BMI was just above the 50th NHANES I percentile over all ages.

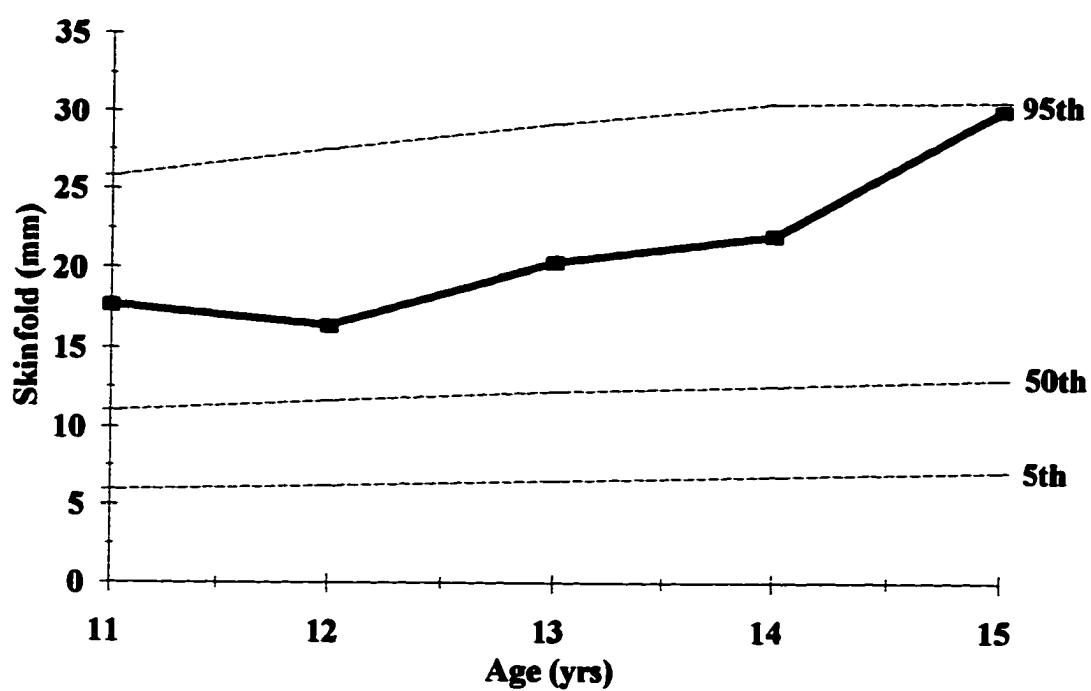


Figure 11. Median triceps skinfold thickness of West Philadelphia female adolescents by age relative to NHANES I African-American reference data (Must et al., 1991). Median triceps skinfold thickness values were well above the 50th NHANES I percentile over all ages, and approaching the 95th percentile at 15 years-of-age.

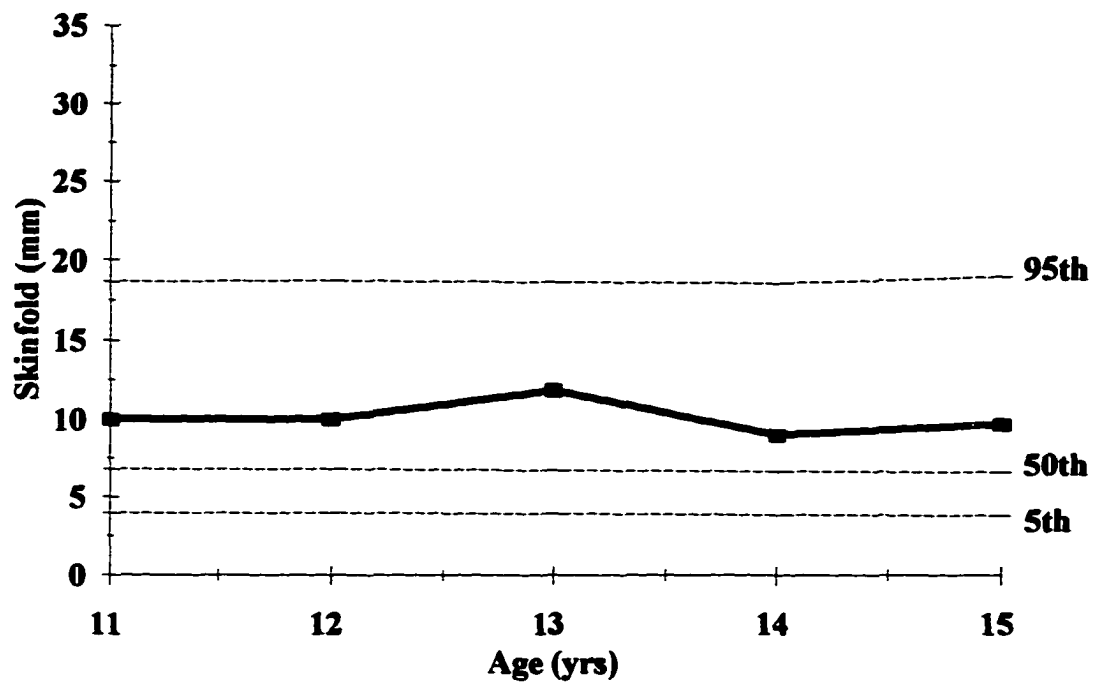


Figure 12. Median triceps skinfold thickness of West Philadelphia male adolescents by age relative to NHANES I African-American reference data (Must et al., 1991). Median triceps skinfold thickness values were between the 50th and 95th NHANES I percentiles over all ages.

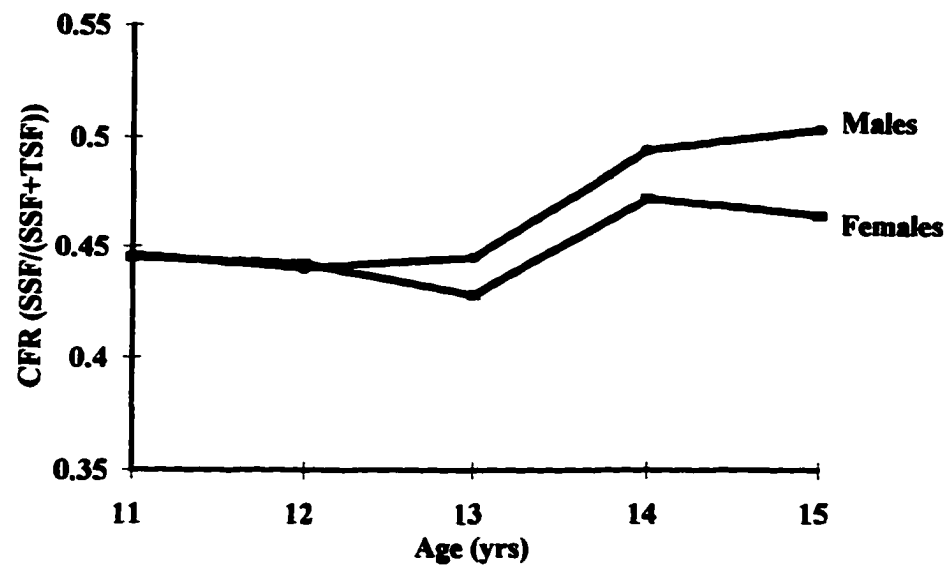


Figure 13. Mean Centripetal Fat Ratio of West Philadelphia adolescents by age and sex. Mean Centripetal Fat Ratio values were similar for males and females at ages 11 and 12 years and increased slightly over age for both sexes, although this increase was greater in males than females.

Table 12

Number (Percentage) of Philadelphia Female Adolescents with BMI, Triceps Skinfold, and Both BMI and Triceps Skinfold Above Given Percentiles for Given Reference Data

Reference Data	BMI	TSF	BMI & TSF
≥ NHANES I 95th percentile (Must et al., 1991; Total Sample)	34.0 (18%)	46.0 (24%)	31.0 (16%)
≥ NHANES I 95th percentile (Must et al., 1991; African-American)	29.0 (15%)	48.0 (25%)	27.0 (14%)
≥ NHANES I 95th percentile (Cronk & Roche, 1982; African-American)	37.0 (19%)	39.0 (21%)	28.0 (15%)
≥ NHANES II 95th percentile (Frisancho, 1990; African-American)	22.0 (12%)	37.0 (19%)	21.0 (11%)
≥ NHANES I 90th percentile (Cronk & Roche, 1982; African-American)	61.0 (32%)	53.0 (28%)	45.0 (24%)
≥ NHANES I 85th percentile (Must et al., 1991; Total Sample)	70.0 (37%)	80.0 (42%)	64.0 (33%)
≥ NHANES I 85th percentile (Must et al., 1991; African- American)	58.0 (31%)	82.0 (43%)	55.0 (29%)

Table 13

Number (Percentage) of Philadelphia Male Adolescents with BMI, Triceps Skinfold, and Both BMI and Triceps Skinfold Above Given Percentiles for Given Reference Data

Reference Data	BMI	TSF	BMI & TSF
≥ NHANES I 95th percentile (Must et al., 1991; Total Sample)	35.0 (17%)	42.0 (20%)	31.0 (15%)
≥ NHANES I 95th percentile (Must et al., 1991; African-American)	44.0 (21%)	56.0 (27%)	40.0 (19%)
≥ NHANES I 95th percentile (Cronk & Roche, 1982; African-American)	33.0 (16%)	43.0 (21%)	28.0 (14%)
≥ NHANES II 95th percentile (Frisancho, 1990; African-American)	46.0 (22%)	50.0 (24%)	40.0 (19%)
≥ NHANES I 90th percentile (Cronk & Roche, 1982; African-American)	50.0 (24%)	62.0 (30%)	43.0 (21%)
≥ NHANES I 85th percentile (Must et al., 1991; Total Sample)	67.0 (32%)	62.0 (30%)	51.0 (24%)
≥ NHANES I 85th percentile (Must et al., 1991; African-American)	84.0 (41%)	100.0 (48%)	71.0 (34%)

Table 14

Sample Sizes for the PCRCG60s, PBPP70s, and EOP90s Studies, by Age and Sex

Mean Age*	PCRCG60s	PBPP70s	EOP90s
<i>Females</i>			
11	119	34	29
12	83	75	49
13	59	43	49
14	52	54	50
15	44	56	12
<i>Males</i>			
11	117	63	21
12	95	78	52
13	58	54	66
14	57	46	44
15	45	51	19
TOTAL	729	553	392

*Chronological age groups represent ± 0.5 of the mean age, i.e., 12 = 11.50 - 12.49

Table 15

Differences Between the Means of Anthropometric Data Collected in 1990s (EOP90s) Compared to Data Collected in 1970s (PBPP70s); Student's t-test Probability $>|t|$, by Age and Sex

Age	Stature	Log Weight	BMI	Log TSF	Log SSF
<i>Females</i>					
11	<i>NS</i>	<i>NS</i>	0.0180	0.0070	<i>NS</i>
12	0.0100	0.0280	<i>NS</i>	0.0070	<i>NS</i>
13	<i>NS</i>	0.0250	0.0140	0.0001*	0.0050
14	<i>NS</i>	<i>NS</i>	<i>NS</i>	0.0001*	0.0330
15	<i>NS</i>	<i>NS</i>	<i>NS</i>	0.0001*	0.0030
<i>Males</i>					
11	0.0231	0.0240	<i>NS</i>	0.0300	<i>NS</i>
12	0.0080	0.0030	0.0150	0.0090	<i>NS</i>
13	<i>NS</i>	0.0400	0.0150	0.0001*	0.0250
14	<i>NS</i>	0.0160	0.0050	0.0070	0.0020
15	<i>NS</i>	<i>NS</i>	<i>NS</i>	0.0500	0.0500

***Indicates that difference is significant after the Bonferroni correction for repeated t-tests**

Table 16

**Differences Between the Means of Anthropometric Data Collected in 1990s (EOP90s)
Compared to Data Collected in 1956-65 (PCRCG60s); Student's t-test Probability $>|t|$,
by Age and Sex**

Age	Stature	Weight
<i>Females</i>		
11	NS	0.0001
12	0.0001	0.0001
13	0.0006	0.0001
14	NS	0.0003
15	NS	0.0037
<i>Males</i>		
11	0.0001	0.0001
12	0.0001	0.0001
13	NS	0.0044
14	NS	0.0028
15	NS	NS

***Indicates that difference is significant after the Bonferroni correction for repeated t-tests**

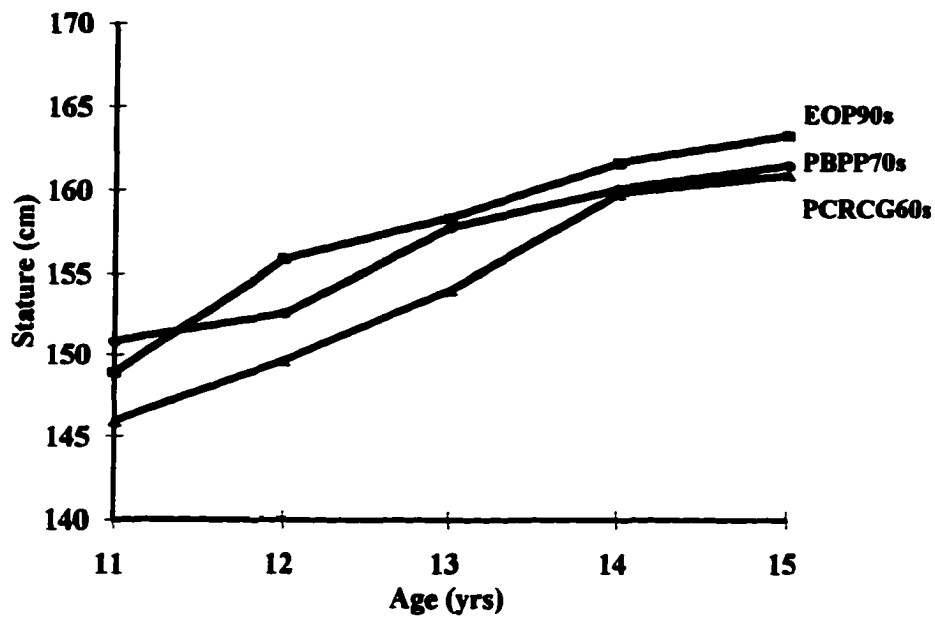


Figure 14. Mean stature of West Philadelphia female adolescents (EOP90s) relative to adolescents from the 1970s (PBPP70s) and 1960s (PCRCG60s) by age. Mean stature was similar across all three samples, particularly at ages 14 and 15 years.

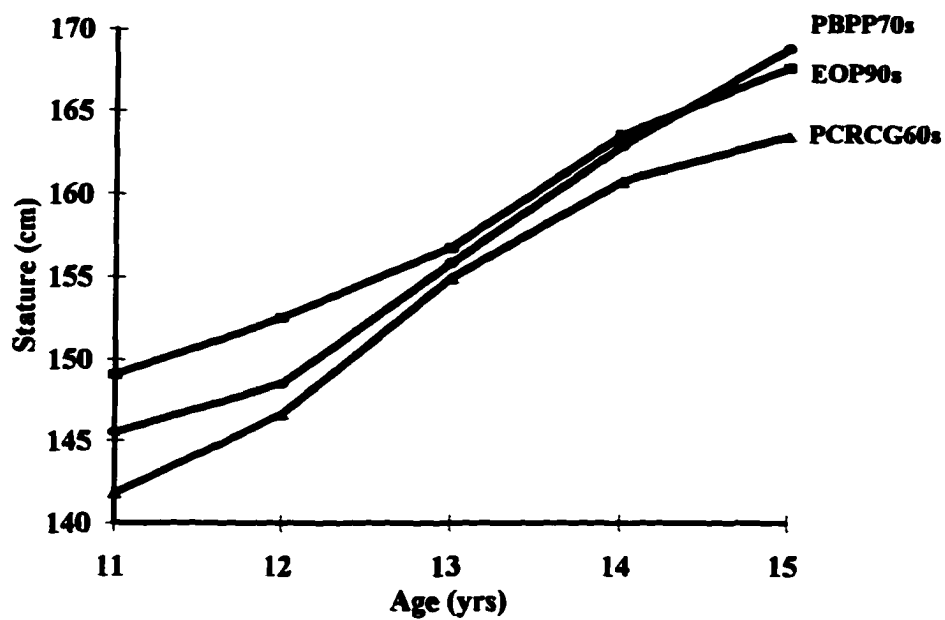


Figure 15. Mean stature of West Philadelphia male adolescents (EOP90s) relative to adolescents from the 1970s (PBPP70s) and 1960s (PCRCG60s) by age. Males from the EOP90s had greater mean stature at 11 and 12 years, stature was similar across all three samples at ages 13 and 14 years, and males from the PBPP70s and EOP70s were taller than those from the PCRCG60s at age 15 years.

Table 17

Sample Sizes, Means, and Standard Deviations for PCRCG60s, PBPP70s and EOP90s

Samples for Stature (cm), by Age and Sex

AGE	PCRCG60s			PBPP70s			EOP90s		
	N	\bar{x}	SD	N	\bar{x}	SD	N	\bar{x}	SD
<i>Fems.</i>									
11	119	145.9	8.3	34	150.8	6.21	29	148.9	8.1
12	83	149.6	7.8	75	152.6	8.34	49	155.9	5.9
13	59	154.0	6.4	43	157.8	8.0	49	158.3	6.2
14	52	159.8	6.6	54	160.0	5.33	50	161.6	7.3
15	44	160.9	7.3	56	161.5	5.67	12	163.3	7.5
<i>Males</i>									
11	117	141.8	7.0	63	154.5	6.08	21	149.1	6.2
12	95	146.6	8.0	78	148.5	8.31	52	152.5	8.2
13	58	154.9	8.8	54	155.8	8.48	66	156.7	9.1
14	57	160.7	9.1	46	162.8	8.65	44	163.5	9.1
15	45	163.4	9.2	51	168.8	7.73	19	167.6	9.2

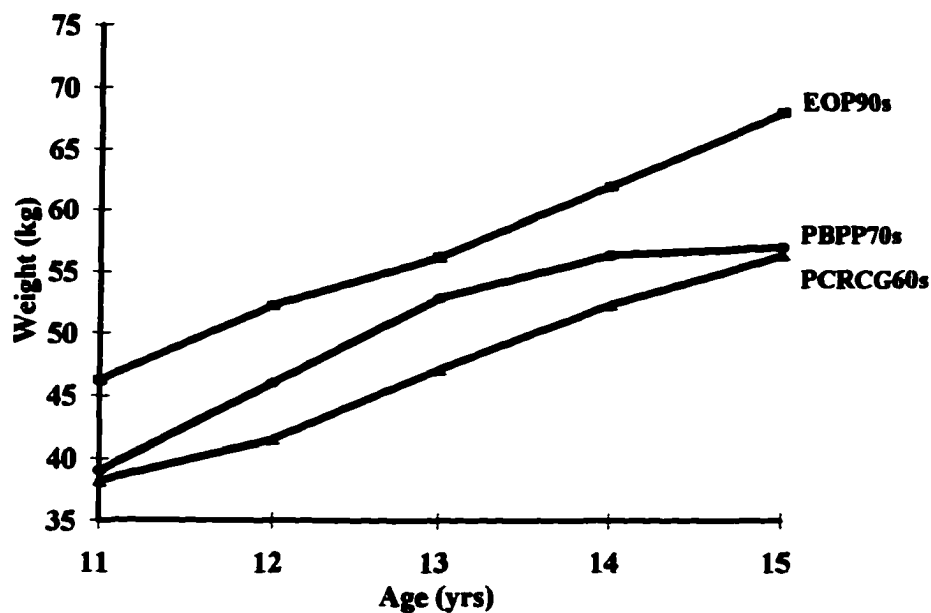


Figure 16. Mean body weight of West Philadelphia female adolescents (EOP90s) relative to adolescents from the 1970s (PBPP70s) and 1960s (PCRCG60s), by age. The EOP90s adolescents had markedly greater mean body weight than females from the PBPP70s and PCRCG60s samples, particularly at 11 and 15 years-of-age.

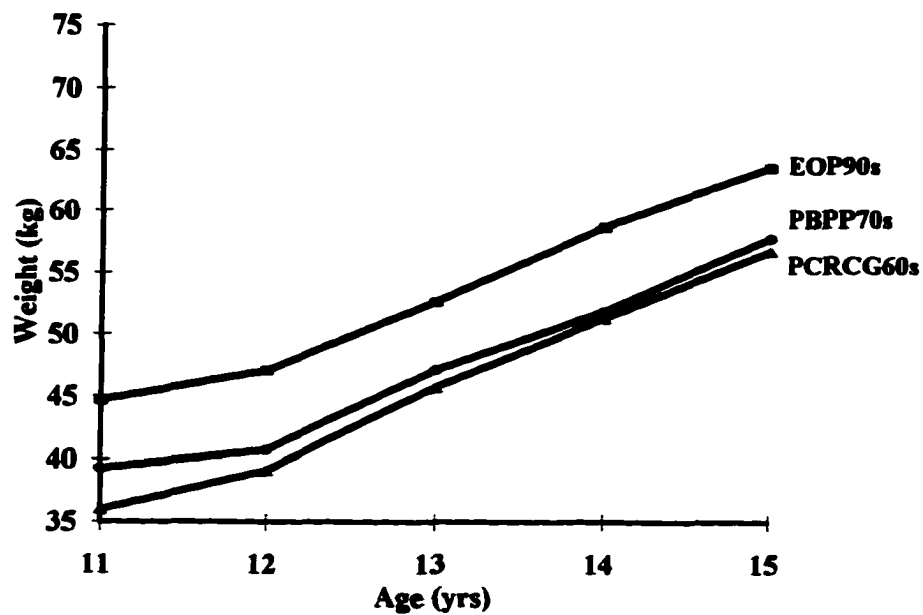


Figure 17. Mean body weight of West Philadelphia male adolescents (EOP90s) relative to adolescents from the 1970s (PBPP70s) and 1960s (PCRCG60s), by age. The EOP90s adolescents had markedly greater mean body weight than males from the PBPP70s and PCRCG60s samples.

Table 18

Sample Sizes, Means, and Standard Deviations for PCRCG60s, PBPP70s and EOP90s

Samples for Body Weight (kg), by Age and Sex

AGE	PCRCG60s			PBPP70s			EOP90s		
	N	\bar{x}	SD	N	\bar{x}	SD	N	\bar{x}	SD
<i>Fems.</i>									
11	119	38.0	7.8	34	42.2	8.2	29	46.2	11.1
12	83	41.5	7.4	75	46.8	12.2	49	52.3	14.1
13	59	47.2	6.9	43	50.29	12.6	49	56.2	13.7
14	52	52.3	7.3	54	56.4	11.1	50	61.9	17.0
15	44	55.7	7.4	56	57.3	11.6	12	68.0	23.3
<i>Males</i>									
11	117	36.0	7.6	63	39.3	11.2	21	44.7	10.8
12	95	39.0	8.0	78	40.7	12.0	52	47.1	13.4
13	58	45.4	9.1	54	47.1	14.2	66	52.6	16.7
14	57	51.2	10.3	46	51.8	12.0	44	58.7	14.3
15	45	56.6	10.0	51	57.8	13.7	19	63.6	19.1

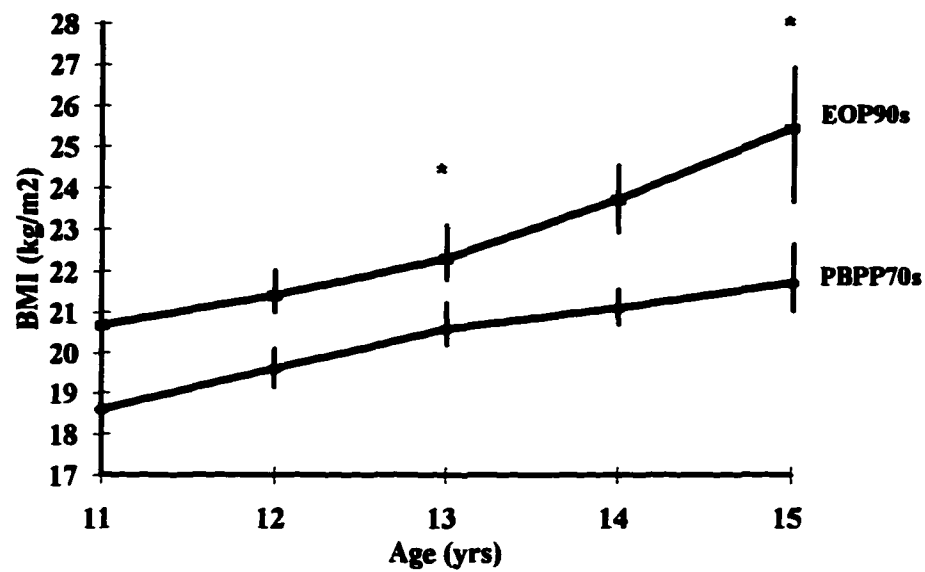


Figure 18. Mean BMI of West Philadelphia female adolescents from the 1990s (EOP90s) relative to adolescents from the 1970s (PBPP70s), by age. Vertical lines indicate ± 1 Standard Error of the Mean. ANOVA results showed group differences ($p \leq 0.001$), age differences ($p \leq 0.001$), and group differences at individual ages (* $p \leq 0.02$).

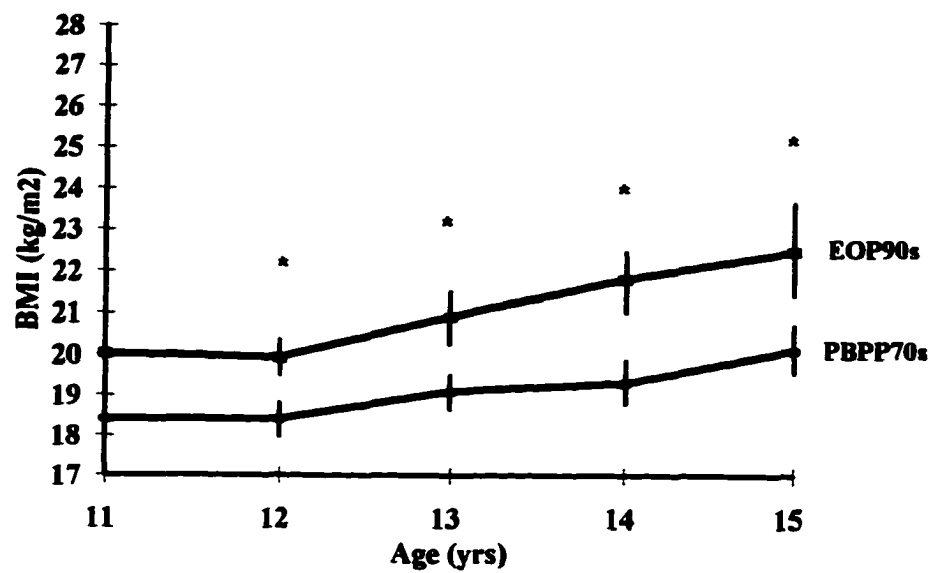


Figure 19. Mean BMI of West Philadelphia male adolescents measured in the 1990s (EOP90s) relative to adolescents from the 1970s (PBPP70s), by age. Vertical lines indicate ± 1 Standard Error of the Mean. ANOVA results showed group differences ($p \leq 0.001$), age differences ($p \leq 0.005$), and group differences at individual ages ($*p \leq 0.02$).

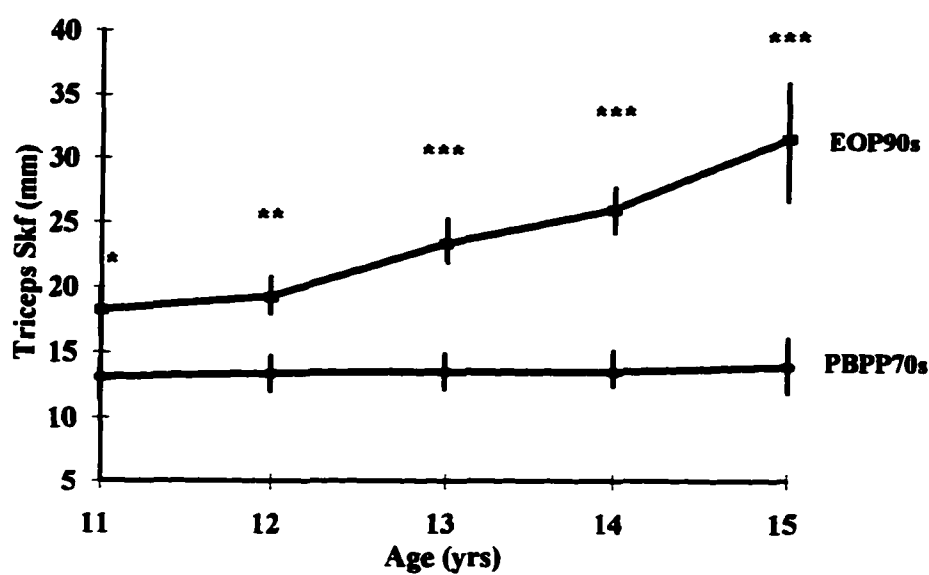


Figure 20. Mean triceps skinfold thickness of West Philadelphia female adolescents measured in the 1990s (EOP90s) relative to adolescents from the 1970s (PBPP70s), by age. Vertical lines indicate ± 1 Standard Error of the Mean. ANOVA results showed group differences ($p \leq 0.001$), age differences ($p \leq 0.007$), and group differences at individual ages (* $p \leq 0.01$; ** $p \leq 0.006$; *** $p \leq 0.0001$).

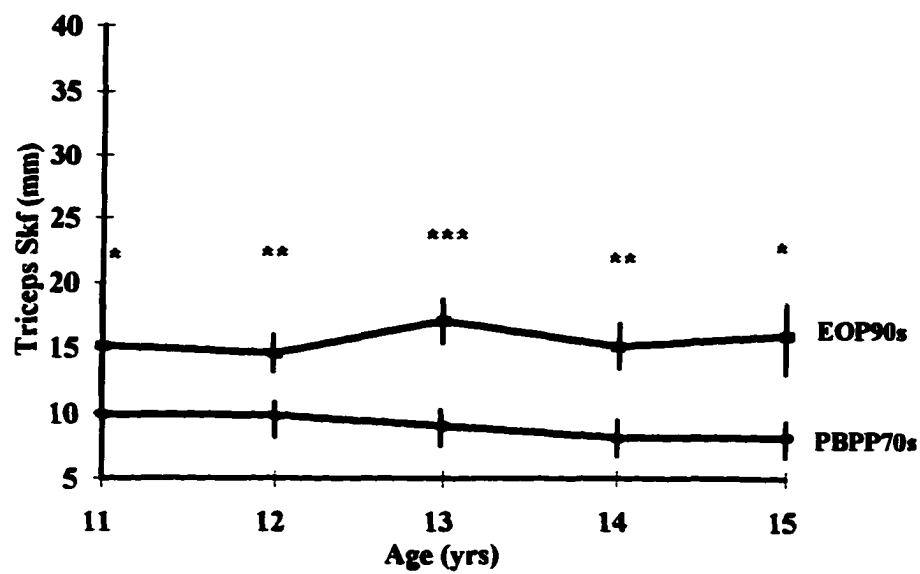


Figure 21. Mean triceps skinfold thickness of West Philadelphia male adolescents measured in the 1990s (EOP90s) relative to adolescents from the 1970s (PBPP70s) by age. Vertical lines indicate ± 1 Standard Error of the Mean. ANOVA results showed group differences ($p \leq 0.001$) and group differences at individual ages (* $p \leq 0.04$; ** $p \leq 0.006$; *** $p \leq 0.0001$).

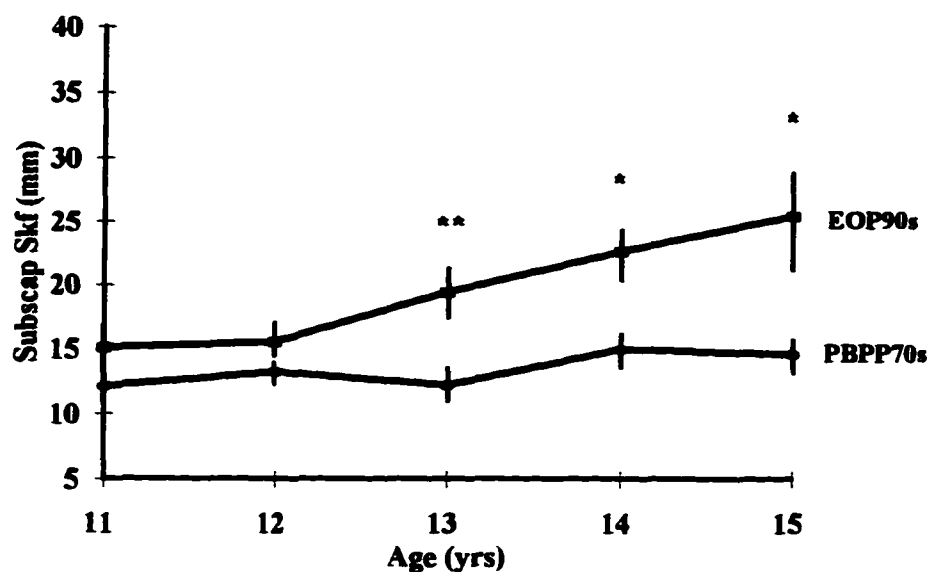


Figure 22. Mean subscapular skinfold thickness of West Philadelphia female adolescents measured in the 1990s (EOP90s) relative to adolescents from the 1970s (PBPP70s), by age. Vertical lines indicate ± 1 Standard Error of the Mean. ANOVA results showed group differences ($p \leq 0.001$), age differences ($p \leq 0.002$), and group differences at individual ages (* $p \leq 0.04$; ** $p \leq 0.003$).

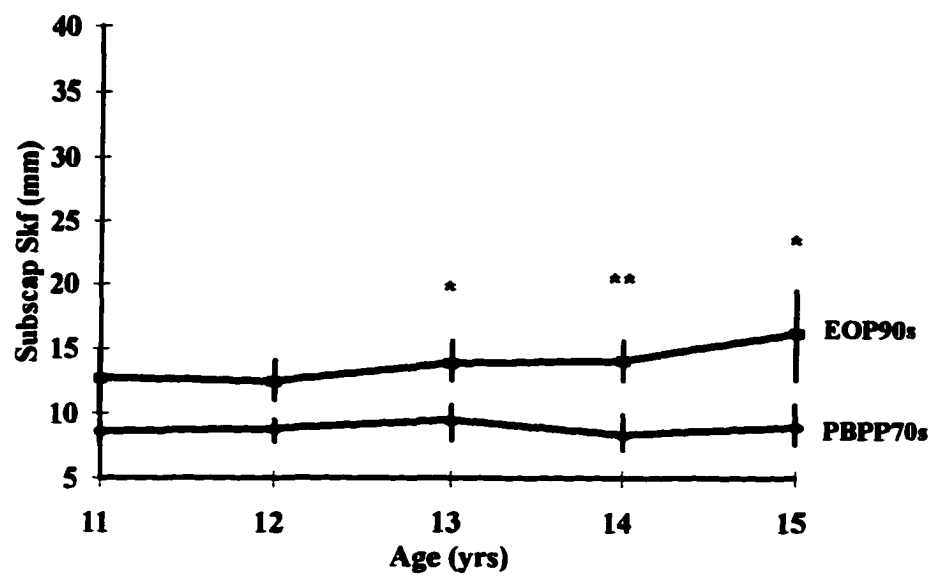


Figure 23. Mean subscapular skinfold thickness of West Philadelphia male adolescents measured in the 1990s (EOP90s) relative to adolescents from the 1970s (PBPP70s), by age. Vertical lines indicate ± 1 Standard Error of the Mean. ANOVA results showed group differences ($p < 0.0001$) and group differences at individual ages (* $p < 0.02$; ** $p < 0.002$).

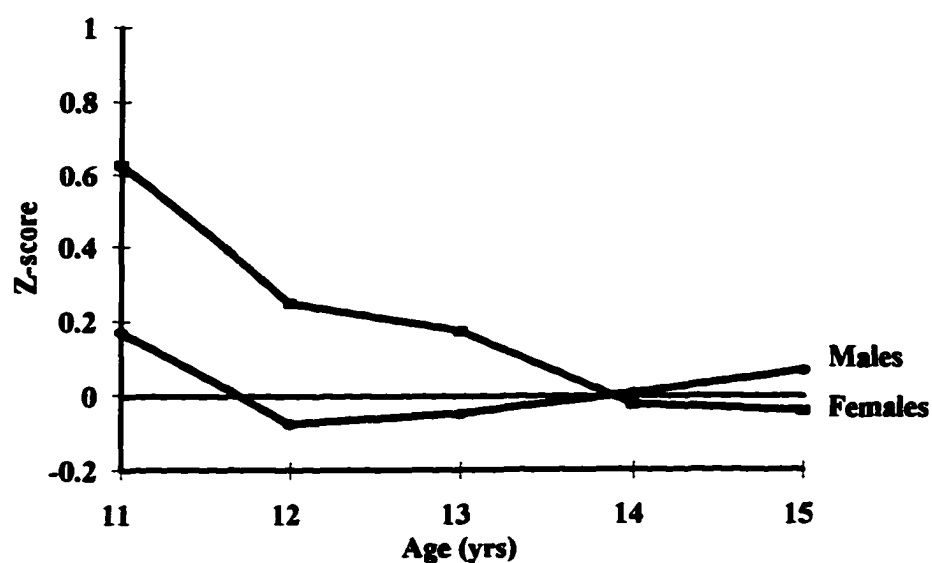


Figure 24. Mean stature Z-scores for adolescents from the 1970s sample (PBPP70s), by sex and age, relative to NHANES I reference data (CDC, 1990a). Male mean stature Z-scores males were close to zero over all ages, whereas female Z-scores were between 0.2 and 0.6 standard deviations above the mean from 11-13 years, and closer to zero at ages 14 and 15 years.

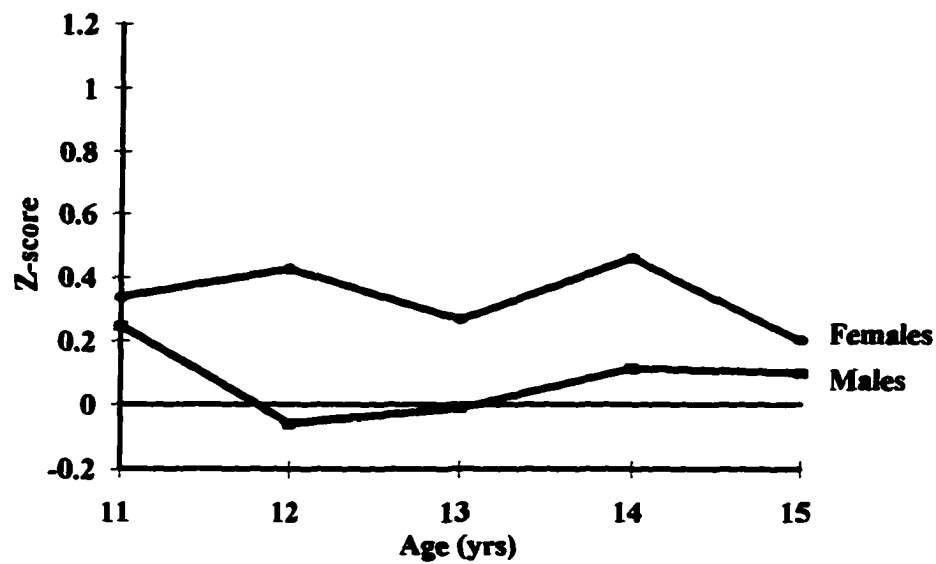


Figure 25. Mean weight Z-scores for adolescents from the 1970s (PBPP70s), by sex and age, relative to NHANES I reference data (CDC, 1990a). Male mean weight Z-scores were close to zero over all ages, whereas female Z-scores were between 0.1 and 0.4 standard deviations above the mean over all ages.

Table 19

Number (Percent) of PBPP70s and EOP90s Adolescents with Both BMI and Triceps Skinfold (TSF) Measures Above Given NHANES I Percentiles (Must et al., 1991) Compared to Reference Data from Phase I of NHANES III (Troiano et al., 1995)

	MALES			FEMALES		
	PBPP70s	EOP90s	NHANES	PBPP70s	EOP90s	NHANES
BMI & TSF > 95th Centile	15.0 (5.0%)	31.0 (15%)		11.0 (4.0%)	31.0 (16%)	
BMI & TSF > 85th Centile	10.0 (3.0%)	51.0 (24%)		26.0 (10%)	64.0 (34%)	
BMI > 95th Centile	18.0 (6.0%)	35.0 (17%)	(12.8%) [†] (9.3%) [‡]	24.0 (9.0%)	34.0 (18%)	(8.8%) [†] (14.4%) [‡]
BMI > 85th Centile	27.0 (9.0%)	67.0 (32%)	(22.0%) [†] (21.1%) [‡]	40.0 (15%)	70.0 (37%)	(21.4%) [†] (29.9%) [‡]

[†]Data for race-ethnicity groups not shown separately (total sample).

[‡]Data for Non-Hispanic African-Americans.

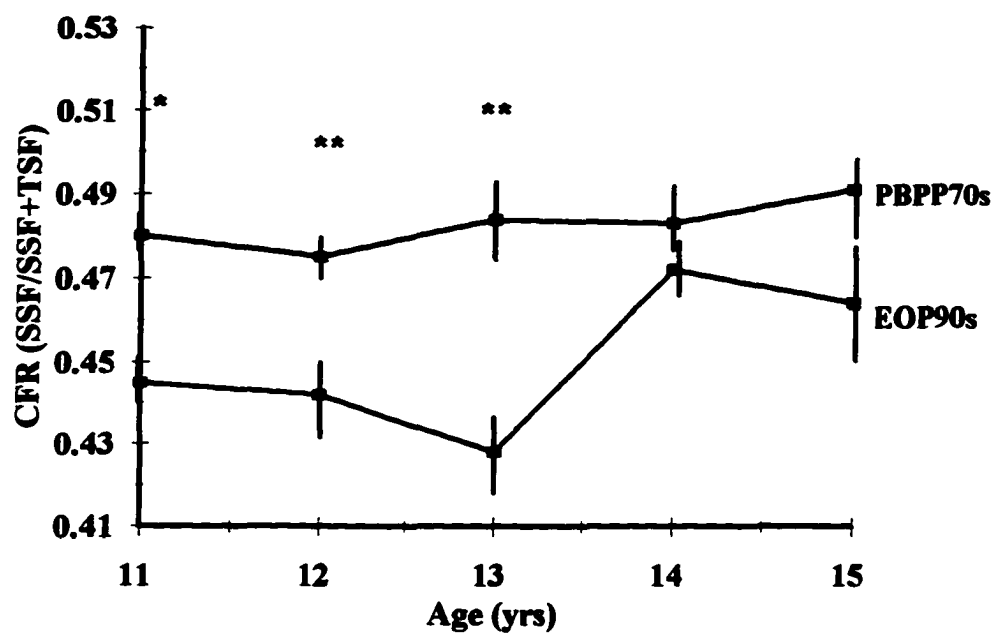


Figure 26. Mean Centripetal Fat Ratio [CFR; subscapular skinfold/(subscapular + triceps skinfold)] of West Philadelphia female adolescents measured in the 1990s (EOP90s) relative to adolescents from the 1970s (PBPP70s), by age. Vertical lines indicate ± 1 Standard Error of the Mean. ANOVA results showed group differences ($p \leq 0.0001$), age differences ($p \leq 0.03$), and group differences at individual ages (* $p \leq 0.04$; ** $p \leq 0.002$).

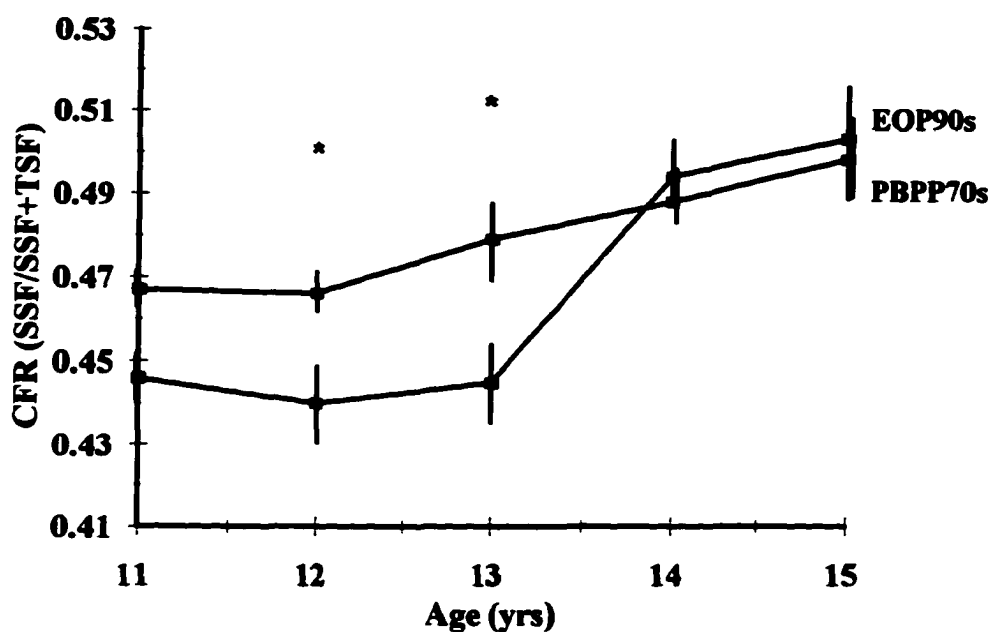


Figure 27. Mean Centripetal Fat Ratio [CFR; subscapular skinfold/(subscapular + triceps skinfold)] of West Philadelphia male adolescents (EOP90s) relative to adolescents from the 1970s (PBPP70s) by age. Vertical lines indicate ± 1 Standard Error of the Mean. ANOVA results showed group differences ($p \leq 0.0001$), age differences ($p \leq 0.024$), and group differences at individual ages ($*p \leq 0.04$).

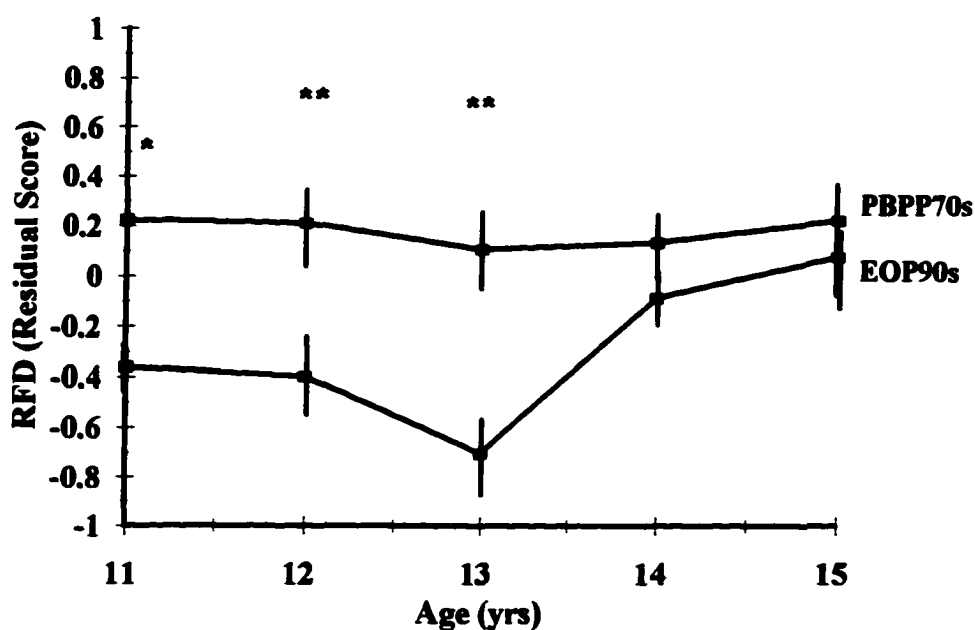


Figure 28. Mean Relative Fat Distribution (standardized residual scores from the regression analysis within each sex of subscapular skinfold on triceps skinfold measures) of West Philadelphia female adolescents measured in the 1990s (EOP90s) relative to adolescents from the 1970s (PBPP70s), by age. Vertical lines indicate ± 1 Standard Error of the Mean. ANOVA results showed group differences ($p \leq 0.0001$), age differences ($p \leq 0.02$), and group differences at individual ages (* $p \leq 0.02$; ** $p \leq 0.001$).

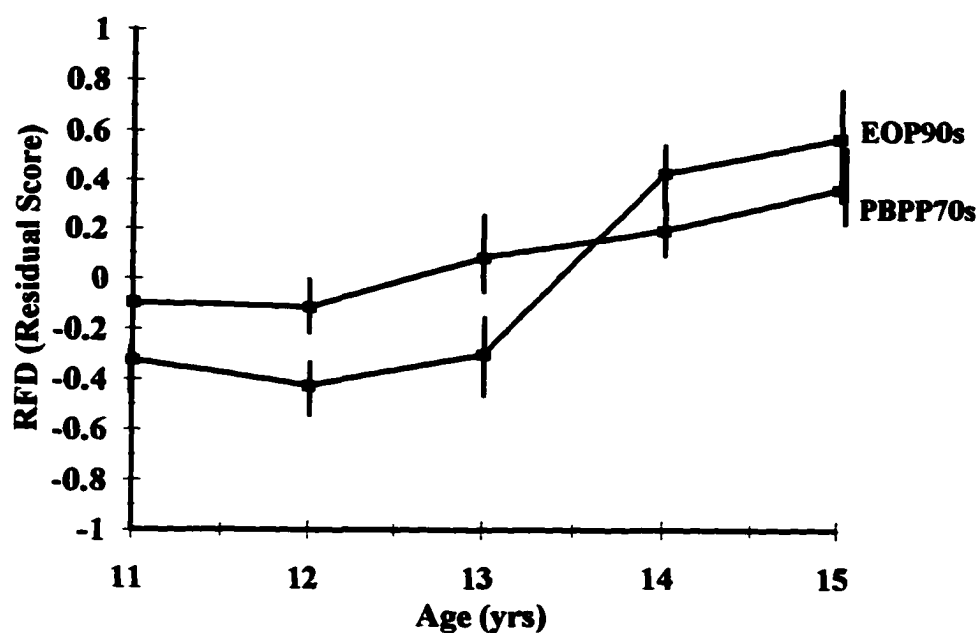


Figure 29. Mean Relative Fat Distribution (standardized residual scores from the regression analysis within each sex of subscapular skinfold on triceps skinfold measures) of West Philadelphia male adolescents measured in the 1990s (EOP90s) relative to adolescents from the 1970s (PBPP70s), by age. Vertical lines indicate ± 1 Standard Error of the Mean. ANOVA results showed a significant age difference ($p \leq 0.0001$).

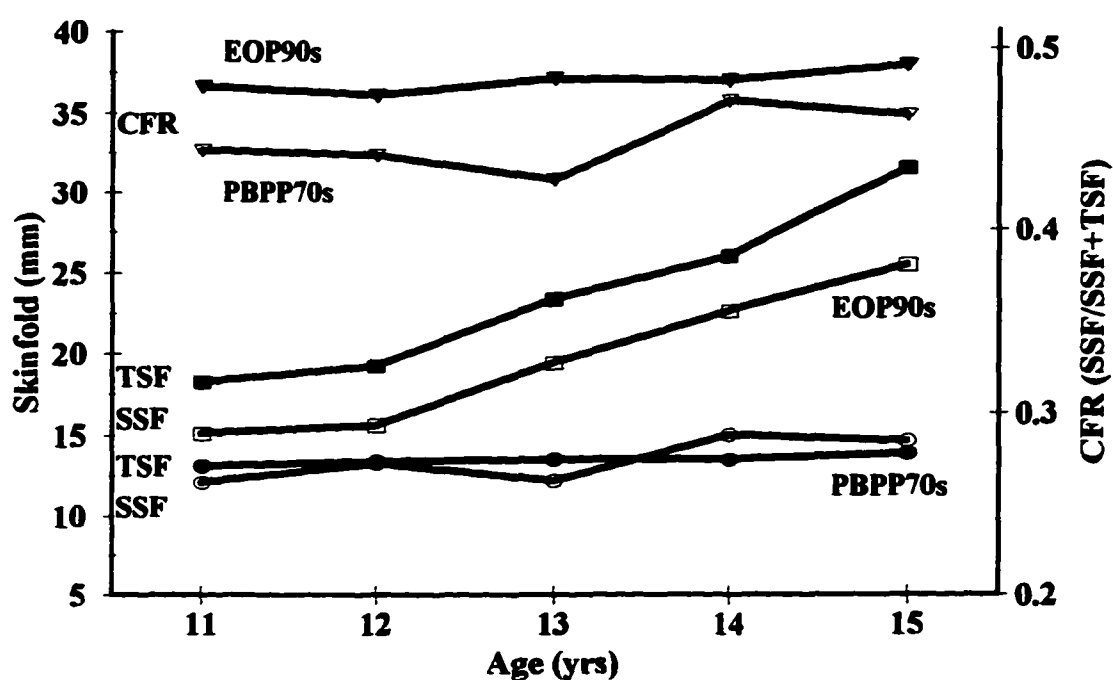


Figure 30. Mean Centripetal Fat Ratio (CFR), triceps (TSF), and subscapular skinfold (SSF) measures for West Philadelphia adolescent females measured in the 1990s (EOP90s) compared to females from the 1970s (PBPP70s), by age. Skinfold values are greater among the EOP90s females. Females from the EOP90s had greater triceps relative to subscapular skinfold thickness, while females from the PBPP70s had greater subscapular relative to triceps skinfold thickness, resulting in elevated CFR values for PBPP70s relative to EOP90s females.

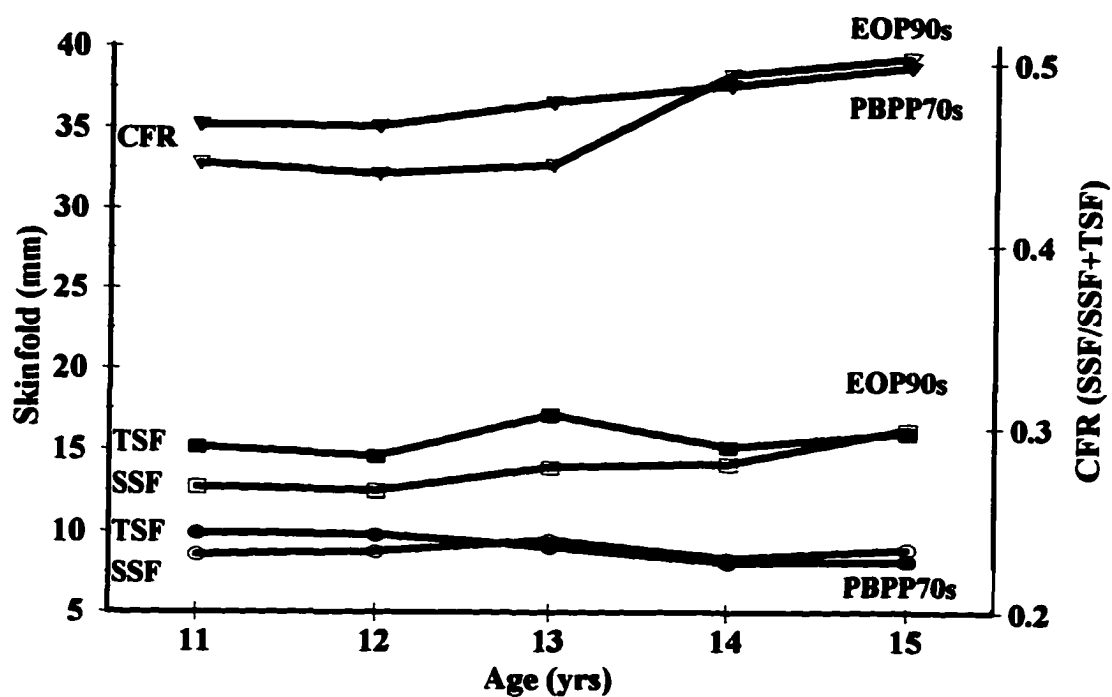


Figure 31. Mean Centripetal Fat Ratio (CFR), triceps (TSF), and subscapular skinfold (SSF) measures for West Philadelphia adolescent males measured in the 1990s (EOP90s) compared to females from the 1970s (PBPP70s), by age. Skinfold values are greater among the EOP90s males. Males from the EOP90s had greater triceps relative to subscapular skinfold thickness, while males from the PBPP70s had greater subscapular relative to triceps skinfold thickness, resulting in elevated CFR values for PBPP70s relative to EOP90s males, except at ages 14 and 15 years.

Table 20

Regression Models to Predict CFR and RFD for Males and Females

<u>Model - CFR: Males</u>		$CFR = C + HT + GRP + HT*GRP$ F = 22.28 P < 0.0001 R ² = 0.116	
	B	T	P
Constant	-0.168	-1.21	0.228
Stature	0.004	4.39	0.0001
Sample	0.221	2.75	0.006
Stature * Sample	0.001	2.51	0.012

<u>Model - RFD: Males</u>		$RFD = C + WT + GRP + WT*GRP$ F = 44.65 P < 0.0001 R ² = 0.212	
	B	T	P
Constant	-3.176	-6.69	0.0001
Weight	0.053	6.04	0.0001
Sample	1.078	3.80	0.0001
Weight * Sample	-0.015	-2.75	0.006

<u>Model - CFR: Females</u>		$CFR = C + WT + GRP$ F = 26.35 P < 0.0001 R ² = 0.106	
	B	T	P
Constant	0.037	25.86	0.0001
Weight	0.001	3.674	0.0001
Sample	0.037	6.743	0.0001

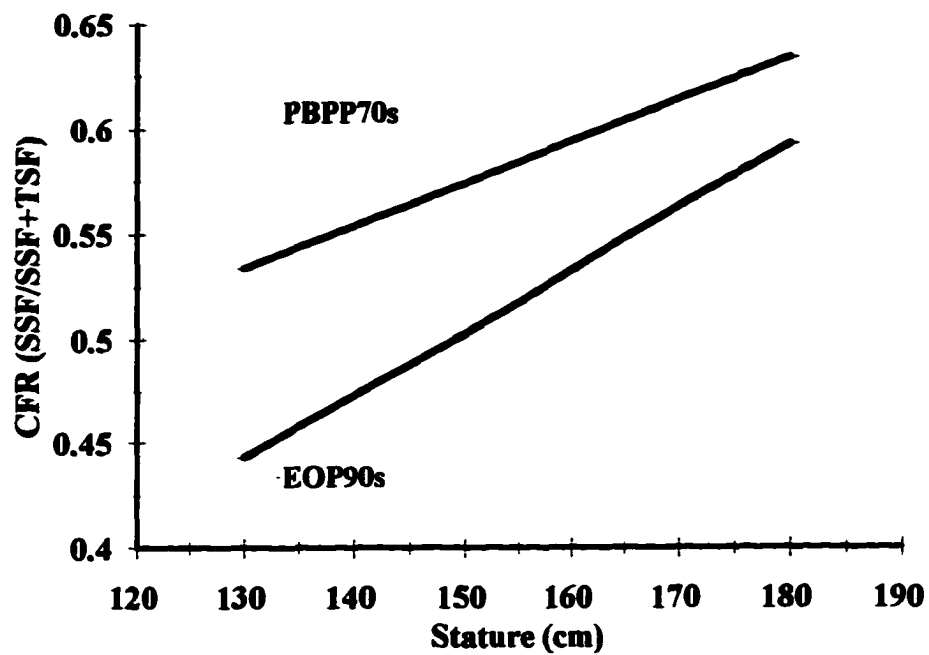


Figure 32. Regression model ($r^2 = 0.116$) for CFR for males as a function of stature ($p \leq 0.0001$), sample assignment ($p \leq 0.006$), and the interaction between stature and sample assignment ($p \leq 0.012$). Sample differences were most marked among shorter males.

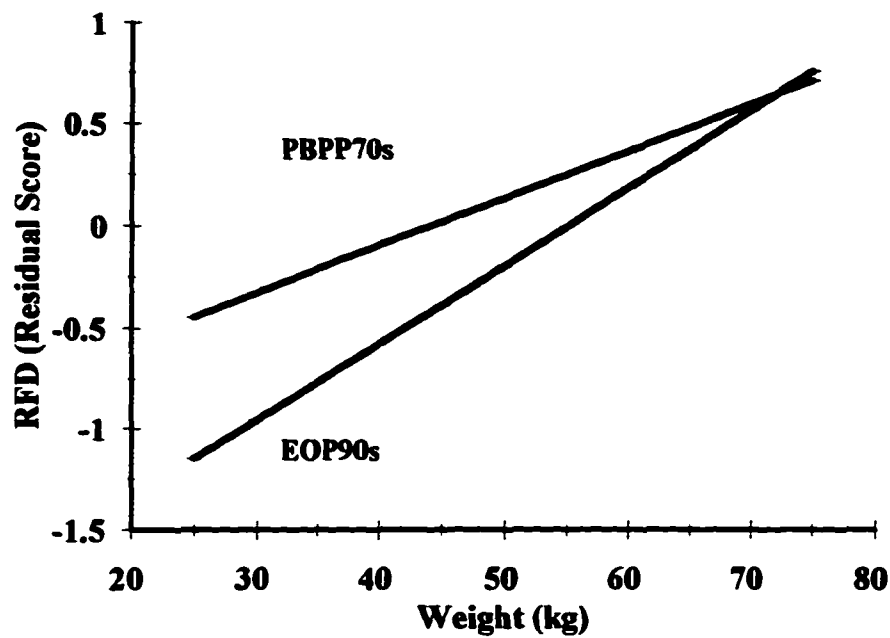


Figure 33. Regression model ($r^2 = 0.212$) for RFD for males as a function of weight ($p \leq 0.0001$), sample assignment ($p \leq 0.0001$), and the interaction between weight and sample assignment ($p \leq 0.006$). Sample differences were most marked among males of lower body weight.

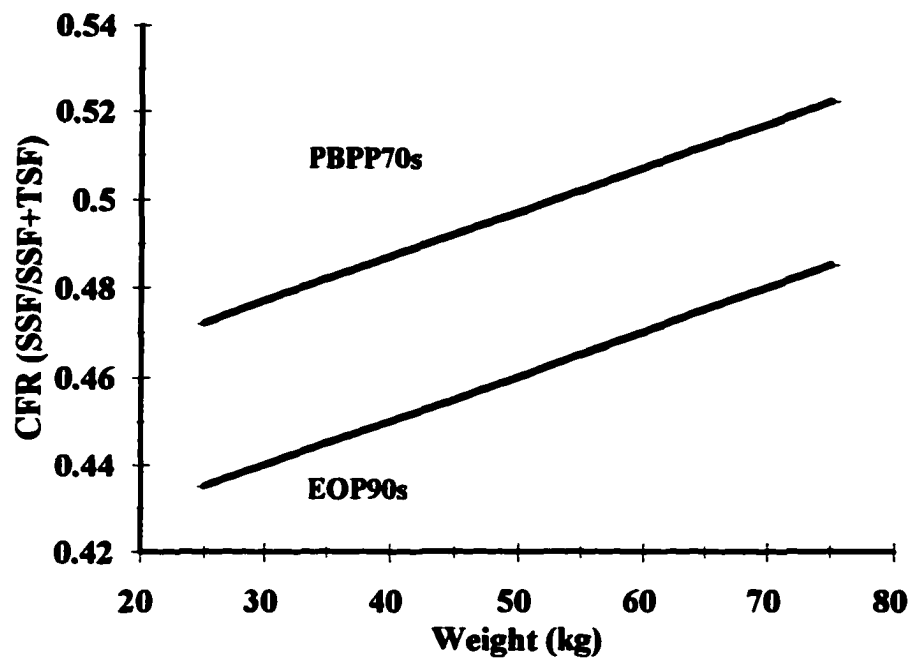


Figure 34. Regression model ($r^2 = 0.106$) for CFR for females as a function of weight ($p \leq 0.0001$) and sample assignment ($p \leq 0.0001$). Females from the EOP90s had lower CFR for given weight relative to female from the PBPP70s.

CHAPTER 5

RESULTS: DIETARY INTAKE

This chapter provides information about the nutrition-related health status of adolescents living in an urban context that can be used to develop strategies for health promotion in this, and similar, populations. In combination with anthropometric data presented in the previous chapter, these data provide a description of the dietary and nutritional status of West Philadelphia adolescents. Dietary intakes, based on standard 24-hour recall assessments, were collected from a sample of 345 West Philadelphia adolescents (171 males; 174 females) between the ages of 11 and 15 years (Table 21). These data were assessed for nutritional adequacy relative to age- and sex-appropriate 1989 U.S. Recommended Daily Allowances (RDA; National Research Council, 1989b), with a focus on nutrients of current public health concern because of their association with diet-related chronic degenerative diseases, including coronary heart disease, stroke, certain cancers, and non-insulin dependent diabetes. In addition, data were compared to national surveillance data reported in the Third Report on Nutrition Monitoring in the U.S. [NHANES III; 1988-1991] (Life Sciences Research Office, 1995).

Energy Intake and Energy Requirements

Energy intake, based on single 24-hour dietary recall data, was assessed and the

coefficient of variation $[(1 \text{ standard deviation/sample mean}) \times 100]$ calculated to characterize the variation in energy intake of these adolescents. The coefficient of variation was 44% for males, 48% for females, and 45% for both males and females. In a methodological study of the sources of variance in 24-hour dietary recall data, Beaton et al. (1979) found a coefficient of variation for energy intake of 36% for adult males and 41% for adult females, which was considered “relatively low” (Quant, 1986).

Energy requirements for these West Philadelphia adolescents were estimated using equations for predicting resting energy expenditure from body weight, and body weight and stature, and a factorial method for estimating total energy requirements (Table 22). The results were multiplied by an activity factor (energy cost of activity) that reflected typical activity patterns for U.S. adolescents (WHO, 1985). However, given the considerable overweight in this sample and the use of weight to calculate energy requirements, these results are likely to overestimate energy requirements. Using body weight, median energy requirements for males was estimated at 2,549 kcals per day/43.84 kcals per kilogram of body weight and at 2,328 kcals per day/52.58 kcals per kilogram for females. The following estimates using both stature and weight were not substantially different from the figures estimated using body weight alone: 2,552 kcals per day, 52.48 kcals per kilogram, for males and 2,296 kcals per day, 43.48 kcals per kilogram, for females. The difference between the equations using weight only or both stature and weight amounted to three kcals per day, 0.10 kcals per kilogram, for males and 33 kcals, 0.40 kcals per kilogram, for females. This finding was similar to findings from an expert consultation group for WHO (1985) showing that variation in stature made no difference

in boys and only a small difference in girls. Estimated energy requirements for this analysis used the figures derived from weight alone to facilitate comparisons with other data based on the same prediction equations.

Estimated energy expenditure, using prediction equations described above, was compared to reported energy intake and these figures are presented in Table 23 and in Figures 35 (females) and 36 (males). Median energy intake for females and males exceeded estimated energy requirements by 264 kcals for males and by 241 kcals for females. Energy intake per day exceeded estimated requirements at all ages, except for 15 year-olds of both sexes, with the greatest difference between estimated energy expenditure and reported energy intake for males at 11 years (844 kcals) and for females at 15 years (445 kcals).

Median values for under reporting of energy intake were calculated by subtracting reported energy intake from estimated energy expenditure. Values for males (-247.18 kcals) and females (-267.89 kcals) indicate that the adolescents in this sample were over reporting energy intake by approximately 250 kcals. Or, these values could indicate that some adolescents had extremely high energy intake or lower than expected energy expenditure. Relative to adolescents in the upper two quartiles of BMI, adolescents in the lowest two quartiles of BMI over reported energy intake (using reported energy intake and estimated energy expenditure) by an average of 900 kcals ($p \leq 0001$). Thus, significantly greater over reporting of energy intake occurred among lighter, relative to heavier, adolescents. Conversely, under reporting of energy intake relative to energy expenditure, using doubly labeled water, has been reported (Mertz et al., 1991;

Livingstone et al., 1990) and has been shown to be greater for African-American as compared to white-American youth (Champagne et al., 1996).

Macronutrient and Micronutrient Intake

Energy intake, total dietary fat intake, and percentage of energy from total fat tertiles by BMI tertile are shown in Table 24. Although there were only small differences between BMI tertiles in energy intake for females (275.62 kcals), reported energy intake was highest for the lowest BMI tertile. A similarly small difference was seen in females for total fat (12.95 gm), with highest intake for lowest BMI tertile. Similar results were found for females for percentage of energy from total fat, with lowest intake for the lowest BMI quartile. Males had a larger difference between BMI tertiles for energy intake (639.08 kcals) than females, with energy intake highest for the lowest BMI tertile. Larger BMI tertile differences were also found for males for total fat (30.9 gm), with highest intake for the lowest BMI tertile. The BMI tertile differences for percentage of energy from total fat for males (2.63%) were larger than those seen for females. The highest percentage of energy from total fat was found for the second BMI tertile. A one-way ANOVA showed significant between-group differences for BMI tertile and energy, total fat, and percentage of energy from total fat tertiles for both sexes ($p \leq 0.00005$).

Median macronutrient intake as percentage of energy for the West Philadelphia adolescents relative to the RDA are shown in Figure 37. Males (35.63%) and females (39.13%) had a greater percentage of energy from total dietary fat than recommended (30.0%). However, percentage of energy from carbohydrates for males (51.97%) and

females (48.57%) were similar to the recommended percentage (50.0%). The percentage of energy from protein for males (13.46%) and females (12.71%) were less than recommended (20.0%).

Median total dietary fat, saturated fat, protein, and energy intakes as percentages of the 1989 RDA (National Research Council, 1989b) for these adolescents are shown in Figure 38. Energy intake (114%) was closest to the recommended amount, while total dietary fat (142%), saturated fat (140%), and protein intake (199%) were considerably greater than the recommended amount. During the 24-hour period surveyed, the dietary intake of these adolescents exceeded recommendations for dietary fat, protein, and percentage of energy from these nutrients.

Median macronutrient intake as percentage of energy for the West Philadelphia females (Figure 39) was compared to NHANES III, African-American reference data (Life Sciences Research Office, 1995). West Philadelphia females (39.13%) had greater intake of total fat as percentage of energy relative to the NHANES III, African-American reference data (37.7%). Median carbohydrate intake as percentage of energy (48.57%) was less than the NHANES III, African-American reference data (50.0%). Saturated fat, polyunsaturated fat, and protein as percentage of energy were similar in West Philadelphia and NHANES III, females.

Median macronutrient intake for the West Philadelphia males (Figure 40) as percentage of energy was compared to NHANES III, African-American reference data (Life Sciences Research Office, 1995). West Philadelphia males had a median intake of total dietary fat as percentage of energy (35.63%) that was similar to the NHANES III,

African-American reference data (35.20%). Carbohydrate as percentage of energy for West Philadelphia adolescents (51.97%) was less than NHANES III, African-American reference data (53.20%). Median intake of saturated fat, polyunsaturated fat, and protein as percentage of energy were relatively similar in West Philadelphia and NHANES III, males.

Differences between West Philadelphia females and males in mean percentage of energy from total dietary fat, saturated, polyunsaturated, and monounsaturated fat, carbohydrates, and protein are shown in Figure 41. Using the Mann-Whitney Two Sample Statistic, females had a higher percentage of energy from total dietary fat ($p < 0.0001$), polyunsaturated fat and monounsaturated fat ($p \leq 0.002$) than males. To correct for skewing characteristic of dietary intake data, total dietary fat data were transformed using the Box-Cox transformation. After the Box-Cox transformation, significant differences in percentage of energy from total dietary fat were still seen.

Median daily intake of kilocalories, total dietary fat, and saturated fat per kilogram of body weight are shown in Figures 42 through 44. Median daily energy intake per kilogram of body weight (Figure 42) was greater for males than females, particularly at younger ages, and these values decreased over the ages shown. Similarly, median daily total dietary fat intake per kilogram of body weight (Figure 43) was greater in males than in females, and these values also decreased over the ages shown, although values were similar for males and females at 15 years-of-age. Median saturated fat intake per kilogram of body weight (Figure 44) differed slightly from energy and total fat intake per kilogram of body weight. Median saturated fat intake per kilogram of body weight was greater in

males than females, except at 15 years when saturated fat per kilogram of body weight was substantially greater in females. Values decreased over the ages shown, although there was a slight increase for both sexes at 13 years and a large increase in saturated fat per kilogram body weight for females between 14 and 15 years-of-age.

Median intake and interquartile ranges for nutrients of current public health concern as percentage of the RDA are shown for females (Table 25) and males (Table 26). Energy intake was relatively high, ranging from 93.77-166.05% RDA (females) and 92.52-145.56% RDA (males). Protein intake was exceptionally high, ranging from 140.43-257.17% RDA (females) and 169.98-286.89% RDA (males). Sodium intake was markedly high, ranging from 129.83-266.21% RDA (females) and 136.00-258.17% RDA (males). Vitamin D intake was markedly low, ranging from 3.75-32.84% RDA (females) and 12.40-46.12% RDA (males). Micronutrient and macronutrient status was excellent. However, fiber, zinc, calcium, sodium, and vitamin D were relatively low and this may have important consequences for the health status of these adolescents.

Median intake of energy, sodium, iron, calcium, vitamin A, and folate as percentage of the 1989 RDA for West Philadelphia females were compared to NHANES III, African-American reference data (Life Sciences Research Office, 1995) and are shown in Figure 45. Median intake of all six of these nutrients as percentage of the RDA were larger for West Philadelphia females relative to the NHANES III, African-American reference data. Sodium intake as percentage of the RDA was greater for West Philadelphia females (186.73% RDA) than for NHANES III females (124.0% RDA). In addition, iron intake as percentage of the RDA was substantially higher in West

Philadelphia females (96.03% RDA) than NHANES III females (65.0% RDA). Intake of zinc, calcium, and vitamin A as percentage of the RDA for West Philadelphia females was at, or below the accepted criterion of adequacy (2/3 RDA or 66% RDA). The 66% RDA criterion was used because the RDA represent a “safety factor” to correct for variation in intake for each nutrient (except energy), and thus the RDA overestimate nutrient requirements.

Median intake of energy, sodium, iron, calcium, vitamin A, and folate as percentage of the 1989 RDA for West Philadelphia males were compared to NHANES III, African-American reference data (Life Sciences Research Office, 1995) and are shown in Figure 46. Median intake of all seven of these nutrients as a percentage of the RDA were larger for West Philadelphia males relative to the NHANES III, African-American reference data. Sodium intake as percentage of the RDA was greater for West Philadelphia males (189.29% RDA) than for NHANES III males (137.0% RDA). Intake of calcium and vitamin A as percentage of the RDA for West Philadelphia males were at, or below the accepted criterion of adequacy.

The percentages of West Philadelphia adolescents to fall below the criterion of adequacy (66.0% RDA) for selected nutrients for which sample intake was relatively low (iron, zinc, calcium, vitamins A and D, total dietary fiber, and sodium) are presented in Table 27. A significant percentage of the sample fell below the accepted criterion of nutritional adequacy for these nutrients. Between 40.0-80.0% of males and females had lower than recommended intake of zinc, calcium, vitamins A (males) and D, and total dietary fiber. In addition, a significant percentage of females fell below recommendations

for iron (25.0%) and vitamin A (31.0%) intake. The vast majority of this sample had higher than recommended intake of sodium (96.0-98.0%).

Nutrient Sources Total Dietary Fat and Saturated Fat

Differences between West Philadelphia males and females in mean nutrient intake of selected nutrients (sodium, iron, zinc, calcium, and vitamin D) as percentage of the RDA are shown in Figure 47. There was no significant sex difference in mean intake of sodium or calcium as percentage of the RDA. However, females had a higher mean zinc intake as percentage of the RDA (87.66% RDA) than males (84.37% RDA) ($p \leq 0.003$). Conversely, males had higher mean iron intake (152.03% RDA; $p \leq 0.0003$) and vitamin D intake (39.11% RDA; $p \leq 0.003$) as percentage of the RDA than females (iron: 105.22% RDA; vitamin D: 26.86% RDA). Differences in mean intake of iron as a percentage of the RDA remained after data were transformed using the Box-Cox transformation.

Percentage of males and females to attain U.S. dietary goals for selected health-related nutrients during a 24-hour period are shown in Figure 48 and Table 28. U.S. dietary goals are as follows: a one-to-one ratio of polyunsaturated to saturated fat, total dietary fat intake less than or equal to 30.0% of energy, saturated fat intake less than or equal to 10.0% of energy, cholesterol intake of less than or equal to 300.0 mg, and a carbohydrate intake of greater than 50.0% of energy. Particularly low levels of attainment were seen for ratio of polyunsaturated fat to saturated fat ratio for males (6.0%) and females (13.0%), total dietary fat for males (21.0%) and females (11.0%), and saturated fat intake for males (32.0%) and females (18.0%). Close to half of the adolescents

attained dietary goals for cholesterol for males (47.0%) and females (45.0%) and for carbohydrate intake for males (57.0%) and females (46.0%). None of the males and females in this sample attained all five goals on the day surveyed.

Nutrient sources of total dietary fat are presented in Figures 49 (females) and 50 (males) and in Table 29. Meat comprised the largest percentage of total dietary fat for both females (40.0%) and males (43.0%). Dairy comprised the second largest percentage of total dietary fat for females (17.0%) and males (15.0%), which is surprising given the low calcium intake of these adolescents. The largest percentage of dairy foods came from high-fat cheeses for both females (60.0%) and males (58.0%). The remaining food sources of total dietary fat were desserts (males: 14.0; females: 13.0%), oils or table fats (males: 9.0%; females 11.0%), and chips (males: 7.0%; females: 11.0%). The remaining percentages of the food sources of dietary fat for females (8.0%) and males (12.0%) were comprised of a variety of other foods.

Nutrient sources of saturated fat are presented in Figure 51 (females) and 52 (males) and Table 30. Again, meat comprised the largest percentage of saturated fat for both females (36%) and males (38.0%). Dairy comprised the second largest percentage of total dietary fat for females (30%) and males (31.0%), largely from high fat cheeses for females (56.0%) and males (44.0%). The remaining food sources of saturated fat were desserts (females: 11.0%; males: 12.0%), oils or table fats (females: 11.0%; males: 6.0%), and chips (females: 7.0%; males: 5.0%).

Meat sources of total dietary fat are presented in Figure 53 (females) and 54 (males) and in Table 29. For males, the greatest percentage of total dietary fat came from

beef (26.0%) and fast-food (26.0%), followed by lunchmeats (19.0%), chicken (17.0%), and a variety of other foods (12.0%). For females, the greatest percentage of total dietary fat also came from fast-foods (28.0%) and beef (27.0%), lunchmeats (24.0%), chicken (14.0%), and from a variety of other foods (7.0%). Meat sources of saturated fat are presented in Figure 55 (males) and 56 (females) and in Table 30. For males, the greatest percentage of saturated fat came from beef (30.0%), fast-foods (23.0%), lunchmeats (21.0%), chicken (14.0%), and other foods (12.0%). For females, the greatest percentage of saturated fat came from beef (30.0%), fast-foods (25.0%), lunchmeats (25.0%), chicken (12.0%), and other foods (8.0%). For these adolescents, the greatest contributors of total and saturated fat from meat were the following: beef (largely hamburger meat), fast-food (mostly McDonald's and Kentucky Fried Chicken), and lunchmeats (bacon, ham, hot dogs, and sausage).

To summarize the above findings, there is some indication that West Philadelphia adolescents may over report energy intake. There was a significant relationship between BMI, energy intake, total dietary fat intake, and percentage of energy from total dietary fat. These adolescents had a high percentage of energy from total dietary fat and a high intake of protein, total dietary fat, and saturated fat relative to the RDA. Females had a significantly higher percentage of energy from total fat, polyunsaturated fat, and monounsaturated fat than males. Nutrient sources of total dietary fat included meat (ground beef, fast-foods, and lunchmeats), dairy (high fat cheeses), desserts, and chips. Macronutrient intake was high for female and males relative to the RDA and relative to NHANES III, African-American reference data. Micronutrient profile was excellent, with

the exception of sodium, vitamin D, fiber, zinc, and calcium, for which a significant percentage of the sample fell below the criterion for adequacy. Females had a significantly higher intake of zinc than males, whereas males had a significantly higher intake of iron and vitamin D than females. A substantial percentage of the total sample failed to attain dietary goals for reducing dietary-related cardiovascular risk. These data also indicate that these West Philadelphia adolescents had a low intake of a select group of micronutrients, which could impact nutritional and health status.

Table 21

Sample Size of 24-hour Dietary Recall Sample, by Age and Sex

AGE	Females	Males
11	33	16
12	51	47
13	42	53
14	38	35
15	10	19
TOTAL = 345	174	171

Table 22

Median Stature (cm), Weight (kg), and Recommended Energy Intake for West Philadelphia Adolescents Using Two Different Equations for Recommended Energy Intake, by Sex

Sex	Stature (cm)	Weight (kg)	REE ^a (kcal/day)	Multiples ^b of REE	Per kg	Per Day
Females ^c	157.67	53.1	1,393.82	1.67	43.84	2,327.68
Females ^d	157.67	53.1	1,374.58	1.67	43.48	2,295.55
Males ^c	156.24	48.47	1,499.23	1.70	52.58	2,548.68
Males ^d	156.24	48.47	1,501.20	1.70	52.48	2,552.04

^aCalculation based on WHO (1985) equations, see below.

^bDaily Energy Expenditure, using an activity factor (energy cost of activity) for schoolchildren, with a blend of light and moderate classes of activity as suggested by WHO (1985).

^cCalculated using weight (WHO, 1985) [Females: $12.2 \times \text{weight (kg)} + 746$; Males: $17.5 \times \text{weight (kg)} + 651$]

^dCalculated using stature and weight (WHO, 1985) [Females: $7.4 \times \text{weight (kg)} + 482 \times \text{stature (cm)} + 217$; Males: $16.6 \times \text{weight (kg)} + 77 \times \text{stature (cm)} + 572$]

Table 23

Comparison of Estimated Median Energy Expenditure and Reported Energy Intake, by Age and Sex

Age (years)	Expenditure kcal/day^a	Intake kcal/day
	<i>Females</i>	
11	2,136.78	2,528.50
12	2,282.86	2,475.00
13	2,338.48	2,707.50
14	2,411.62	2,711.00
15	2,525.92	2,081.00
11-15	2,327.68	2,569.00
	<i>Males</i>	
11	2,358.58	3,202.50
12	2,438.01	2,717.00
13	2,514.32	2,878.50
14	2,775.23	2,812.00
15	2,820.30	2,654.00
Total Sample	2,548.68	2,812.00

^aCalculation based on WHO (1985) equations using weight (WHO, 1985) [Females: $12.2 \times \text{weight (kg)} + 746$; Males: $17.5 \times \text{weight (kg)} + 651$], Multiples of REE (Females: 1.67; Males: 1.70)

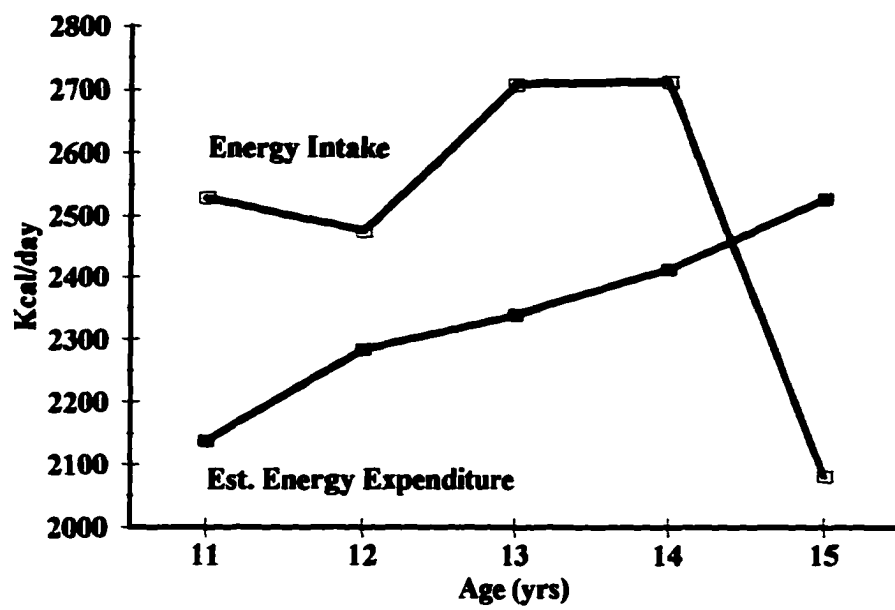


Figure 35. Median estimated energy expenditure relative to reported energy intake. Females by age. Energy intake exceeded estimated requirements at all ages, except at 15 years-of-age.

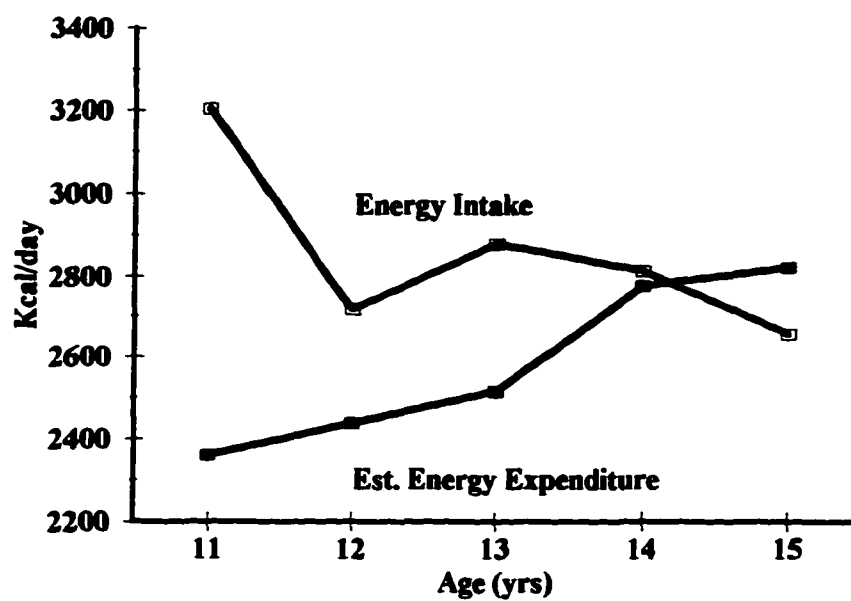


Figure 36. Median estimated energy expenditure relative to reported energy intake. Males by age. Energy intake exceeded estimated requirements at all ages, except at 15 years-of-age.

Table 24

Energy and Total Dietary Fat Intake Tertiles [Mean (SD)] by BMI Tertile

BMI Tertile ^a	N	Kcal	Fat	%Fat ^b
<i>Females</i>				
1	52	3,097.92 (1,264.4)	135.02 (64.71)	38.33 (7.67)
2	54	2,914.56 (1,417.05)	126.12 (63.83)	39.04 (7.04)
3	54	2,822.28 (1,514.15)	122.07 (72.70)	38.71 (7.46)
<i>Males</i>				
1	56	3,426.40 (1,470.72)	139.09 (65.44)	36.31 (6.94)
2	56	3,104.71 (1,416.83)	129.23 (67.19)	36.84 (7.58)
3	57	2,787.32 (1,104.89)	108.19 (55.78)	34.21 (7.21)

^a1 = Lowest BMI tertile; 3 = Highest BMI tertile

^bPercent of energy from total dietary fat

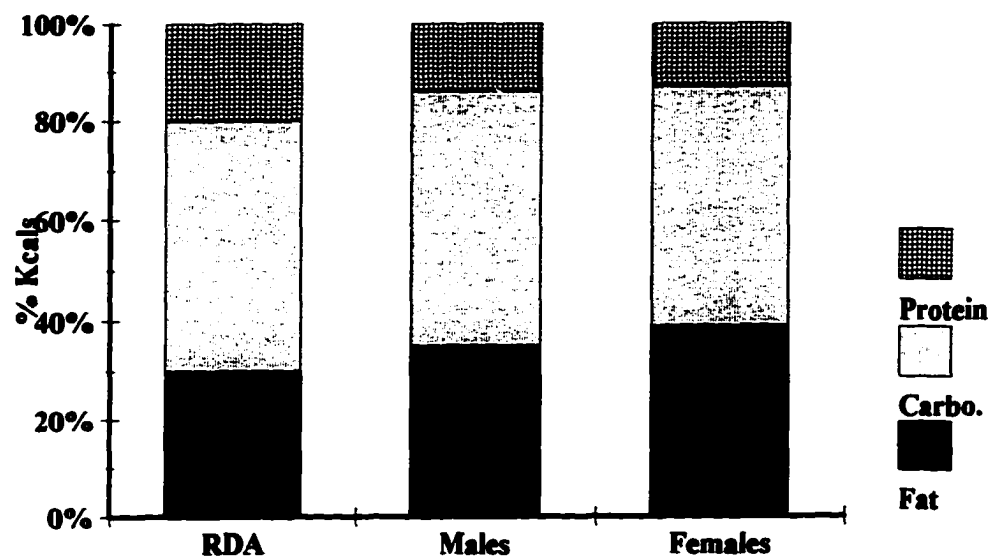


Figure 37. Median protein, carbohydrate, and total dietary fat intake as percentage of kilocalories. West Philadelphia females and males relative to 1989 U.S. RDA (National Research Council, 1989b). Males and females had a greater percentage of energy from total fat than recommended. Percentage of energy from carbohydrates was similar to, and protein less than, recommended.

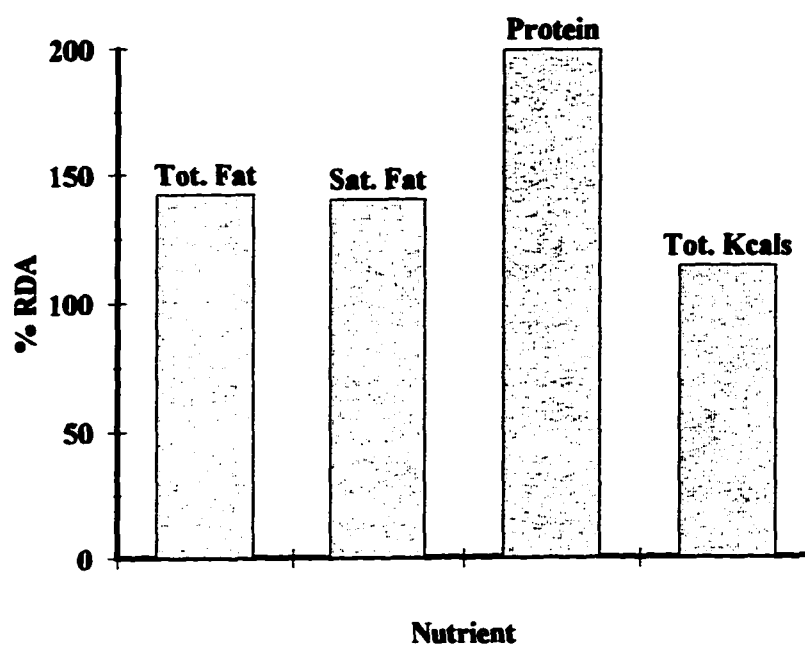


Figure 38. Median total dietary fat, saturated fat, protein, and total energy intake of West Philadelphia adolescents as percentage of 1989 U.S. RDA (National Research Council, 1989b). Energy intake was closest to recommendations, whereas total dietary fat, saturated fat, and protein intakes were considerably greater than recommended.

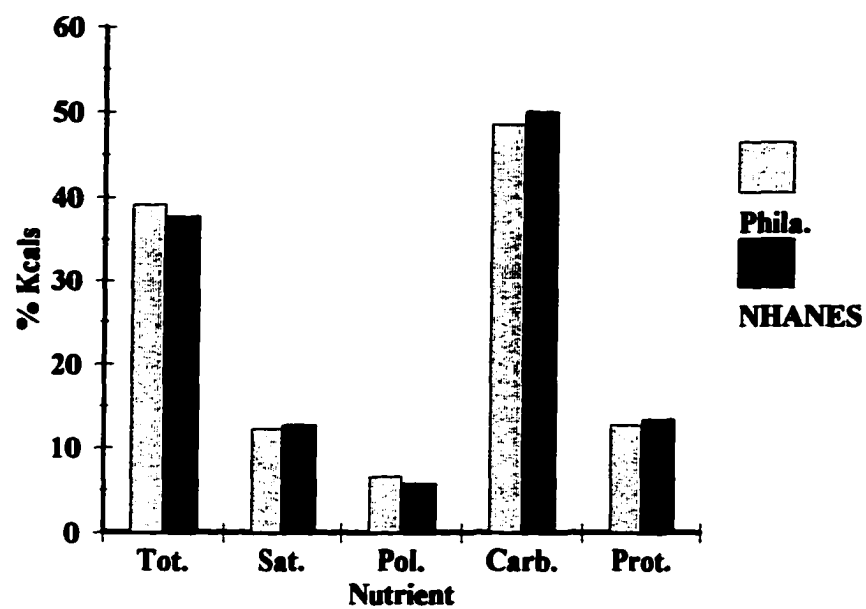


Figure 39. Median total dietary fat, saturated fat, polyunsaturated fat, carbohydrate, and protein intake as percentage of kilocalories. West Philadelphia females relative to NHANES III, African-American reference data (Life Sciences Research Office, 1995). Total dietary fat and polyunsaturated fat intake were greater for the West Philadelphia adolescents, whereas saturated fat, carbohydrate, and protein intake were greater for the NHANES III adolescents.

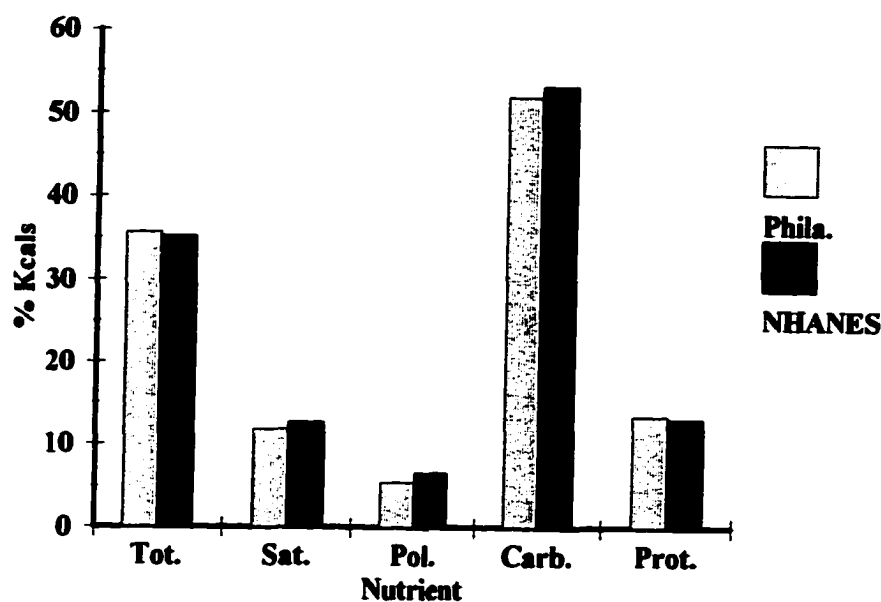


Figure 40. Median total dietary fat, saturated fat, polyunsaturated fat, carbohydrate, and protein intake as percentage of kilocalories. West Philadelphia males relative to NHANES III, African-American reference data (Life Sciences Research Office, 1995). Total dietary fat and protein intake were greater for the West Philadelphia adolescents, whereas saturated fat, polyunsaturated fat, and carbohydrate intake were greater for the NHANES III adolescents.

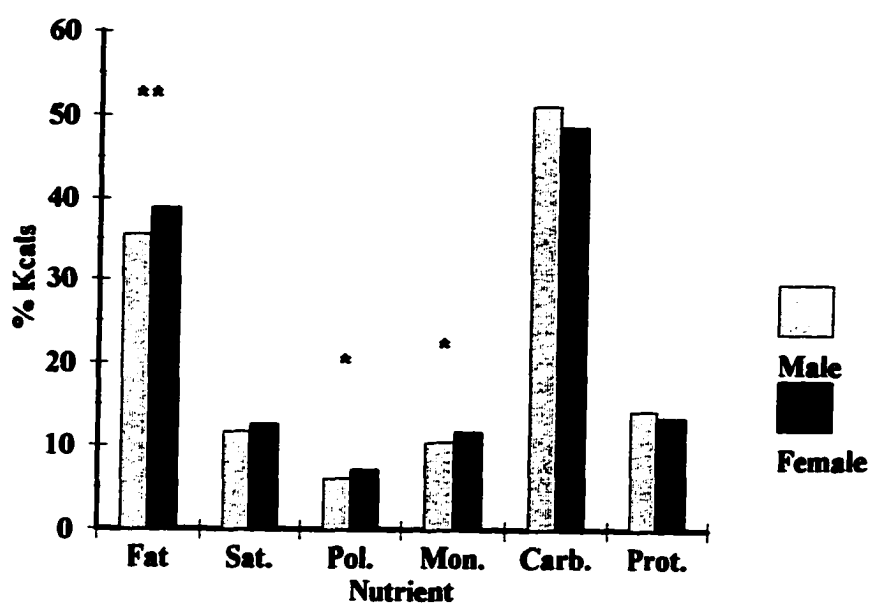


Figure 41. Mean total dietary fat, saturated fat, polyunsaturated fat, monounsaturated fat, carbohydrate, and protein intake for West Philadelphia adolescents as percentage of kilocalories for females and males. Females had higher mean intake of total dietary fat (** $p \leq 0.0001$; Box-Cox Transform, t-test), polyunsaturated fat, and monounsaturated fat (* $p \leq 0.002$; Mann-Whitney) than males.

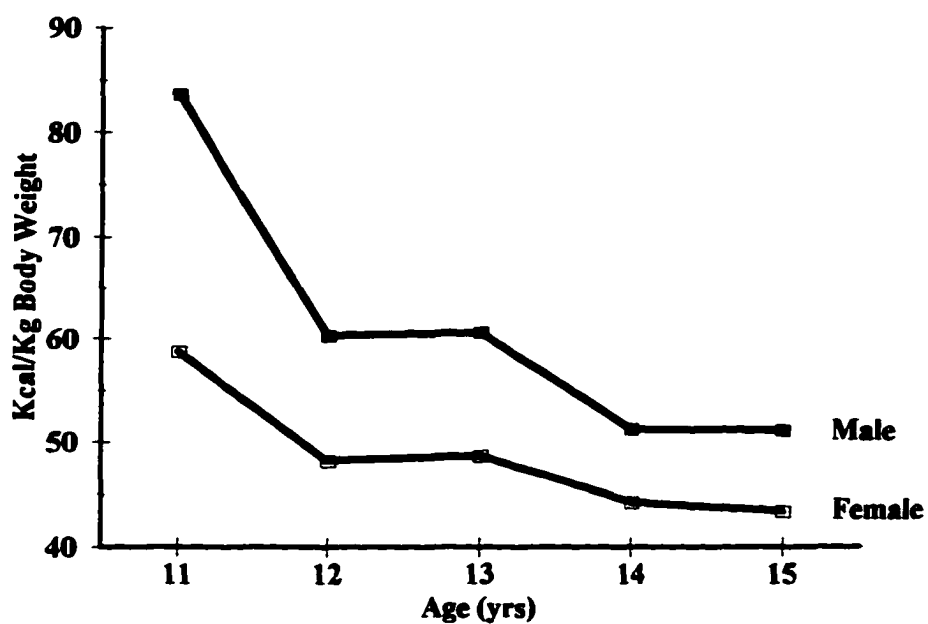


Figure 42. Median daily energy intake per kilogram of body weight. Females and males, by age. Median daily energy intake per kilogram of body weight was greater for males than females, and these values decreased over age.

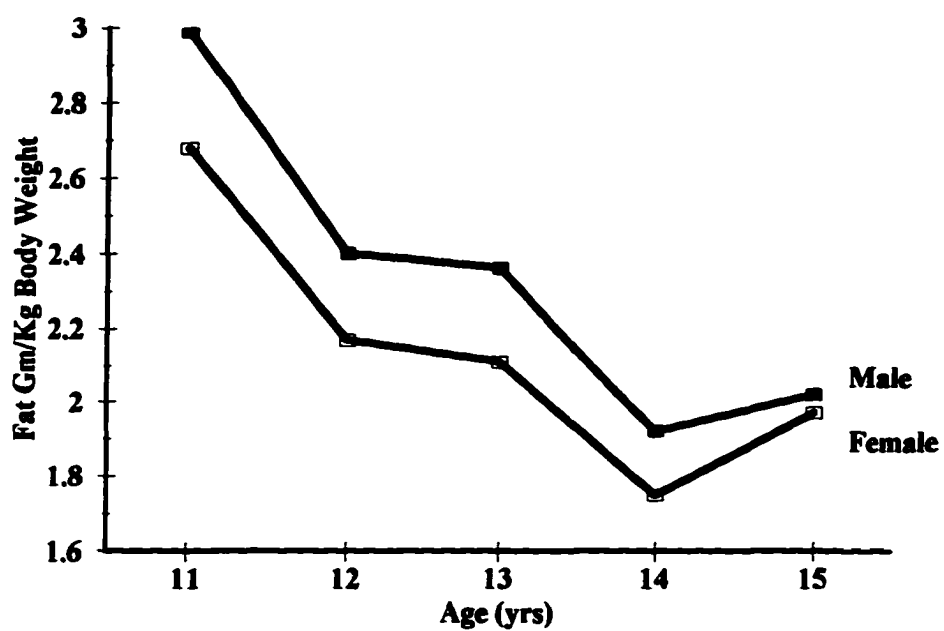


Figure 43. Median total fat intake per kilogram of body weight. Females and males, by age. Median daily total fat intake per kilogram of body weight was greater for males than females, and these values decreased over age.

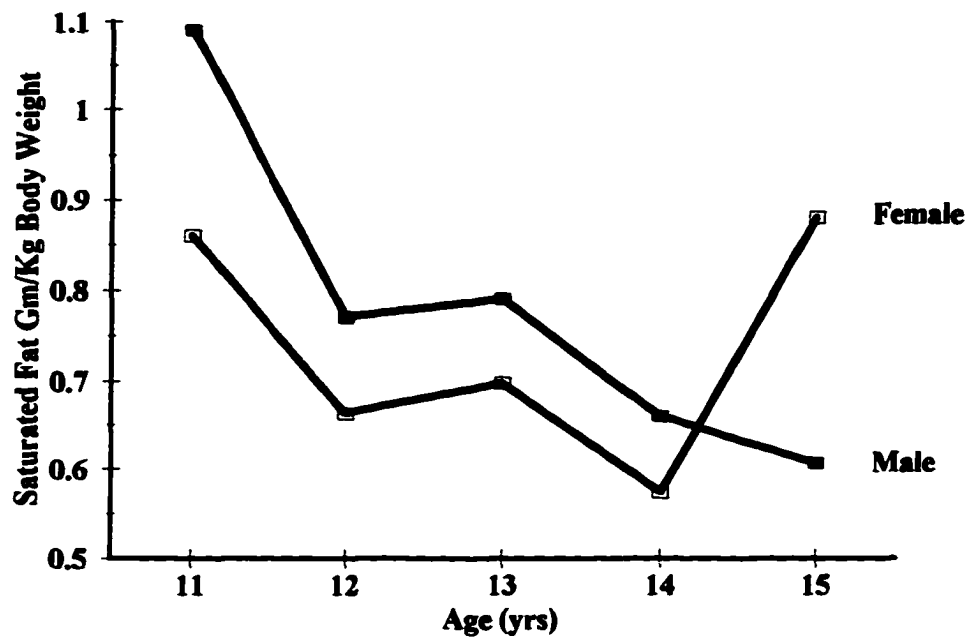


Figure 44. Median saturated fat intake per kilogram of body weight. Females and males, by age. Median daily saturated fat intake per kilogram of body weight was greater for males than females, except at 15 years-of-age, when values were greater for females than males.

Table 25

Medians and Interquartile Ranges (25th - 75th Percentiles) of Selected Nutrients as Percentages of 1989 RDA (National Research Council, 1989b)

Females

Nutrient	Median	Interquartile Range
Kilocalories (kcal)	114.05	93.77 - 166.05
Protein (g)	180.58	140.43 - 257.17
Total Dietary Fiber (mg)	9.11	5.89 - 13.60
Vitamin A ($\mu\text{g RE}$) ^a	76.99	45.34 - 160.50
Vitamin C (mg)	206.3	76.58 - 341.40
Vitamin D ($\mu\text{g RE}$) ^b	16.92	3.75 - 32.84
Folate (μg)	127.70	73.33 - 191.93
Thiamin (mg)	148.86	95.64 - 212.36
Niacin (mg NE) ^c	142.50	105.40 - 194.60
Vitamin B-6 (mg)	103.14	69.79 - 157.43
Vitamin B-12 (μg)	175.33	107.40 - 303.60
Potassium (mg)	116.65	82.90 - 160.35
Sodium (mg)	185.38	129.83 - 266.21
Iron (mg)	96.03	65.55 - 130.40
Calcium (mg)	58.81	35.30 - 85.25
Zinc (mg)	76.98	52.97 - 110.33

^aretinol equivalents. 1 retinol equivalent = 1 μg retinol or 6 μg β -carotene.

^bAs cholecalciferol. 10 μg cholecalciferol = 400 IU of vitamin D.

^c1 NE (niacin equivalent) is equal to 1 mg of niacin or 60 mg of dietary tryptophan.

Table 26

Medians and Interquartile Ranges (25th - 75th Percentiles) of Selected Nutrients as Percentages of 1989 RDA (National Research Council, 1989b)

Males

Nutrient	Median	Interquartile Range
Kilocalories (kcal)	113.20	92.52 - 145.56
Protein (g)	214.71	169.98 - 286.89
Total Dietary Fiber (mg)	10.30	6.70 - 15.72
Vitamin A ($\mu\text{g RE}$) ^a	65.21	41.47 - 134.50
Vitamin C (mg)	253.40	115.32 - 434.40
Vitamin D ($\mu\text{g RE}$) ^b	26.05	12.40 - 46.12
Folate (μg)	140.47	89.73 - 217.33
Thiamin (mg)	141.38	95.92 - 200.46
Niacin (mg NE) ^c	147.65	111.94 - 219.24
Vitamin B-6 (mg)	92.41	62.29 - 140.76
Vitamin B-12 (μg)	230.00	116.50 - 325.50
Potassium (mg)	134.75	94.50 - 180.00
Sodium (mg)	185.21	136.00 - 258.17
Iron (mg)	133.83	103.00 - 180.08
Calcium (mg)	67.60	45.36 - 101.92
Zinc (mg)	76.20	51.84 - 101.20

^aretinol equivalents. 1 retinol equivalent = 1 μg retinol or 6 μg β -carotene.

^bAs cholecalciferol. 10 μg cholecalciferol = 400 IU of vitamin D.

^c1 NE (niacin equivalent) is equal to 1 mg of niacin or 60 mg of dietary tryptophan.

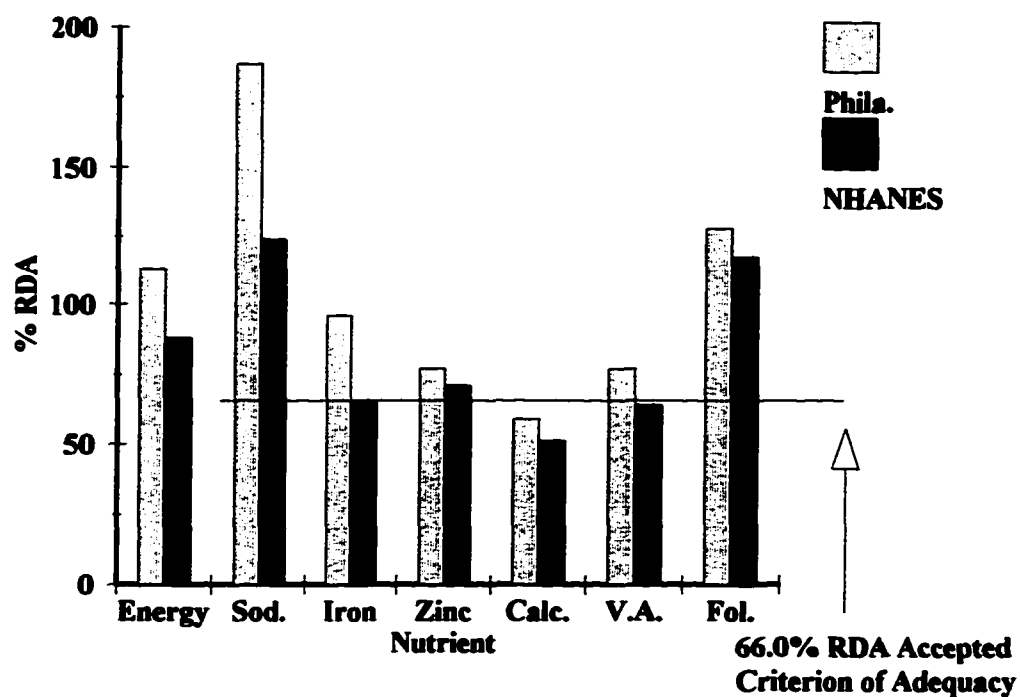


Figure 45. Median energy, sodium, iron, zinc, calcium, vitamin A, and folate intake as percentage of the 1989 U.S. RDA (National Research Council, 1989b). West Philadelphia females relative to NHANES III, African-American reference data (Life Sciences Research Office, 1995). West Philadelphia females had higher median intake of all nutrients, particularly sodium. Zinc, calcium, and vitamin A intake were at, or below the accepted criterion of adequacy (66.0% RDA).

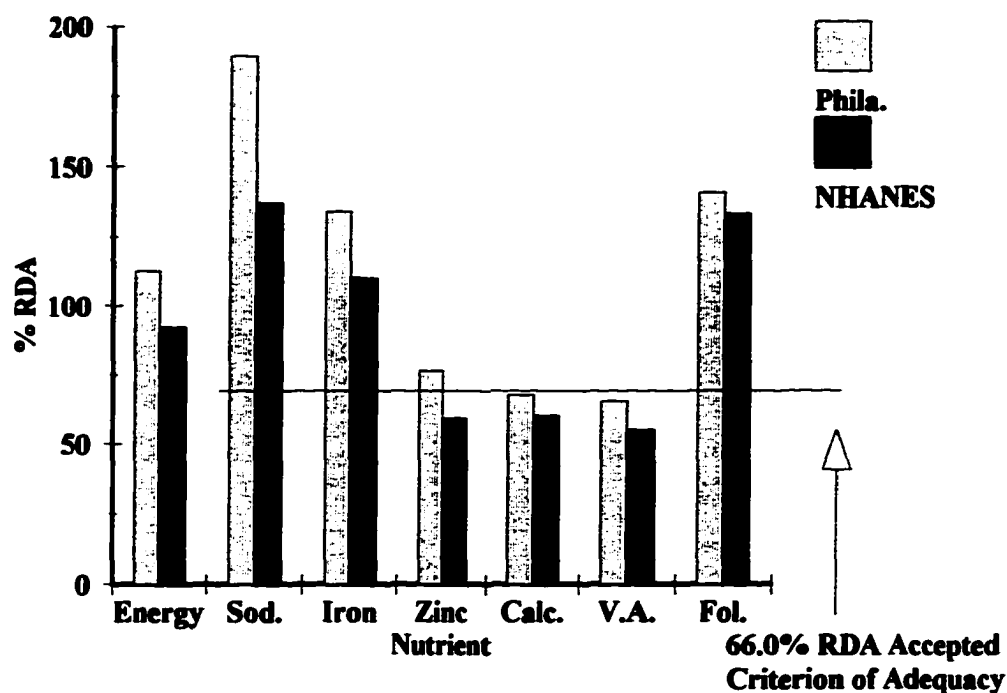


Figure 46. Median energy, sodium, iron, zinc, calcium, vitamin A, and folate intake as percentage of the 1989 U.S. RDA (National Research Council, 1989b). West Philadelphia males relative to NHANES III, African American reference data (Life Sciences Research Office, 1995). West Philadelphia males had higher median intake of all nutrients, particularly sodium. Zinc, calcium, and vitamin A intake were at, or below the accepted criterion of adequacy (66.0% RDA).

Table 27

Percentage of Sample to Fall Below Criterion of Adequacy (66.0% RDA) for Intake of Selected Nutrients, by Sex

Nutrient	Females	Males
Iron	25.0%	5.0%
Zinc	39.0%	40.0%
Calcium	56.0%	48.0%
Vitamin D	88.0%	85.0%
Vitamin A	31.0%	43.0%
Sodium	4.0%	2.0%
Total Dietary Fiber	74.0%	64.0%

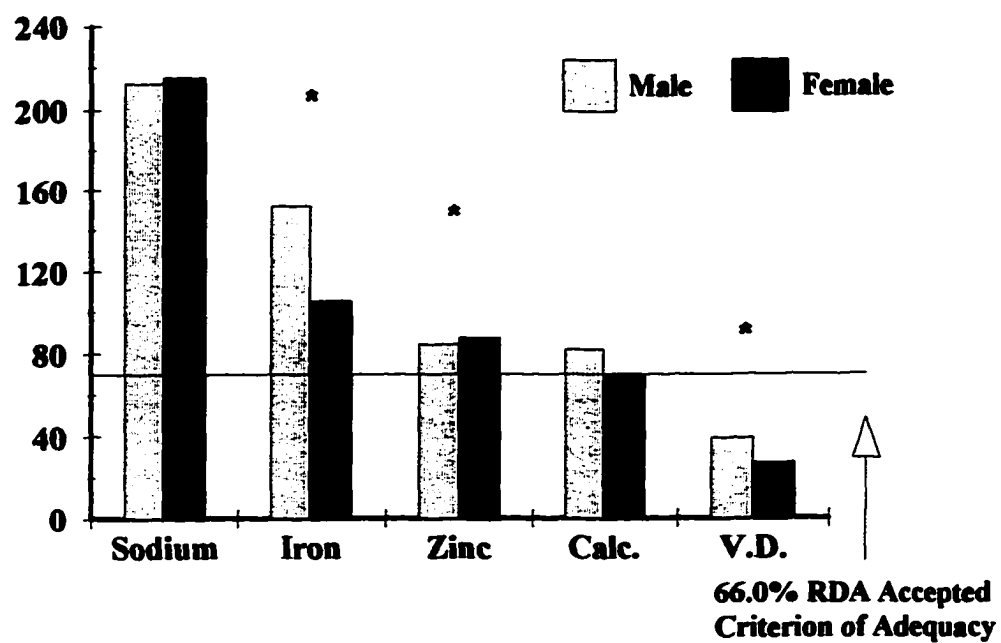


Figure 47. Mean sodium, iron, zinc, calcium, and vitamin D intake for West Philadelphia adolescents as percentages of the 1989 U.S. RDA (National Research Council, 1989b). Females had higher mean iron intake (* $p \leq 0.003$; Mann-Whitney) than males, whereas males had higher mean zinc intake (** $p \leq 0.0003$; Box-Cox Transform, t-test) than females.

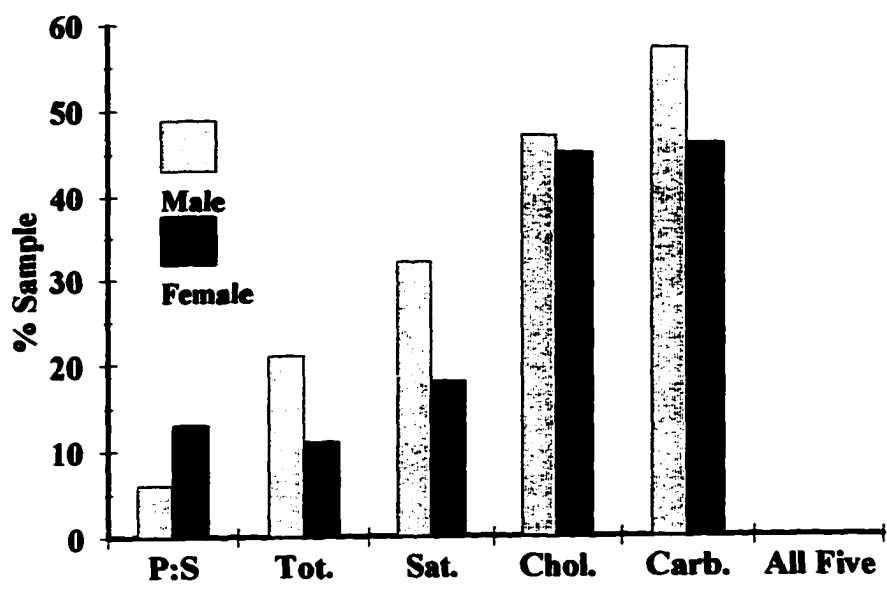


Figure 48. Percentage of the West Philadelphia female and male adolescents attaining the following U.S. Dietary Goals: a one-to-one ratio of polyunsaturated to saturated fat, total dietary fat intake less than or equal to 30.0% of energy, saturated fat intake less than or equal to 10.0% of energy, cholesterol intake of less than or equal to 300.0 mg, and a carbohydrate intake of greater than 50.0% of energy. A small percentage of these adolescents attained dietary fat-related goals. A large percentage of these adolescents attained goals for cholesterol and carbohydrate intake. More males than females attained these dietary goals, except for the ratio of polyunsaturated to saturated fat. None attained all five dietary goals.

Table 28

Percentage of West Philadelphia Adolescents Attaining U.S. Dietary Goals During a 24-Hour Period, by Sex.

Dietary Goal	Females	Males	Total
P:S Ratio > 1.0.0	13.0	6.0	10.0
Total. Fat Intake \leq 30.0% kcals	11.0	21.0	16.0
Saturated Fat Intake \leq 10.0% kcals	18.0	32.0	25.0
Cholesterol Intake \leq 300.0 mg	45.0	47.0	46.0
Carbohydrate Intake > 50.0% kcals	46.0	57.0	51.0
All Five Goals Met	0	0	0

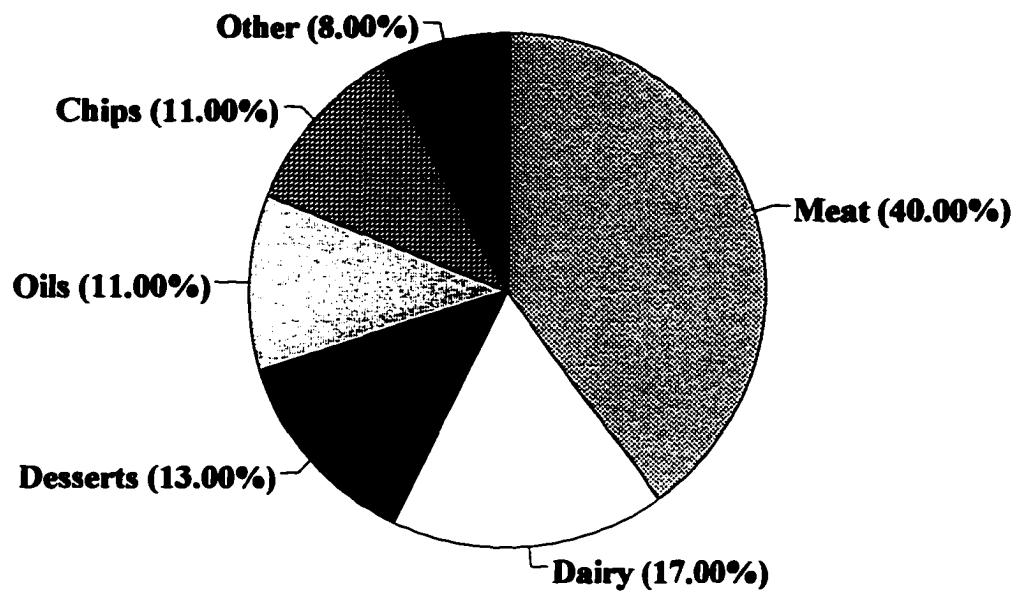


Figure 49. Nutrient sources of total dietary fat for West Philadelphia females. Meat comprised the largest percentage of total dietary fat, followed by dairy, desserts, oils or table fats, and chips.

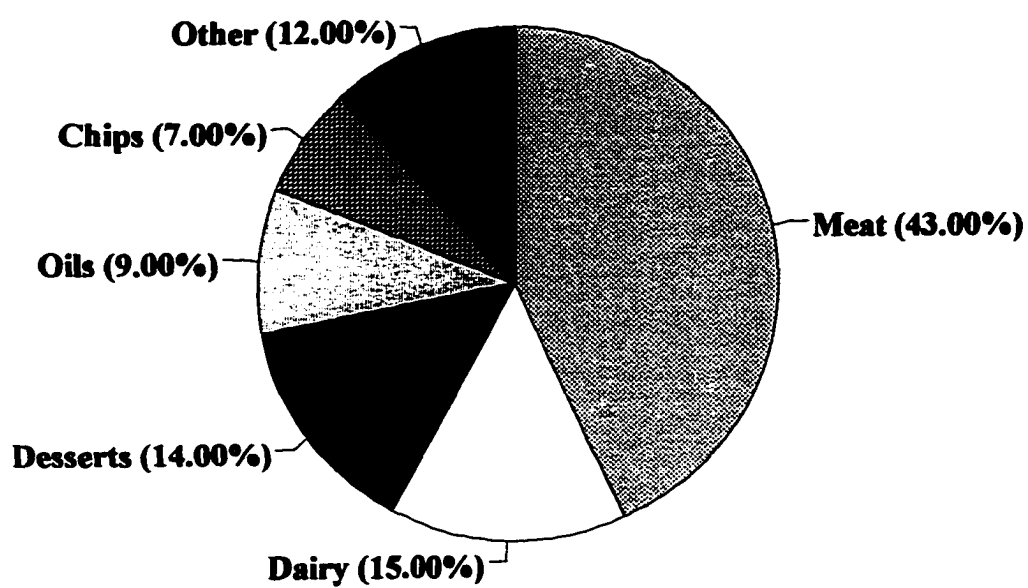


Figure 50. Nutrient sources of total dietary fat for West Philadelphia males. Meat comprised the largest percentage of total dietary fat, followed by dairy, desserts, oils or table fats, and chips.

Table 29

Nutrient Sources of Total Dietary Fat (Percentages), by Sex

	Females	Males
Meat	40.0	38.0
Beef	27.0	30.0
Fast-food	28.0	23.0
Lunchmeats	24.0	21.0
Fried Chicken	14.0	14.0
Dairy	17.0	31.0
Cheese	60.0	44.0
Desserts	13.0	12.0
Oils	11.0	6.0
Chips	11.0	5.0

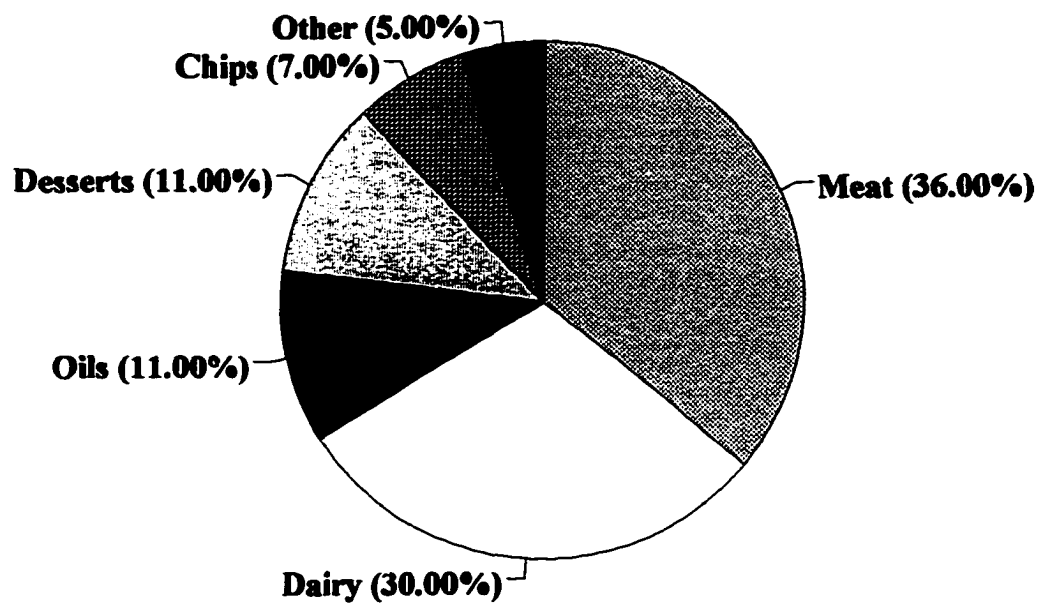


Figure 51. Nutrient sources of saturated fat for West Philadelphia females. Meat comprised the largest percentage of saturated fat, followed by dairy, desserts, oils or table fats, and chips.

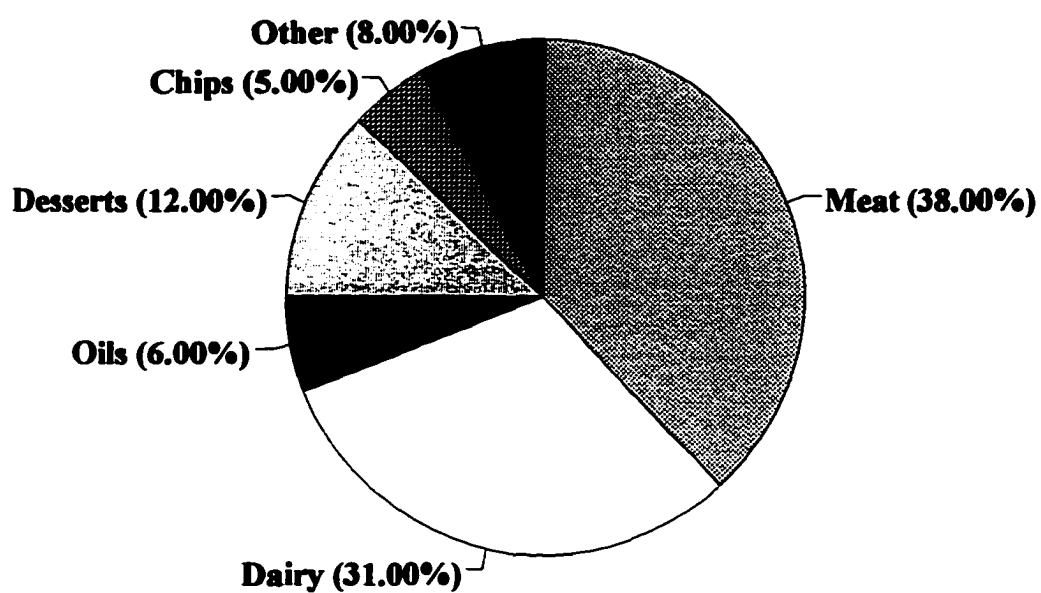


Figure 52. Nutrient sources of saturated fat for West Philadelphia males. Meat comprised the largest percentage of total dietary fat, followed by dairy, desserts, oils or table fats, and chips.

Table 30

Nutrient Sources of Dietary Saturated Fat (Percentages), by Sex

	Females	Males
Meat	36.0	38.0
Beef	30.0	30.0
Fast-food	25.0	23.0
Lunchmeats	27.0	21.0
Fried Chicken	12.0	14.0
Dairy	30.0	31.0
Cheese	56.0	44.0
Desserts	11.0	12.0
Oils	11.0	6.0
Chips	7.0	5.0

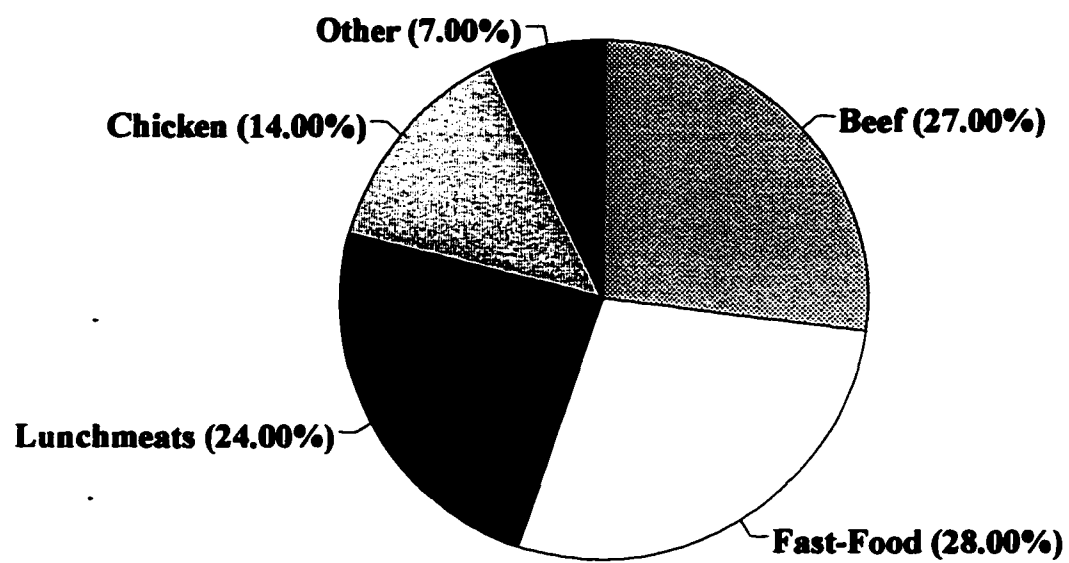


Figure 53. Nutrient sources (meat) of total dietary fat for West Philadelphia females. The greatest percentage of meat sources of saturated fat came from fast-foods, beef, lunchmeats, and chicken.

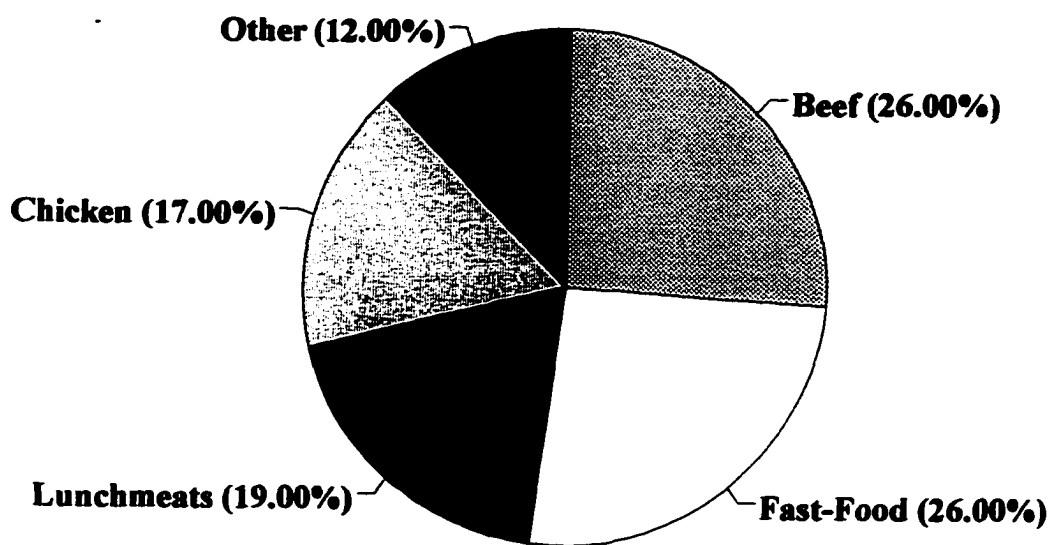


Figure 54. Nutrient sources (meat) of total dietary fat for West Philadelphia males. The greatest percentage of meat sources of saturated fat came from fast-foods, beef, lunchmeats, and chicken.

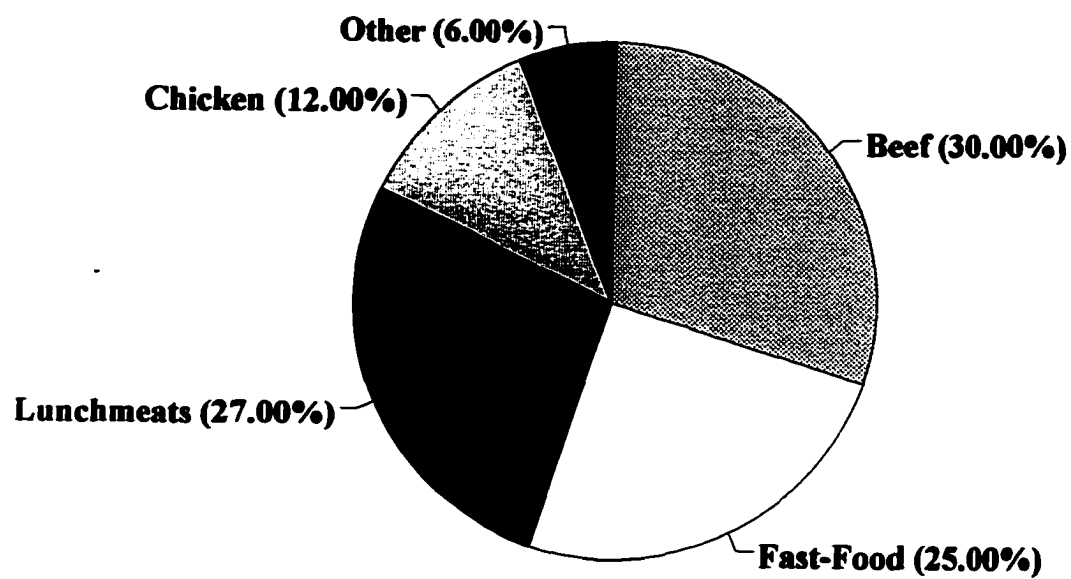


Figure 55. Nutrient sources (meat) of saturated fat for West Philadelphia females. The greatest percentage of meat sources of saturated fat came from beef, lunchmeats, fast-foods, and chicken.

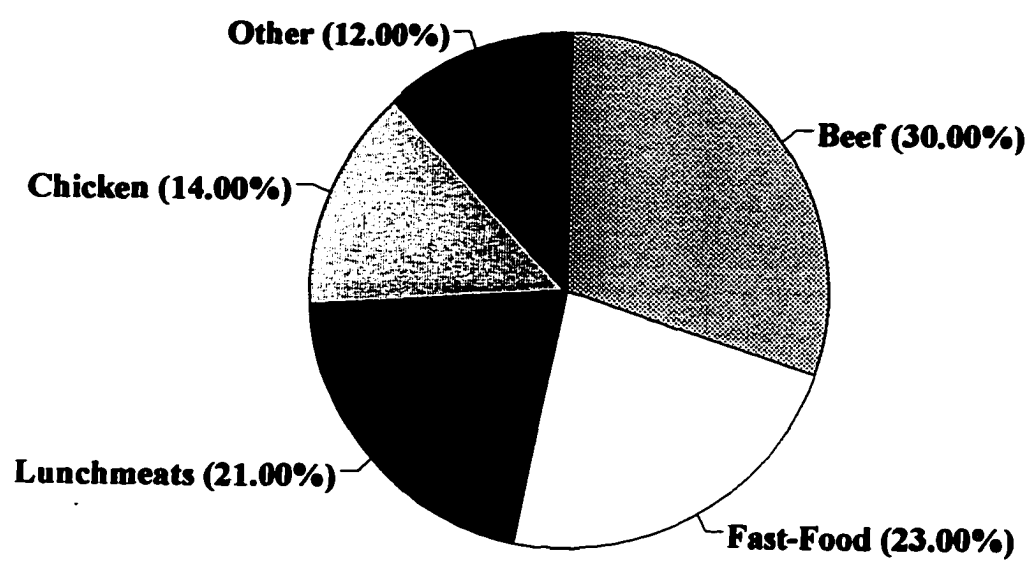


Figure 56. Nutrient sources (meat) of saturated fat for West Philadelphia males. The greatest percentage of meat sources of saturated fat came from beef, fast-food, lunchmeats, and chicken.

CHAPTER 6

RESULTS: SOCIODEMOGRAPHIC CORRELATES OF OBESITY

PHYSICAL ACTIVITY AND TELEVISION VIEWING

Sociodemographic data provide information about the sociocultural context of obesity in West Philadelphia adolescents and are thus a necessary component of this ecological study. Factors such as household characteristics, household composition, region of birth of the adolescents and parents, occupational status of parents, and household material goods are important elements of the home and family environments. Furthermore, sociodemographic factors potentially impact physical activity and dietary patterns, and thus, obesity status. In addition, after-school snacking habits, physical activity, and sedentary activity patterns have a direct impact on obesity status.

Sociodemographic data and data on physical activity and television viewing data were based on an interview-administered questionnaire given to 305 adolescents (151 females, 154 males). This chapter provides data on household characteristics, household composition, region of birth of the adolescents and their parents, occupational status of parents, household material goods, after-school snacking habits, physical activity, and sedentary behavior.

Sociodemographic Correlates of Obesity

Household characteristics are shown in Table 31; 86.18% of the sample lived in a house, whereas 13.49% lived in an apartment. In addition, 70.33% of these adolescents live in family-owned homes, and 29.18% had lived in their home for more than ten years at the time of interview. These household characteristics suggest that this West Philadelphia neighborhood is relatively stable. In addition, close to half of the sample (45.90%) lived in a home with more than seven rooms.

Data on household composition, or the categories and numbers of individuals living in the adolescents' households, are presented in Table 32. The majority (89.8%) of the total sample reported living with their mother, and just under half reported living with their father (47.04%) or with both mother and father (44.26%). A very small percentage of adolescents lived with neither their mother nor father (7.54%). Data indicate that 16.45% of these adolescents had no siblings and 49.01% lived with two or more siblings in the same household. The adolescents' households were often comprised of immediate family members as well as non-related individuals. Close to half of the total sample (42.11%) lived with at least one non-nuclear relative (in addition to one parent) and 35.49% of the total sample lived with more than two non-nuclear relatives (in addition to one parent). In terms of the extended family, 18.42% of the total sample lived with at least one grandparent and 7.57% lived with two grandparents.

The adolescents were asked to recall their own birthplace and the birthplace of their parents; these data are presented in Table 33. The majority of adolescents (84.87%) and their mothers (65.81%) and fathers (68.75%) were born in Philadelphia. A small

percentage (3.62%) of adolescents (3.62%), their mothers (13.97%) and fathers (13.02%) were born in the South. Another small percentage of adolescents (7.89%), their mothers (12.87%) and fathers (9.90%) were born in other American regions, excluding Philadelphia and the South. A very small percentage of adolescents (3.62%), their mothers (5.51%) and fathers (8.33%) were born outside of the U.S.

Data on occupational status of parents are presented in Table 34. The majority of mothers (51.65%) and fathers (69.29%) worked full-time and a smaller percentage of mothers (23.08%) and fathers (16.43%) worked part-time. A moderate percentage of mothers (23.44%) and fathers (10.71%) were unemployed and an even smaller percentage of mothers (1.83%) and fathers (3.57%) were laid off.

Percentages of the sample to own a given number of specified household material goods are presented in Table 35. The majority of households (total sample) reported that they had three or more television sets (53.30%), two or more video cassette recorders (86.09%), cable television (67.88%), and one or more compact disc players (57.62%). Close to half of the total sample had one or more Sega video games (49.01%). More than half of the sample had one or more cars (64.24%) and two or more bicycles (53.31%). Just under one-half of the sample had one or more pets (44.04%). A total material goods score was calculated by adding the total number of material goods listed in Table 35, with the exception of pets. Approximately half of the sample (48.2%) had more than 15 of these material goods.

After-school snacking habits are shown in Table 36. The majority of adolescents in the total sample (75.83%) reported that they lived in households where an adult was

home after school. Over half of the female (54.25%) and male (65.33%) adolescents reported that they snacked at home after school as opposed to purchasing snack foods outside of the home. More males (41.81%) than females (31.33%) reported snacking outside of the home after school. Under a third of the adolescents (25.64%) stated that they ate fast-food more than two times per week. The percentage of males (23.33%) to eat fast-food more than two times per week was slightly greater than that of females (19.23%).

Physical Activity and Television Viewing

Using the Activity Rating Scale, adolescents were asked the following question, "Compared to others of your same age and sex, how much physical activity do you get?" (Sallis et al., 1988b: 935); results are shown in Table 37. Less than half of these adolescents (38.15%) reported that they participated in more physical activity than their peers. Figures were similar for females (36.42%) and males (39.87%). A smaller percentage of adolescents (19.73%) reported that they participated in less physical activity than their peers. More males (21.57%) than females (17.88%) reported that they engaged in less physical activity than their peers.

Adolescents were also asked to rank their own level of physical activity (Table 37). The majority of adolescents reported that they considered themselves to be "sometimes" or "often" active (total sample: 67.43%; females 72.18%; males 62.75%). A small percentage of adolescents (31.25%) considered themselves to be "always" active. More males (37.25%) than females (25.16%) considered themselves to be "always" active.

Approximately half of the males in the sample (53.59%), and close to one-third (37.09%) of the females reported that they participated in a team sport. The category “team sport” included formal leagues, drill teams, and informal teams, such as neighborhood, after-school teams, and church teams. Adolescents also reported the number of hours that they engaged in light and moderate physical activity. Less than half (47.53%) of the total sample reported that they engaged in physical activity less than 20 minutes in duration or less than three times per week (light activity) and over one-fourth (27.18%) of the total sample reported that they engaged in physical activity for a total of 20 or more minutes in duration, three or more times per week (moderate activity). There were significant sex differences in reported light (χ^2 , $p \leq 0.0001$) and moderate (χ^2 , $p \leq 0.0001$) physical activity. Males reported that they had higher levels of light (45.57%) and moderate (20.88%) activity than females (light: 33.51%, moderate: 12.18%).

Intensity of physical activity and television watching are shown in Tables 38 and 39. Under a third of the adolescents (19.35%) who considered themselves to be moderately active watched five or more hours of television per day (Table 38). Conversely, 80.65% of adolescents who considered themselves to engage in light activity watched five or more hours of television per day (Table 39). Among the moderate exercisers, more males (24.53%) than females (15.49%) watched five or more hours of television a day (Table 38). Among the light exercisers, more females (84.51%) than males (75.47%) watched five or more hours of television a day (Table 39).

Summary

Data presented in this chapter indicate that these adolescents came from a basically stable neighborhood in terms of home ownership, length of time residing in residence, and family history in Philadelphia. In large part, these adolescents lived with their mothers, had many siblings, and lived in extended-family households. More than half of the adolescents' mothers and fathers worked full-time and the majority of adolescents had adult supervision after school. In addition, these adolescents had a significant number of material goods, suggesting that their households had some disposable income. A significant percentage of the sample reported that they consumed fast-food twice a week and consumed snack foods outside of the home. However, the majority of adolescents consumed after-school snacks at home. On average, these adolescents had a low level of exercise and high frequency of television watching. In addition, there was a negative association between television viewing and physical activity level. Detailed information about physical activity and television viewing habits are necessary to further develop an understanding of the physical and sedentary activity patterns of these adolescents.

Table 31

Household Characteristics, by Sex

Household Variable	Female	Male	Total Sample
House	86.0%	86.36%	86.18%
Apartment	14.0%	12.99%	13.49%
Family-Owned Residence	73.15%	67.55%	70.33%
More than 10 Years Living in Residence	29.80%	28.57%	29.18%
Residence Has Less than 7 Rooms	46.36%	45.45%	45.90%

Table 32

Household Composition, by Sex

Percent of Students to Live with the Following Individuals	Female	Male	Total Sample
Mother	90.07%	89.54%	89.80%
Father	43.71%	50.33%	47.04%
Both Parents	41.72%	46.75%	44.26%
Neither Parent	7.95%	7.14%	7.54%
No siblings	17.22%	15.69%	16.45%
More Than 2 siblings	50.99%	47.06%	49.01%
At Least One Relative Not of the Nuclear Family	43.05%	41.18%	42.11%
More Than Two Relatives Not of the Nuclear Family	13.25%	23.73%	13.49%
One grandparent	18.54%	18.30%	18.42%
Two grandparents	8.61%	6.54%	7.57%

Table 33

Region of Birthplace for West Philadelphia Adolescents and Their Parents

Region	Student	Mother	Father
Philadelphia	84.87%	65.81%	68.75%
South of Philadelphia	3.62%	13.97%	13.02%
Other Regions of the U.S.	7.89%	12.87%	9.90%
Non-U.S.	3.62%	5.51%	8.33%

Table 34

Occupational Status of Mother and Father

Occupational Status	Mother	Father
Unemployed	23.44%	10.71%
Full-Time	51.65%	69.29%
Part-Time	23.08%	16.43%
Laid-Off	1.83%	3.57%

Table 35

Household Material Goods, by Sex

Material Good	Females	Males	Total Sample
Three or More Television Sets	51.33%	51.31%	53.30%
At Least One VCR	86.00%	86.18%	86.09%
At Least One Sega Video Game	50.66%	47.33%	49.01%
Household has Cable Television	66.00%	69.74%	67.88%
At Least One Car	62.67%	65.79%	64.24%
At Least One CD Players	51.33%	63.82%	57.62%
Two or More Bicycles	50.67%	55.92%	53.31%
One or More Pets	40.00%	48.03%	44.04%
More Than 15 of the Material Goods Above (Except Pets)	47.68%	48.70%	48.20%

Table 36
After-School Snacking Habits, by Sex

Characteristic	Females	Males	Total Sample
Adult is Home After School	74.83%	76.82%	75.83%
Snack at Home	65.33%	54.25%	59.74%
Snack Outside of Home	31.33%	41.18%	36.30%
Fast Food Eaten More than Two Times Per Week	19.23%	23.33%	25.64%

Table 37

Physical Activity and Television Viewing, by Sex

Activity	Females	Males	Total Sample
Less Activity Than Peers	17.88%	21.57%	19.73%
More Activity Than Peers	36.42%	39.87%	38.15%
Considered Self to be "Sometimes" or "Often" Active	72.18%	62.75%	67.43%
Considered Self to be "Always" Active	25.16%	37.25%	31.25%
Engaged in Light Activity ^a	33.51% ^b	47.54%	47.53%
Engaged in Moderate Activity ^c	12.18% ^b	20.88%	27.18%
Participated in a Team Sport	37.09%	53.59%	45.39%
Watched Five or More Hours of Television Per Day	49.16%	40.64%	46.36%

^a Light Activity: Any physical activity done for less than 20 minutes or less than three times per week.

^b Significant sex difference (χ^2 , $p \leq 0.0001$)

^c Moderate Activity: Any physical activity done for a total of 20 or more minutes three or more times per week.

Table 38

Percentage of Students who Engaged in Moderate Physical Activity^a, by Hours of Television Watched on One Day and Sex

	One-Two Hours	Two-Three Hours	Five or More Hours
Females	13.79%	6.52%	15.49%
Males	32.43%	25.42%	24.53%
Total Sample	24.99%	17.31%	24.24%

^aTotal of 20 or more minutes three or more times per week

Table 39

Percentage of Students who Engaged in Light Physical Activity^a, by Hours of Television Watched on one Day and Sex

	One-Two Hours	Two-Three Hours	Five or More Hours
Females	86.21%	93.48%	84.51%
Males	67.50%	74.58%	75.47%
Total Sample	75.76%	82.86%	80.65%

^aLess than 20 minutes three or more times per week

CHAPTER 7

RESULTS: FOCUS GROUP DISCUSSIONS

This chapter reports the results of twelve focus group discussions (nine female and three male groups). These focus group discussions generated some valuable information about the cultural concept of obesity held by these adolescents. Several themes emerged during the focus group discussions, including eating habits, definition of obesity, the concept of attractiveness, dieting behaviors, and health concerns associated with body shape and size.

Eating Habits

In general, the Turner students' favorite foods were foods high in fat. All focus groups mentioned the following foods in their lists of favorites: cheesesteaks, hoagies, fried chicken, stromboli, junk food (chips and snack foods), donuts, and Checkers (fast-food chain comparable to McDonald's). In addition, all groups reported that healthy food was generally "nasty food." All groups of students distinguished between snacking and eating meals and all reported a high level of snack relative to meal consumption. Meals were considered to be combinations of different types of foods, examples given were "Fried chicken, mashed potatoes, macaroni and cheese, and ice cream," "Barbecue ribs, rice, corn, peach cobbler," and "Turkey, stuffing, cranberry sauce, and pie," or even

“Cheesesteak,” or “Pizza.” Conversely snacks that were considered “junk” included “chips,” “Tastykakes” (snack cakes), or “Oodles of Noodles” (soup and noodle mix).

In the focus group discussions, the majority of students reported that they had sit-down dinners each night and family breakfasts each morning. Lunch was the most variable meal and students reported that they consumed a variety of snack foods and meals for lunch. At Turner, the school lunch program provided a federally subsidized lunch free of charge for each student as part of the Chapter One program. In the school lunchroom there was also a parent-run snack stand that sold Tastykake snack cakes and soft pretzels (with and without processed cheese food) each day during the lunch period. In addition, there were also several vending machines, also managed by the parent association, that offered juice drinks, ice cream, packaged salty snacks, and packaged snack cakes. Overall, students did not eat the free lunch provided by the school but opted to either purchase foods offered in the school lunch room or bring their own food from outside of school. This was particularly true for female students who agreed that school lunch was “nasty.” Jason, a sixth grader, stated that, “Girls don’t eat the lunch. They just be chilling, eating some snacks.” The female students stated that their male counterparts were more likely to eat school lunch, and the male groups confirmed this pattern. All groups of students called the school lunch, “freebies” referring to the federally subsidized program, and “you eat freebies” was a common insult, particularly used by female students. However, one student, Quiyanna, a seventh grader, stated, “I eat the school lunch. When you are hungry, you don’t care what your friends be saying, you just eat it.”

All students reported snacking between meals. Most students purchased snacks

with money given to them by their parents. The students stated that they stopped at corner stores on the way to and from school. These corner stores sold snack items as well as larger food items, such as cheesesteaks, hoagies, or pizzas. One student, Kia, a seventh grader, described the typical pattern,

I eat a big breakfast at home, sausages, eggs, pancakes. After that, I walk to school with my homegirls and we stop at the corner store and get chips and donuts on the way. Then, we be chilling and eating -- talking and all. Sometimes, I buy five or six bags of Mr. G's (potato chips) and I eat three and then save the other two for lunch. Then, I buy me a big 20 oz juice, like kiwi-strawberry (Snapple) and I drink that too.

The estimate of energy and total fat intake of the foods that Kia reported consuming during one morning totaled 1,814.0 kilocalories and 88.5 grams of total dietary fat (Table 42). A one ounce bag potato chips cost 25 cents and a 20 ounce Snapple cost \$1.20. Thus, the snacks that Kia consumed totaled \$2.70. This one example illustrates a pattern of high-fat, energy-dense, and somewhat inexpensive snack consumption commonly reported by these students. The cost of the above snack foods, while moderately inexpensive, can add to a considerable amount of money over time, \$13.50 per week per child and \$54.00 per month per child. However, just one dollar each day would allow an adolescent to purchase two 2 oz. bags of potato chips and a hug (a small juice drink similar to Kool-aid), which would provide 545.25 kilocalories and 19.56 grams of fat.

The corner stores, particularly those close to the Turner school were often full of students before and after school. One store, 'C and M,' which was located directly across

from Turner, had a line of students outside of its doors each day before and after school. Each day, the store owner allowed only 15 students to enter the store at a time for approximately five minutes. Each five minutes a new group of students was allowed to enter the store to purchase snacks. Once school started, the shelves of 'C and M' were frequently empty and had to be restocked for the after-school customers.

Definition of Obesity

All groups expressed an understanding of the concept of obesity and a concern for being "too large." However, the students expressed a general tolerance towards overweight and reserved the concept of obesity to denote people who were markedly or morbidly obese. In general, the students demonstrated a sense of comfort with their own bodies and several focus group discussions led to competitions during which individuals argued that they were extremely, if not the most, attractive person in the group. Many of the students selected by their peers as examples of "attractive" adolescents had high body mass indices.

When asked about the most attractive body size, students agreed that neither thin, nor fat, were preferable. Bernice, a sixth grader, stated that, "It is best to be medium size. If you are too skinny, you get injured easier. If you are too fat, you get diseases." Sahkia, an eighth grader, reported, "You don't want to be skinny, down to the bone. If you look like that you look boney, like you don't eat, your bones stick out. Its nasty." In discussions about overweight and obesity, several students made reference to morbidly obese people. Aundrey, a seventh grader, explained, "Obese people are those on talk

shows, you know that can't get out of the house." Or, as another student, Taneisha, a sixth grader, explained, "A lot of fat people can't hug, have to use canes to walk, can't walk." Almost all groups agreed that it was best to be "pleasantly plump."

During one focus group discussion about concepts of attractiveness, one group of eighth grade females started a competition and several shouted, "I am the most attractive." This group of students took turns prancing around the circle, "showing off their goods." In this group, there were two students, Tiffany (BMI: 32.2) and Sherrita (BMI: 33.1) with BMI values falling above the 95th percentile of age- and sex-specific reference curves (NHANES I). There was also a female, Niche (BMI: 16.7), who was very thin. After this group of females returned to class, a group of their male classmates engaged in a focus group discussion. These males remarked on the attractiveness of their female classmates and agreed that Tiffany and Sherrita were the "best looking," while Niche was "not attractive at all."

Similarly, another group of students used their classmates as examples to illustrate their concept of ideal body size. The group thought that their classmates, Kai (BMI: 21.5), Christina (BMI: 20.3), Monaye (BMI: 21.4), and Ebony (BMI: 16.9) were skinny or "boney," while Remi (BMI: 28.3) was considered "pleasantly plump." One particular group of seventh grade girls was interested in what I looked like. In order to judge, they wanted me to lift my long skirt up to my knees so they could see my calves. After doing so, they all agreed that I (BMI: 22.0) was "too skinny" and my assistant, Jessica (BMI: 24.3) was "fine."

Although the students expressed tolerance for larger body shapes, they did have an

upper limit of obesity that defined excess weight/body fat. Latifah, an eighth grader, explained,

There's this really fat lady who lives on my street. She be wearing tights and tank tops and you be seeing layers of fat poking out in between the tank top and the tights. Its trifling. If she would wear the right clothes, she wouldn't look so ugly.

Latoya, also in eighth grade, agreed, "Its no big deal to be a little fat, but dag if you're that big you should at least try." In describing the upper limit of acceptance, Clarissa, a sixth grader, explained, "Roseanne (Barr) [a television comedienne], that's an example. She is too large, she be needing to lose some weight."

Several themes emerged regarding cultural meaning associated with body shape and size. For example, Angela, a sixth grader, stated, "If you be skinny, real boney, people be thinking you a piper (crack user)." This concept was mentioned in all groups. Malik, a seventh grader, said that, "My friend told me that its good that you are fat because that means that you have a lot of food in your house." Another concept mentioned in several groups was that of self-defense. Khaliah, a seventh grader, reported, "If you are too boney, you can get hurt easier. If you are fat (and attacked) you can just jump on them and get away." Similarly, Eneke, a seventh grader stated "You don't want to be too small. If somebody messes with you, you know you better fight back."

The Concept of Attractiveness

Much discussion about attractiveness centered on actresses on television. Many

groups of students felt that television actresses do not often meet their concept of ideal body size. All groups felt that clothing and “attitude” (how you carry yourself) were much more important than body shape and size. Clothing and hair style were particularly important aspects of the concept of attractiveness and both were mentioned when discussing the attractiveness of peers or actresses. When shown photographs, students selected actresses and adolescents of higher body mass as most attractive.

Several groups of students mentioned the actress Angela Basset in her role as Tina Turner in the movie, *What's Love Got to Do With It?* in discussions of actresses. Aliya, a seventh grader, explained, “Angela Basset, she be all muscley. She beat her husband up in that movie. Having that many muscles is trifling. Men don’t like that.” Khidir, an eighth grader, stated that “Those girls on *90210* [television show], they be all boney. They have fly gear (clothing), but they don’t look good. I like a baby with back (starts singing ‘Baby Got Back’, a popular rap song about large women).” Aja, a seventh grader, described two well known actresses by saying, “Whitney Houston looks like a skeleton” and “Madonna is skinny.” Biryanna, a sixth grader explained “I know a whole lot of actresses who need to gain some weight. Latoya Jackson needs to gain some weight, so does Whitney Houston. Oprah even needs to gain weight now.”

To understand the attractiveness concept, all groups of students were asked to rank the following three attributes in order of importance: body shape and looks, clothing, and attitude (personality). All groups consistently reported that clothing and attitude were much more important than looks, although some groups ranked clothing more important than attitude and vice versa. One actress, Queen Latifah (television actress), was

mentioned in almost every group as an example of a woman to be admired for possessing the “right” attitude. Queen Latifah can be described as overweight and assertive. In describing the concept of attitude, Khaliah, a seventh grader stated, “It means that you carry yourself well. You take pride in yourself.” Another seventh grader, Annaggiid, stated, “It ‘aint always what you look like, its what’s inside.” Another seventh grader, Kai, explained, “What they are trying to say is, it don’t matter if you look good. You dress right, you look good. You have the right attitude, you look good.”

All groups of students felt that clothing was extremely important and all agreed that clothing was much more important than body size. Relative to body shape and size, Kia, a seventh grader, stated, “Just face, hair, and clothes are important.” Annaggiid, a seventh grader explained, “If somebody is heavy but wears really nice clothes and has nice hair it is OK if she is heavy -- just as long as she is not really, really big.” Wearing the right clothing, was equally important for thin people as it was for large people. Diara, a seventh grader explained that, “Skinny girls look ugly with tights. You be seeing those boney knees poking out.”

The female adolescents expressed a desire to look good for their male peers and part of the strategy for looking good was to wear nice clothing and to have nice hair. In addition, the female students agreed that boys preferred full-figure females. Eneke, a seventh grader, reported that, “Boys like the hair and sneakers to be fine.” Eneke continued to tell a story about a girl who was being “checked out” by a boy named Devon, “Devon, he said that she had a real pretty face, but she had these ugly sneakers, and he said no way.” Monaye, a seventh grader, agreed, “If a girl has no butt AND bad gear -

nuh-uh (shakes her head), but you large and have nice hair and good gear, boys go with you.” Waliyah, also in seventh grade, stated “Boys like girls to be medium to big. They like big butts.” Eneke, laughing said, “You know Tasha from Bryant (another middle school), she have these big, she have a ‘G’ bra size - them boys want to go with her.”

One of the activities used in the focus group discussions to elucidate the concept of attractiveness was to show the students a series of photographs taken from magazines. These photographs depicted a broad range of body shapes and sizes. One photograph was of a famous African-American model, Naomi Campbell, taken for a Milk advertisement. This model was described by sixth and seventh grade females as “gross,” and several students stated that she looked like “a spider,” “a bug,” or even “an alien.” Another photograph was of a famous African-American singer, Barry White, with his family, including his mother who is moderately to severely obese. In this photo White’s mother is smiling and posing in a mumu, and it prompted the following statements from the students. Diara, a seventh grader, exclaimed, “She looks real nice. That’s what a mother should look like.” Dante, a sixth grader, stated, “She is large, but she’s not too big.” Clarissa, a sixth grader, stated, “She looks like my Auntie. I think she’s pretty.” A photograph of Janet Jackson prompted comments such as, “She is all that,” “She is so fine,” and “She has a nice figure.”

Another series of photographs came from an African-American teen magazine that had a feature article on Philadelphia’s School of Performing Arts. The article showed several Philadelphia teenagers in different poses. All females selected as examples of attractive adolescents were on the large size, and each of these females had elaborate hair

designs. One photograph of a thin female wearing a miniskirt was consistently overlooked in the discussions of attractiveness.

Dieting Behavior

All groups of students were familiar with the concept of dieting, although most of the students did not have first-hand experience with dieting. The students could differentiate between diet and non-diet foods, although most students labeled their favorite foods as unhealthy and their non-favorites as healthy. When the students were given a list of healthy (e.g., broccoli, oatmeal, and frozen yogurt) and non-healthy foods (e.g., french fries, potato chips, and ice cream) and asked to report which foods were “healthy” invariably the response was in terms of favorites and non-favorites rather than in terms of health. Most students reported that they would not want to diet and would rather eat foods that they enjoy.

Students who mentioned diet and non-diet foods often remarked that diet foods were not commonly eaten by their peers. Sabrina, an eighth grader, said that if you are on a diet you should eat, “rice cakes, vegetables, and salad.” Kai, a seventh grader, had the following advice for dieters, “Don’t eat a lot of junk, eat salads and vegetables, starve yourself.” Annaggiid, a seventh grader, described foods that she considers inappropriate diet foods, “Pigs feet, pork chop, hamhock, grease, chitterlings. Cheesesteaks are bad for a diet, anything with grease, french fries, ummm Checkers (fast-food chain) make good fries!” Dieting techniques focused on food intake; as Kai, a seventh grader, described, “Say you be feeling like going on a diet, one day you eat a lot of food, the next day you

don't eat much." Clarissa, a sixth grader, explained how she diets, "I'll skip breakfast and have a snack instead, but I'm going to eat what I want, not some nasty salad."

All groups of students reported that they received most of their information about health and nutrition from television. One group of females agreed that they received information about dieting from Jenny Craig (weight loss center) on television. Students in three groups mentioned Slim Fast advertisements. The second most important source of dieting information was school, followed by parents. In response to a question about friends providing information about dieting, Kai, a seventh grader, stated, "Friends -- they be telling you to eat MORE!"

The majority of students reported that people should know when to diet based on guidance from a doctors. Jenaya, another sixth grader, explained, "You know if you are too large by having a doctor tell you. If the doctor says you need to be on a diet -- that's how you know." Sharon, a sixth grader, had experience with such physician advice and reported, "My sister, she is a little overweight for her age, she is 7 and weighs over 100 pounds. Our doctor said she needed to go on a diet." However, Abby, a seventh grader, stated, "People our age don't need to diet. Later on, when you get older, that's when you watch what you eat."

Males were more concerned with increasing their muscle mass than with dieting. One group of male sixth graders' favorite actors included extremely muscular men, Arnold Schwarzenegger, Steven Segal, and Jean Claude Van Damme. Techniques for gaining muscle mass were also focused on eating. To be muscular, Dante, a sixth grader, explained, "Eat a lot of food before you go to bed." Khidir, an eighth grader, stated, "My

cousin, he be trying to be all muscular so he be eating all that. Like, he go to 62nd street and he eat two cheesesteaks before he go to bed.” Steven, a sixth grader, stated, “If you want to be muscular you lift weights and eat right. We know what to eat -- we just eat whatever we want.”

Only one focus group participant mentioned exercise as a method of weight loss. James, a seventh grader in that group, stated that, “Push ups are the best for losing weight, that and sit ups.” Regarding weight loss, students in three focus groups mentioned playing outside with friends. However, Osby, a sixth grader, remarked, “My little cousin Henry, he got hit by a car. Now none of us can play outside anymore.” In this group of ten students, eight students reported that a sibling or cousin had been hit by a car; each of these accidents resulted in injury and not death. Clarissa, a sixth grader, stated, “None of my brothers or sisters are allowed outside. We come home from school and that’s it. We don’t play outside.”

Health Concerns Associated with Body Shape and Size

Several students expressed knowledge of the association between overweight and disease. Gregory, a seventh grader, stated, “Fat is bad because it interferes with your heart.” Karima, a seventh grader, stated, “Fat people get diabetes and it slows your heart.” In response to a question about the students’ concern with chronic degenerative diseases, none of the students expressed concern. The majority of students felt that these were diseases of adulthood. For example, Kevin, a seventh grader, stated, “Those are diseases that old people get.” Similarly, Sofia, a sixth grader, stated, “People our age

don't need to worry about disease." One seventh grader, Diara, explained, "If you have sugar or high blood, then you watch what you eat. My grandma, she has high sugar diabetes, and she has to watch what she eats."

In terms of life cycle, one group of students agreed that older people (parents) get fat when they age and this was considered to be a normal part of aging. Gregory, a seventh grader, stated, "My mama is big, so is my auntie, they all big. They look nice, though, they 'aint too big." Another group of students linked weight gain to pregnancy. Jennifer, a seventh grader, reported that, "Salt-n-Pepa (an all female band) had babies all at the same time. They used to be real small, and now they all big." A group of male students also brought up Salt-n-Pepa's weight gain and described it as related to pregnancy. However, the students agreed that Salt-n-Pepa did not need to lose weight, and several remarked that "they look good."

Summary

This chapter provides sociocultural information about the context of obesity in West Philadelphia from the perspective of the Turner students, which is an essential component of the ecological model used in this project. This information serves to expand upon underlying concepts indicated by the survey data. These group discussions provided the students a forum in which they could interact with each other and explain their ideas in their own words. Thus, these discussions provided a unique opportunity for the expression of group ideals and concepts of obesity held by these adolescents.

The themes presented in these discussions have direct influence on eating behavior,

physical activity pattern, and sociocultural behaviors and attitudes that impact obesity status in this population. For example, the students reported a high frequency of snacking behavior. Snacking was not only a major source of moderately inexpensive energy and fat, but snacking was also a social activity of importance for these urban adolescents. The social context of snacking in this group suggests that health-promotion efforts that do not provide a healthy alternative at the corner store will be likely to fail.

For these urban adolescents, the physical environment did not provide many opportunities for physical activity. Several students reported that safety concerns forced them to remain inside their homes instead of exercising outside. Several students also expressed safety concerns with being too thin to defend themselves. The decreased opportunity for physical activity and the use of body size as a strategy for self defense may serve to promote obesity for these adolescents.

The West Philadelphia adolescents had a very positive view of body weight and health that was not focused on thinness. In fact, thinness carried with it some degree of social stigma, while moderate overweight was viewed as attractive and even important in terms of self-defense. Obesity was seen as a health problem, albeit at a larger body mass/size. Concepts of attractiveness were not generally focused on body size, but rather on personality (attitude), clothing, and hairstyle. Thus, there is some indication that there are cultural values that may predispose, or even encourage obesity in this population.

Table 40

**Energy and Total Dietary Fat Consumption of Food Eaten and Purchased Before School,
Reported by Kia as Part of a Focus Group Discussion**

Food	Amount	Energy	Fat (gm)
Egg Fried in Butter	1.0 Item	91.50	6.90
Pancakes	2.0 Items	256.00	10.70
Butter	1.0 Pat	36.00	4.10
Pancake Syrup	2.0 Tbsp	100.00	0.00
Sausage Links	2.0 Items	96.00	8.10
Potato Chips	6.0 oz.	910.40	58.70
Snapple Kiwi-Strawberry	20.0 oz.	325.00	0.00
TOTAL		1,814.00	88.50

PHASE II

CHAPTER 8

RESULTS: DIETARY INTAKE

This chapter provides a description of the food and nutrient consumption of obese and non-obese West Philadelphia female adolescents based on three-day repeated 24-hour dietary recall data. In addition to providing further information about the nutrition-related health status of adolescents living in an urban context, this chapter also compares the dietary intake of obese relative to non-obese adolescents in order to determine if there were dietary factors that contributed to obesity status differences between the two groups. In addition, micronutrient and macronutrient intake were examined to determine if there were differences in nutrient intake that may have been a consequence of obesity status.

This chapter presents dietary intake of Phase II females based on three-day repeated 24-hour dietary recall assessments of dietary intake (64 matched-pairs; 192 dietary recalls). Sample description of the Phase II adolescents is shown in Table 41. These data were assessed for nutritional adequacy relative to age- and sex-appropriate 1989 U.S. Recommended Daily Allowances (RDA; National Research Council, 1989b), with a focus on nutrients of current public health concern because of their association with diet-related chronic degenerative diseases, including coronary heart disease, stroke, certain cancers, and non-insulin dependent diabetes (National Research Council, 1989b). Data were also compared to national surveillance data for African-American adolescents

reported in the Third Report on Nutrition Monitoring in the U.S. [NHANES III; 1988-1991] (Life Sciences Research Office, 1995).

Energy Intake and Energy Requirements

Energy intake was based on the average value of energy intake over three days. The coefficient of variation $[(1 \text{ standard deviation/population mean}) \times 100]$ for kilocalories (kcal) was estimated to characterize the variation in energy intake of these females as an indicator of reliability. These figures were compared to published data for adults (Beaton et al., 1979) and are shown in Table 42. The coefficient of variation for energy for the total Phase II sample was 35.53%, intra-individual coefficient of variation was 18.99%, inter-individual coefficient of variation was 32.32%, and the ratio between intra- and inter-individual variation was 0.35. These figures compare favorably with published data for urban adults (Beaton et al., 1979).

Data for total energy intake for the 64 adolescents from Phase II (3-day repeated single 24-hour dietary recalls) were compared to figures reported for the 174 females from Phase I (single 24-hour dietary recalls). Median energy intake for Phase I females (2,569.0 kcal) was slightly less than median energy intake for the total sample of Phase II females (2,805.17 kcal). Median estimated energy expenditure for the total sample of Phase II females (2,457.46 kcal) was similar to that for Phase I females (2,327.68 kcal).

Energy requirements for these West Philadelphia female adolescents were estimated using equations for predicting resting energy expenditure from body weight and a factorial method for estimating total energy requirements (WHO, 1985). The results

were multiplied by an activity factor (energy cost of activity), which reflected typical activity patterns for U.S. female adolescents (Table 43). Median energy requirements for obese females were estimated at 2,796.28 kcals per day, or 45.14 kcals per kilogram of body weight. Non-obese females had median energy requirements estimated at 2,270.94 kcals per day, or 36.74 kcals per kilogram of body weight. The results for obese females are likely to overestimate energy expenditure due to the excess weight of this group.

Median estimated energy requirements for the West Philadelphia adolescents (Table 44) were compared to female reference adolescents (National Research Council, 1989b). Estimated energy requirements for obese (2,796.28 kcals) and non-obese (2,270.94 kcals) West Philadelphia adolescents were considerably higher than those for reference adolescents, by 596 kcals for the obese and 71 kcals for the non-obese subsample.

Estimated energy expenditure was also compared to reported energy intake for these adolescents; results are presented in Table 45 and in Figure 57. Median reported energy intake exceeded estimated energy requirements by 126 kcals for the obese subsample and by 464 kcals for the non-obese subsample. The difference between reported energy intake and estimated energy requirements was greatest for the non-obese relative to obese adolescents.

Under reporting of energy intake was calculated by subtracting reported energy intake from estimated energy expenditure. Median values for under reporting were -191.35 for the obese subsample and -480.28 for the non-obese subsample. Thus, according to estimates of energy expenditure and reported energy intake, these

adolescents were, on average, over reporting energy intake by the above values. Over reporting was highest among the non-obese subsample; on average non-obese females reported that they consumed 480 kilocalories more per day than their estimated energy requirements. These values indicate that either these adolescents are over reporting energy intake or they are in positive energy balance.

Macronutrient and Micronutrient Intake

Median macronutrient intake as percentage of total energy intake for West Philadelphia adolescents relative to the RDA are shown in Figure 58. The obese (37.29%) and non-obese (35.88%) subsamples had a greater percentage of energy from total dietary fat than the RDA (30.0%). The obese (50.07%) and non-obese (51.14%) adolescents had a similar percentage of energy from carbohydrates relative to the RDA (50.0%). The obese (13.1%) and non-obese (12.61%) adolescents had a smaller percentage of energy from protein than the RDA (20.0%).

Median macronutrient intake as percentages of energy for Phase II females were compared to NHANES III, African-American reference data (Life Sciences Research Office, 1995) (Figure 59). The obese (37.29%) and non-obese (35.88%) subsamples had a similar percentage of energy from fat relative to the NHANES III adolescents (37.9%). The obese (50.07%) and non-obese (51.14%) adolescents had a similar percentage of energy from carbohydrates relative to the NHANES III females (50.1%). In addition, the obese (13.10%) and non-obese (12.61%) females had a similar percentage of energy from protein relative to the NHANES III females (13.4%).

Median total dietary fat, saturated fat, protein, and energy intake (total kcals) as percentage of the RDA (National Research Council, 1989b) for the obese and non-obese subsamples are shown in Figure 60. Dietary intake of total energy for the obese (117.0%) and non-obese (109.0%) adolescents, total dietary fat for the obese (168.0%) and non-obese (149.0%) adolescents, saturated fat for the obese (164.0%) and non-obese (139.0%) adolescents, and protein for the obese (208.0%) and non-obese (195.0%) adolescents were also substantially greater than recommended. The obese subsample had higher intake of each of these nutrients as percentage of the RDA relative to the non-obese subsample. During the three days surveyed, the dietary intake of both obese and non-obese West Philadelphia adolescents exceeded dietary recommendations for total dietary fat, protein, and percent of energy from these nutrients. However, obese adolescents had higher intake of total dietary fat, saturated fat, and total energy as percentage of the RDA.

Median intake of total dietary fat, saturated fat, polyunsaturated fat, carbohydrates, and protein as percent of energy for the West Philadelphia obese and non-obese subsamples were compared to NHANES III, African-American reference data (Life Sciences Research Office, 1995); results are shown in Figure 61. Median percentage of energy from total dietary fat intake was greatest for NHANES III, African-American adolescents (37.70%) followed by the obese (37.29%) and the non-obese (33.80%) subsamples. Median percentage of energy from carbohydrate was greatest for the non-obese females (51.14%) followed by the obese subsample (50.07%) and the NHANES III, African-American reference data (50.10%). Median percentage of energy from saturated

fat was similar in all three samples of females, although the NHANES III, African-American adolescents had the greatest values. Values for polyunsaturated fat, and protein as percent of energy were similar between all three samples of females, with slightly greater values for polyunsaturated fat for the West Philadelphia obese females and slightly greater values for protein for the NHANES III, African-American reference data.

Mean differences between the obese and non-obese subsamples in percentage of energy from total dietary fat, saturated fat, polyunsaturated fat, monounsaturated fat, carbohydrates, and protein are shown in Figure 62. Differences were tested using paired t-tests and the Wilcoxon matched-pairs signed-ranks test. There were no significant differences between the obese and non-obese subsamples in any of the nutrients shown. Although differences were not significant, mean values for percentage of energy from total fat, saturated fat, and protein were higher in obese relative to non-obese females, whereas mean values for percentage of energy from carbohydrate and monounsaturated fat were higher among non-obese females, and values for polyunsaturated fat were similar for both subsamples.

Median daily intake of energy, total dietary fat, and saturated fat per kilogram of body weight for the obese and non-obese West Philadelphia females are shown in Figure 63. A two-way ANOVA showed that body weight had a significant impact on energy intake ($p \leq 0.0001$). Median daily energy intake per kilogram of body weight was greatest for the non-obese (55.40 kcals) compared to the obese (37.04 kcals) females. Similarly, median total dietary fat intake per kilogram of body weight was greatest for non-obese (2.18 gm) relative to the obese (1.65 gm) females. Median saturated fat intake per

kilogram of body weight differed slightly from energy and total fat intake per kilogram of body weight. Median saturated fat intake per kilogram of body weight was only slightly greater for the non-obese compared to obese females.

Median intake and interquartile range of selected nutrients of public health concern as percentages of the RDA are shown in Table 46 (obese subsample) and Table 47 (non-obese subsample). Interquartile ranges for energy intake of the obese (92-132%) and non-obese (95-124%) subsamples were relatively high. Interquartile ranges for protein intake for the obese (167-254%) and non-obese (153-217%) subsamples and sodium intake for the obese (150-235%) and non-obese (149-219%) subsamples were both exceptionally high. Interquartile ranges for vitamin D intake for the obese (11-27%) and non-obese (7-28%) subsamples were markedly low. With the exception of fiber, zinc, calcium, sodium, and vitamin D, micronutrient and macronutrient status was excellent.

Median intake of energy, sodium, iron, calcium, vitamin A, and folate as percentages of the RDA for the obese and non-obese subsamples were compared to total sample reference data from NHANES III (Life Sciences Research Office, 1995). These data are shown in Figure 64. Median percentage of the RDA of these six nutrients for the obese and non-obese subsamples exceeded median percentage of the RDA for adolescents from NHANES III. However, median percentage of the RDA for all nutrients was greatest in the obese subsample (as expected due to higher energy intake). For example, sodium intake was greatest in the obese (200.0%) relative to the non-obese (183.22%) and the NHANES III (124.0%) females. In addition, iron intake was substantially higher in the obese (105.81%) than both the non-obese (93.82%) and NHANES III (65.0%)

females. Calcium intake as percentage of the RDA was below the accepted criterion of adequacy (2/3 RDA or 66% RDA) for both subsamples, with higher values for the obese (60.84%) than non-obese (59.20%) females.

The percentages of West Philadelphia adolescents to fall below the criterion of adequacy for iron, zinc, calcium, vitamins A and D, and total dietary fiber are shown in Table 48. The majority of obese and non-obese females (97.88%) fell below the accepted criterion of nutritional adequacy for vitamin D intake. A significant percentage of obese (71.88%) and non-obese (79.96%) females had total dietary fiber intakes that fell below the criterion of adequacy. Approximately half of both subsamples fell below the criterion of adequacy for calcium (obese subsample, 50.0% and non-obese subsample, 61.46%) and vitamin A (obese subsample, 50.0% and non-obese subsample, 53.12%). A smaller percentage of the sample fell below 66% RDA for zinc (obese subsample, 35.38% and non-obese subsample, 43.75%) and iron (obese subsample, 15.62% and non-obese subsample, 12.50%). Although not shown in Table 48, 95.83% of obese and non-obese females had sodium intakes that exceeded the criterion of adequacy.

Mean differences between the obese and non-obese subsamples for intake of sodium, iron, zinc, calcium, and vitamin D as percentages of the RDA are shown in Figure 65. Differences were tested using paired t-tests and the Wilcoxon matched-pairs signed-ranks test. There were no significant differences between the obese and non-obese subsamples in any of the nutrients shown. Although differences were not significant, mean values for each nutrient (except vitamin D) were higher for the obese than for the non-obese females.

The percentage of Phase II females to attain U.S. dietary goals for selected health-related nutrients during a 24-hour period are shown in Table 49 and Figure 66. U.S. dietary goals are as follows: a one-to-one ratio of polyunsaturated to saturated fat, total dietary fat intake less than or equal to 30% of energy, saturated fat intake less than or equal to 10% of energy, cholesterol intake of less than or equal to 300 mg, and a carbohydrate intake of greater than 50% of energy. Notably small percentages of females attained these goals; for example, 14.0% of obese and 7.0% of non-obese females attained goals for ratio of polyunsaturated fat to saturated fat, 16.0% of obese and 19.0% of non-obese females attained goals for total dietary fat, and 24.0% of obese and 29.0% of non-obese females attained goals for saturated fat intake. A larger percentage of obese (46.0%) and non-obese (38.0%) females attained dietary goals for cholesterol. Similarly, 48.0% of obese and 57.0% of non-obese females attained goals for carbohydrate intake. A very small percentage of the obese (3.0%) and non-obese (1.0%) females attained all five goals during this time period.

Summary

In summary, the obese adolescents had higher estimated energy requirements than the non-obese adolescents. In addition, these adolescents also had higher energy intake than national reference data. Given these factors plus the high prevalence of overweight and obesity in this group, figures for over reporting may represent positive energy balance as opposed to actual over reporting of energy intake. Percentage of energy from total dietary fat was greater for the obese than the non-obese adolescents (although this

difference was not significant). Both obese and non-obese females had a higher percentage of energy from total dietary fat than the RDA and the NHANES III, African-American reference data. Similarly, dietary intake of energy, fat, saturated fat, protein, and percent of energy from these nutrients were greater for the obese relative to the non-obese subsamples; however, these differences were not statistically significant. There were no statistically significant differences between obese and non-obese females for micronutrient intake.

These findings suggest that there is not enough evidence to support the hypothesis that obese females consume a greater percentage of overall energy intake from dietary fat than non-obese adolescents. The absence of statistically significant differences between obese and non-obese adolescents in nutrient and food intake may be due to difficulties associated with the measurement of dietary intake. However, the lack of difference in dietary intake of obese and non-obese adolescents suggests that other determinants of energy balance are likely to impact obesity status in this group.

Table 41

Phase II Sample Description Mean (Standard Deviation), by Obesity Status

	Obese [N=32]	Non-Obese [N=32]	P
Age	13.55 (0.93)	13.28 (2.24)	NS
Stature (cm)	158.92 (6.98)	159.39 (5.87)	NS
Weight (cm)	78.42 (16.43)	49.77 (5.90)	0.0001
BMI (wt/ht ²)	31.53 (6.11)	19.57 (1.86)	0.0001
Triceps Skinfold	44.39 (13.26)	15.21 (4.09)	0.0001

Table 42

**Estimated Intra-individual and Inter-individual Coefficients of Variation for Energy
(kcal/day), West Philadelphia Females Relative to Published Data**

Sample	Mean	Total CV	Inter- Indiv. CV	Intra- Indiv. CV	Ratio Intra/Indiv
West Philadelphia	2805.17	36%	32%	20%	0.35
Beaton et al., 1979	2639.0	36%	25%	26%	1.0

Table 43

Median Stature, Body Weight, and Recommended Energy Intake of Obese and Non-Obese West Philadelphia Females

Subsample	Stature (cm)	Weight (kg)	REE ^a (Kcal/day)	Multiples ^b of REE	Per Kg	Per Day
Obese	157.24	76.1	1,674.42	1.67	45.14	2,796.28
Non-Obese	159.27	50.32	1,359.84	1.67	36.74	2,270.94

^aCalculation based on WHO (1985) equations, see below.

^bDaily Energy Expenditure, using an activity factor (energy cost of activity) for school-children, with a blend of light and moderate classes of activity as suggested by WHO (1985). Calculated using weight (WHO, 1985) [Females: $12.2 \times \text{weight (kg)} + 746$]

Table 44

Median Stature, Body Weight, and Recommended Energy Intake of Obese and Non-Obese West Philadelphia Females Relative to Female Reference Adolescents (National Research Council, 1989b)

Sample	Stature (cm)	Weight (kg)	REE ^a (Kcal/day)	Multiples of REE	Per Kg	Per Day
Obese	157.24	76.1	1,674.42	1.67	45.14	2,796.28
Non-Obese	159.27	50.32	1,359.84	1.67	36.74	2,270.94
RDA, 1989 ^b	157.00	46.00	1,310.00	1.67	47.00	2,200.00

^aCalculation based on WHO (1985) equations using weight (WHO, 1985) [Males: $17.5 \times \text{weight (kg)} + 651$; Females: $12.2 \times \text{weight (kg)} + 746$]

^b Figures are rounded.

Table 45

Comparison of Estimated Median Energy Expenditure and Observed Intakes for Obese and Non-Obese West Philadelphia Females

Subsample	Expenditure Kcal/day^a	Intake kcal/day
Obese	2,796.28	2,922.50
Non-Obese	2,270.94	2,735.17

^aCalculation based on WHO (1985) equations using weight (WHO, 1985) [$12.2 \times \text{Weight (kg)} + 746$], Multiples of REE (1.67)

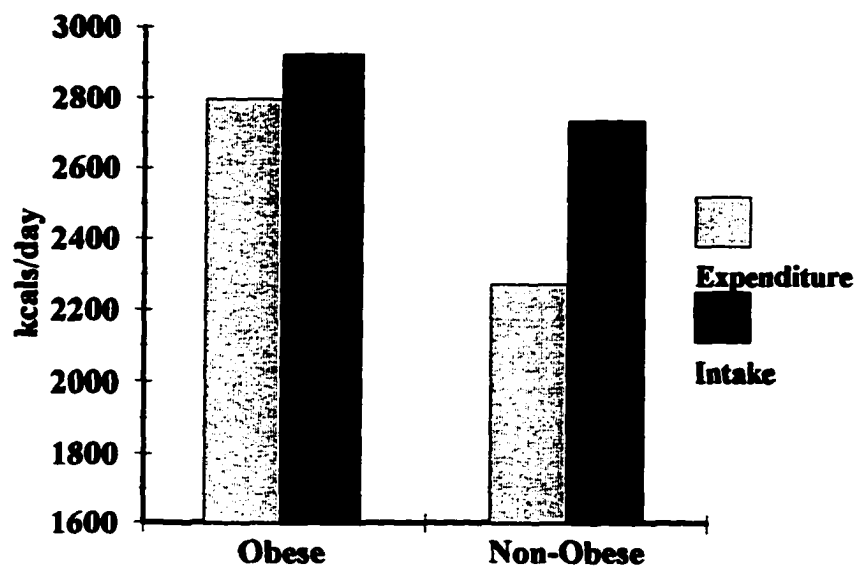


Figure 57. Median estimated energy expenditure compared to reported energy intake for obese and non-obese West Philadelphia adolescents. Difference between energy intake and expenditure was greatest among the non-obese females.

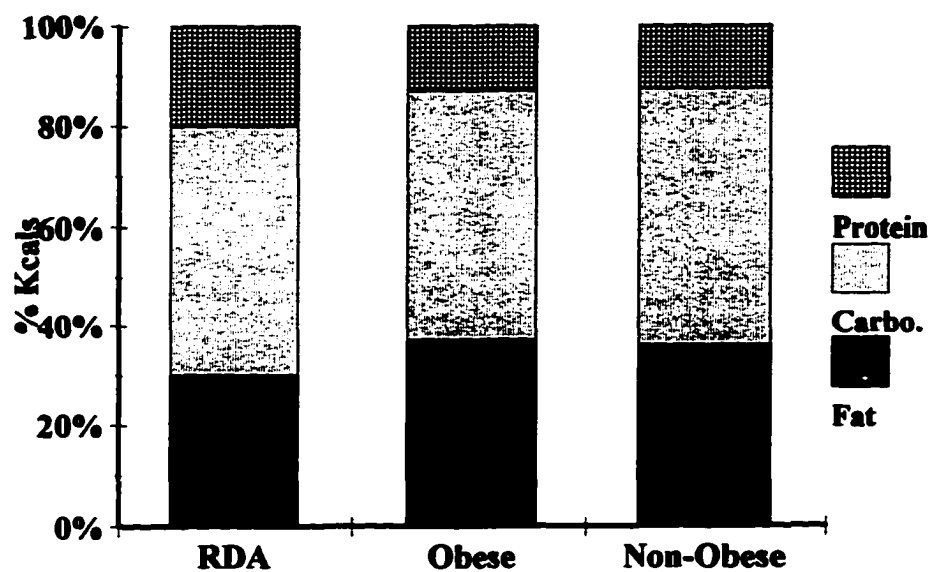


Figure 58. Median macronutrient intake as percentage of energy for obese and non-obese West Philadelphia adolescents compared to the U.S. RDA. Percentage of energy from total dietary fat was higher than recommendations. Whereas, percentage of energy from carbohydrate and protein were lower in Philadelphia adolescents than recommended.

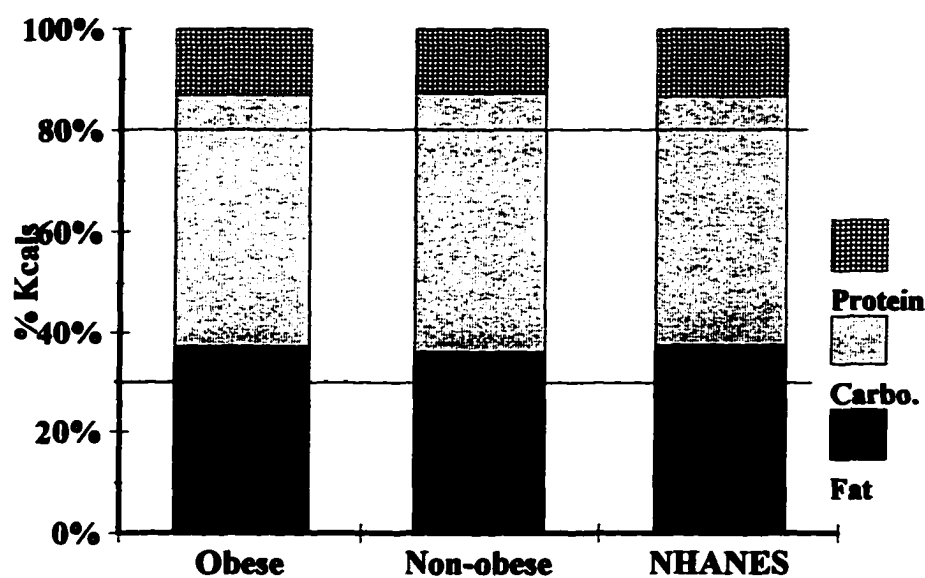


Figure 59. Median macronutrient intake as percentage of energy for obese and non-obese West Philadelphia adolescents compared to African-American adolescents from NHANES III. Percentage of energy from total dietary fat was lower than national reference data; whereas percentage of energy from carbohydrate and protein were similar to national reference data. Horizontal lines indicate RDA values (30% fat, 50% carbohydrate, 20% protein).

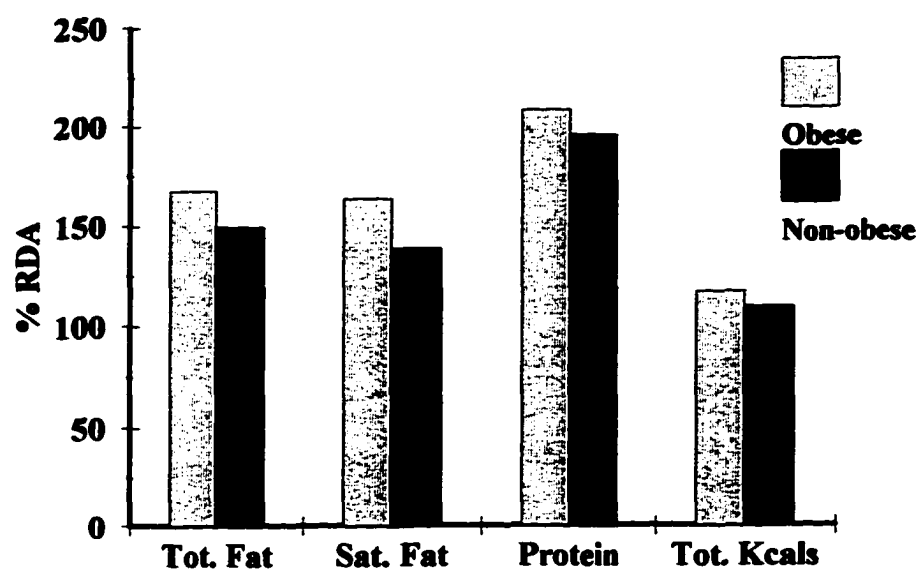


Figure 60. Median total dietary fat, saturated fat, protein, and energy intake (total kcals) as percentage RDA for obese and non-obese West Philadelphia adolescents. Intake of all nutrients shown were higher than recommended.

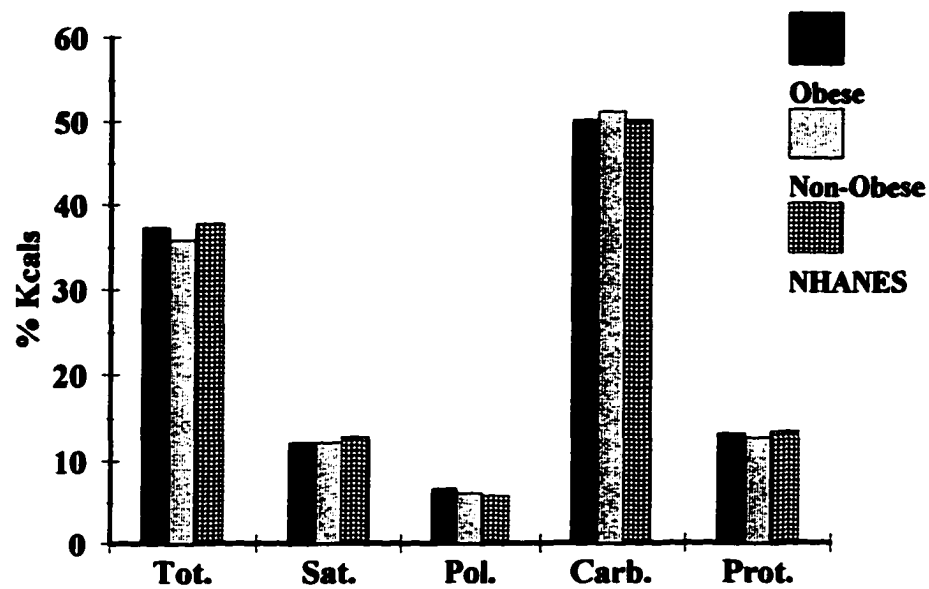


Figure 61. Median total dietary fat, saturated fat, polyunsaturated fat, carbohydrate, and protein intake as percentage of energy for obese and non-obese West Philadelphia adolescents relative to NHANES III African-American reference data. Median intake was greatest in African-American adolescents, with the exception of carbohydrate intake as percentage of energy.

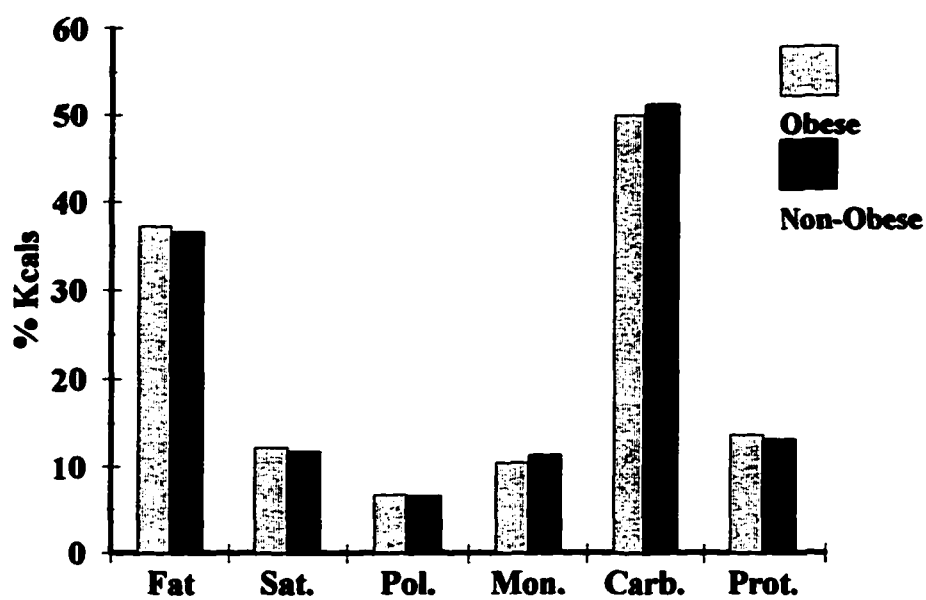


Figure 62. Median total dietary fat, saturated fat, polyunsaturated fat, monounsaturated fat, carbohydrate, and protein intake as percentage of energy for obese and non-obese West Philadelphia adolescents. Between-pair differences were tested using paired t-tests and the Wilcoxon matched pairs signed rank test and no significant differences were found for any of the nutrients.

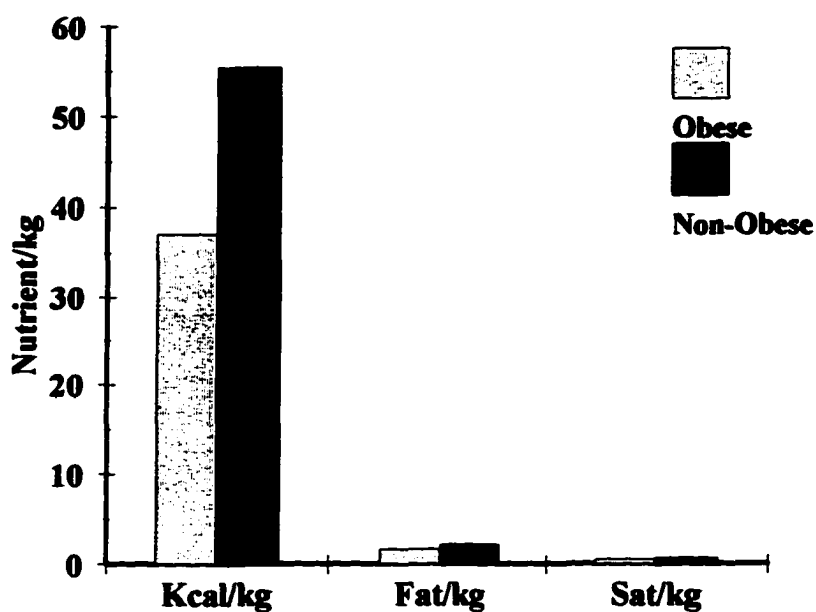


Figure 63. Median daily energy, total dietary fat, and saturated fat intake per kilogram of body weight for obese and non-obese West Philadelphia adolescents. Median daily energy, total dietary fat, and saturated fat intake per kilogram of body weight were greatest for the non-obese females.

Table 46

Medians and Interquartile Ranges (25th - 75th Percentiles) of Selected Nutrients as Percentage RDA (National Research Council, 1989b), Obese West Philadelphia Females (3 Day Repeated 24-hour Dietary Recall)

Nutrient	Median	Interquartile Range
Kilocalories (kcal)	116.9	91.66 - 132.07
Protein (g)	208.12	166.73 - 254.46
Total Dietary Fiber (mg)	51.57	40.13 - 67.03
Vitamin A ($\mu\text{g RE}$) ^a	96.80	48.35 - 156.68
Vitamin C (mg)	170.44	91.33 - 261.12
Vitamin D ($\mu\text{g RE}$) ^b	18.95	10.61 - 27.34
Folate (μg)	124.57	88.90 - 158.30
Niacin (mg NE) ^c	143.17	114.76 - 210.97
Vitamin B-6 (mg)	113.61	68.5 - 136.96
Vitamin B-12 (μg)	170.53	121.93 - 257.93
Potassium (mg)	124.2	96.06 - 142.81
Sodium (mg)	200.21	150.15 - 235.22
Iron (mg)	105.81	87.29 - 136.32
Calcium (mg)	60.84	48.53 - 80.29
Zinc (mg)	86.75	63.36 - 108.67

^aretinol equivalents. 1 retinol equivalent = 1 μg retinol or 6 μg β -carotene.

^bAs cholecalciferol. 10 μg cholecalciferol = 400 IU of vitamin D.

^c1 NE (niacin equivalent) is equal to 1 mg of niacin or 60 mg of dietary tryptophan.

Table 47

Medians and Interquartile Ranges (25th - 75th Percentiles) of Selected Nutrients as Percentage of the RDA (National Research Council, 1989b), Non-Obese West Philadelphia Females (3 Day Repeated 24-hour Dietary Recall)

Nutrient	Median	Interquartile Range
Kilocalories (kcal)	109.41	95.03 - 124.29
Protein (g)	195.04	153.44 - 217.26
Total Dietary Fiber (mg)	48.68	35.35 - 63.38
Vitamin A ($\mu\text{g RE}$) ^a	92.40	53.13 - 175.85
Vitamin C (mg)	188.82	103.97 - 280.20
Vitamin D ($\mu\text{g RE}$) ^b	17.34	6.81 - 28.45
Folate (μg)	110.08	76.22 - 167.7
Niacin (mg NE) ^c	153.46	134.41 - 195.74
Vitamin B-6 (mg)	103.0	80.89 - 115.55
Vitamin B-12 (μg)	175.17	124.25 - 251.6
Potassium (mg)	107.25	88.43 - 132.87
Sodium (mg)	183.22	148.96 - 219.28
Iron (mg)	93.82	85.51 - 127.77
Calcium (mg)	59.20	48.80 - 75.51
Zinc (mg)	82.42	59.14 - 99.55

^aretinol equivalents. 1 retinol equivalent = 1 μg retinol or 6 μg β -carotene.

^bAs cholecalciferol. 10 μg cholecalciferol = 400 IU of vitamin D.

^c1 NE (niacin equivalent) is equal to 1 mg of niacin or 60 mg of dietary tryptophan.

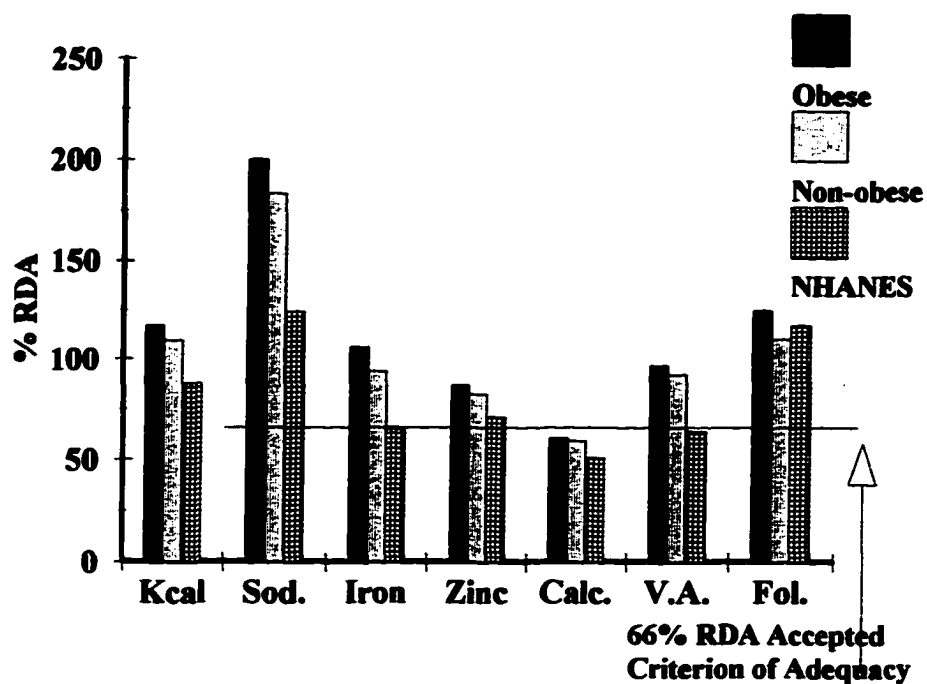


Figure 64. Median energy, sodium, iron, zinc, calcium, vitamin A, and folate intake as percentage U.S. RDA for West Philadelphia obese and non-obese adolescents relative to NHANES III African-American reference data. Median intake of all nutrients as percentage RDA for West Philadelphia adolescents exceeded national reference data, with greater nutrient intake for obese relative to non-obese adolescents.

Table 48

Percentage of Sample Below Criterion of Adequacy (66% RDA) for Selected Nutrients,
West Philadelphia Females (Non-Obese and Obese Subsamples)

Nutrient	Obese Females	Non-Obese Females
Iron	15.62%	12.50%
Zinc	35.38%	43.75%
Calcium	50.0%	61.46%
Vitamin D	96.88%	96.88%
Vitamin A	50.0%	53.12%
Total Dietary Fiber	71.88%	79.96%

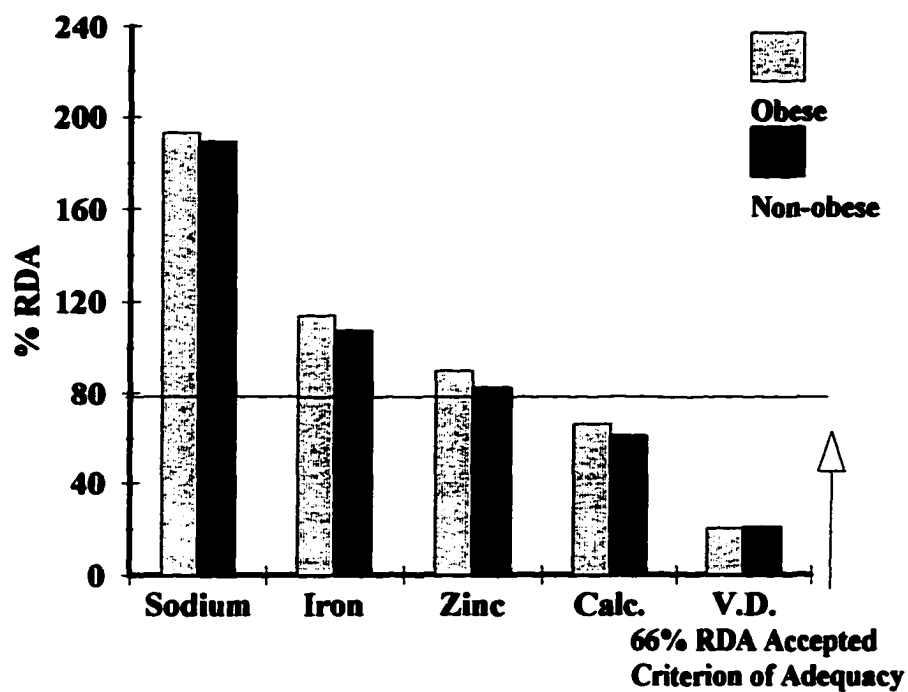


Figure 65. Mean sodium, iron, zinc, calcium, and vitamin D intake as percentage of U.S. RDA for West Philadelphia obese and non-obese adolescents. Between-pair differences were tested using paired t-tests and the Wilcoxon matched pairs signed rank test and no significant differences were found for any of the nutrients.

Table 49

Percentage of West Philadelphia Obese and Non-Obese Females Attaining U.S. Dietary Goals over Three Days

Dietary Goal	Obese Females	Non-Obese Females
P:S Ratio > 1.0	13.54%	7.29%
Total Fat Intake \leq 30% Kcals	15.62%	18.75%
Saturated Fat Intake \leq 10% Kcals	23.96%	29.17%
Cholesterol Intake \leq 300 mg	45.83%	37.50%
Carbohydrate Intake > 50% Kcals	47.92%	57.29%
All Five Goals Met	3.12%	1.04%

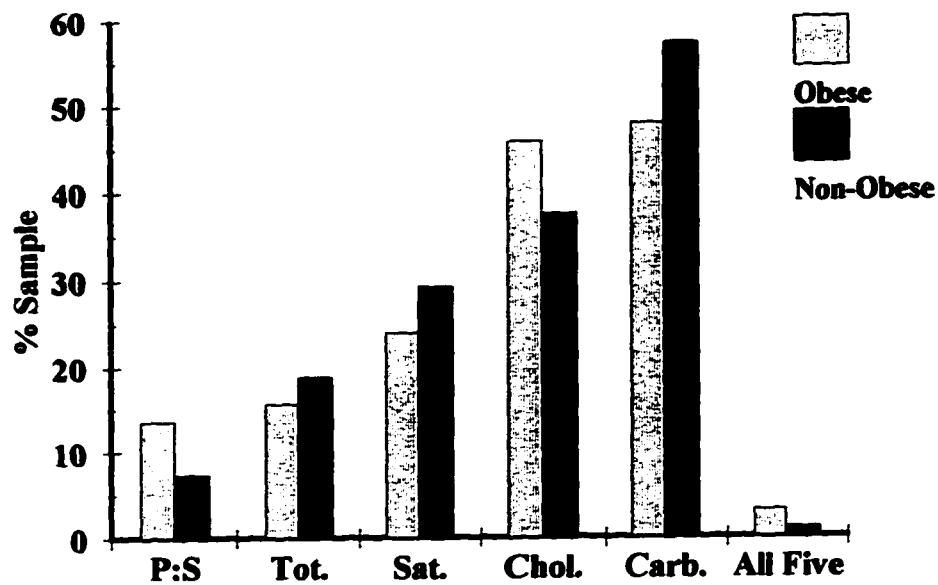


Figure 66. Percentage of West Philadelphia obese and non-obese adolescents attaining U.S. Dietary Goals for the following: a one-to-one ratio of polyunsaturated to saturated fat, total dietary fat intake less than or equal to 30% of energy, saturated fat intake less than or equal to 10% of energy, cholesterol intake of less than or equal to 300 mg, and a carbohydrate intake of greater than 50% of energy. A small percentage of these adolescents attained dietary fat-related goals. A large percentage of these adolescents attained goals for cholesterol and carbohydrate intake. None attained all five dietary goals.

CHAPTER 9

RESULTS: SOCIOCULTURAL AND INDIVIDUAL ENVIRONMENT CORRELATES, PHYSICAL ACTIVITY, AND SEDENTARY ACTIVITY PATTERNS

Sociocultural, behavioral and psychological factors were assessed to determine whether these factors influenced dietary and physical activity patterns and whether they were likely to underlie the increased prevalence of obesity in this population. Scores from the Piers-Harris Self-Concept scale, Children's Eating Attitudes Test, Body Image Assessment, Child Health Behavior Knowledge Scale are presented first, followed by responses from the Seven-Day Physical Activity Recall, Television Viewing Recall, Menarcheal Age Recall, and sociodemographic questions. Multivariate analyses were used to determine which measures of behavior, psychology, diet, physical, and sedentary activity patterns best explained variation in obesity status of these adolescents.

To address test-retest reliability using the Phase II survey data, a subsample (n=31) of adolescents was given the Piers-Harris Self-Concept scale, Children's Eating Attitudes Test, Body Image Assessment, Child Health Behavior Knowledge Scale, and Menarcheal Age Recall a second time and differences between the original and reliability samples were assessed using paired t-tests. No significant differences were found for any of the measures.

Piers-Harris Self-Concept Scale

The mean Piers-Harris Self-Concept scores for the obese (59.47) and non-obese (61.97) females were markedly higher than the published mean of 51.8 and were considered "above average" according to reference data (Piers, 1984). Mean values for this study are similar to the mean value of 58.5 found for 851 African-American adolescents from Philadelphia public schools (Kaplan and Wadden, 1986).

The between-pairs differences in Piers-Harris scores by obesity status were tested using paired t-tests and the Wilcoxon matched-pairs signed-ranks test. Both obese (59.47) and non-obese (61.97) adolescents scored highly on the Piers-Harris scale (Table 50). The lack of a statistically significant difference between obese and non-obese adolescents for self-concept, using the Piers-Harris scale, was similar to findings for urban adolescents (Sallade, 1973; Wadden et al., 1984; Kaplan and Wadden, 1986; Fisher et al., 1996). Using different measures of self-esteem, other researchers have found no difference in self-esteem between obese and non-obese groups (Stunkard and Mendelson, 1967; Klesges, 1984; Kaplan and Wadden, 1986; Pastore et al., 1996).

Twelve of the specific items from the Piers-Harris Self-Concept scale related to physical appearance, general happiness, and physical activity, were contrasted for obese and non-obese females and these findings are presented in Table 51. The two groups scored exactly the same for the following three statements: "I am a happy person" (87.5%), "My looks bother me" (87.5%), and "I have pretty eyes" (81.3%). A significantly greater percentage of non-obese (96.8%) than obese (78.1%) females

responded positively to the statement, "I like being the way that I am" ($p \leq 0.023$). A greater percentage of non-obese (78.1%) than obese (53.1%) also responded positively to the statement, "I have a good figure" ($p \leq 0.001$). A significantly greater percentage of obese (34.4%) than non-obese (3.1%) females responded positively to the statement, "I wish I were different" ($p \leq 0.001$). The majority of obese (84.4%) and non-obese (90.6%) females responded positively to the statement, "I am good looking." Similarly, almost all obese (96.9%) and non-obese (100.0%) females responded positively to the statement, "I am a good person." A smaller percentage of obese (37.5%) and non-obese (59.4%) females responded positively to the statement, "I am a leader in games and sports." A similar percentage of obese (53.1%) and non-obese (56.3%) responded positively to the statement, "In games and sports, I watch instead of play." Approximately three-fourths of obese and non-obese females agreed with the two statements, "I hate school" and "I am popular with girls." Conversely, more non-obese (71.8%) than obese (59.4%) responded positively to the statement, "I am popular with boys."

Children's Eating Attitudes Test (ChEAT)

The mean Children's Eating Attitudes Test scores for the obese (8.63) and non-obese (8.84) females are above the 50th percentile (8.0) of a distribution of Eating Attitudes Test scores obtained from 675 high school girls (Rosen et al., 1988). In addition, these data are similar to published data for middle school (8 ± 7 ; Maloney et al., 1989) and high school students (10.1; Fisher et al., 1994).

Scores above 20 on the ChEAT are generally considered to be consistent with the

diagnosis of an eating disorder. In this group of West Philadelphia adolescents, there were three females (4.7% of the total Phase II sample) who scored in this range, with ChEAT scores of 21, 22, and 26. The female with the highest score, 26, was obese, while the other two females were non-obese. The mean value for West Philadelphia adolescents was slightly less than published data for Cincinnati white schoolchildren, 6.9% of whom scored within the eating disorder range (Maloney et al., 1989).

The West Philadelphia obese (8.63) and non-obese (8.84) females had similar mean ChEAT scores, and there was no significant between-pairs difference in ChEAT scores (Table 52). Conversely, Pastore et al. (1996) found significantly different mean EAT scores by body weight (based on ideal body size) for adolescents. In this study, Pastore et al. found significantly different mean EAT scores for obese (11.0) and normal weight (9.0) female adolescents from a New York City high school.

Ten items from the ChEAT were contrasted for obese and non-obese females and results are shown in Table 53. There was a significant difference in the percentage of obese (40.6%) and non-obese (12.5%) females ($P \leq 0.03$) to respond positively to the statement, "I think a lot about wanting to be thinner." There were no significant differences for any of the other items shown in Table 53. Between a third and a fourth of obese (31.2%) and non-obese (25.0%) adolescents responded positively to the following statement, "I am scared about being overweight." More obese (40.6%) than non-obese (18.7%) adolescents responded positively to the statement, "I think a lot about having fat on my body." Similarly, more non-obese (37.5%) than obese (53.1%) adolescents responded positively to the statement, "I think about burning up energy (calories) when I

exercise.” Similarly, small percentages of obese and non-obese adolescents responded positively to statements pertaining to dieting behavior, such as “I eat diet foods,” “I stay away from eating when I am hungry,” and, “I have been dieting.” However, a somewhat larger percentage of both obese and non-obese adolescents responded positively to the statement, “I am aware of the energy (calorie) content in the foods that I eat” (28.2%). A very small percentage of adolescents responded positively to statements related to eating disorders, such as, “I have gone on eating binges where I feel that I might not be able to stop” and, “I have the urge to vomit after eating.”

Body Image Assessment

Three different scores for the Body Image Assessment Test, Current Body Size, Ideal Body Size, and Body Dysphoria (Current - Ideal Body Size) are shown in Tables 54, 55, and 56. The mean Current Body Size scores for the obese females was 5.91 and for the non-obese females was 3.88, on a scale of one to nine. Both groups had mean scores that fell well above the 50th percentile of reference norms published by Veron-Guidry and Williamson (1996). The mean Ideal Body Size score for the obese females (4.19) was greater than for the non-obese females (3.88). Both groups had mean scores that fell just above the 50th percentile of reference norms (Veron-Guidry and Williamson, 1996). The mean Body Dysphoria Score for obese (1.72) and non-obese (0.25) indicated a slight dissatisfaction with body size, particularly for obese females. Both groups of females had slightly smaller ideal relative to current body size perceptions.

Current and Ideal Body Size scores were slightly greater than mean values of 3.6

for current body size and 3.8 for ideal body size findings for urban African-American adolescents (Cohn et al., 1987). Findings for Body Dysphoria of West Philadelphia adolescents were similar to those for urban African-American adolescents (Cohn et al., 1987; Desmond et al., 1989) and adults (Dawson, 1988). Wadden et al. (1989) found significantly more dissatisfaction with weight and body image among obese relative to non-obese females. Data from NHANES III indicate that 50% of African-American high school students consider themselves to be "about the right weight", while 24.2% consider themselves to be "slightly overweight" (Life Sciences Research Office, 1995). These figures are somewhat greater than those found for white-American high school students of whom 44.1% consider themselves to be "about the right weight" and 38.0% consider themselves "slightly overweight" (Life Sciences Research Office, 1995).

There was a significant between-pairs difference in Current Body Size ($p \leq 0.00001$) using both the paired t-test and the Wilcoxon matched-pairs signed-ranks tests (Table 54) indicating these adolescents had a fairly good sense of their body weight/mass status. There was also a significant difference between obese and non-obese females for Ideal Body Size using the t-test ($p \leq 0.04$) but not the Wilcoxon signed rank test (Table 55). Thus, the difference in Ideal Body Size between obese and non-obese adolescents was not highly significant. There was a significant difference for Body Dysphoria score by obesity status (Table 56) using both the t-test ($p \leq 0.0001$) and the Wilcoxon test ($p \leq 0.0002$). Body Image values for all three measures are shown in Figure 67. The correlation matrix for obesity status, Current Body Size, Ideal Body Size, and Body Dysphoria Score is shown in Table 57. Obesity status and Current Body Size were highly

correlated ($r=0.67$) as were Current Body Size and Body Dysphoria Score ($r=0.72$).

Mean Ideal Body Size of 3.89 for a female selected by 106 same-age males was between that selected by obese and non-obese females (Table 58). This finding is similar to findings using the adult version of the Body Image Assessment test (Williamson, 1990) for African-American adult males who selected a mean body size preference of 4.65 for adult females (Allison et al., 1993).

Child Health Behavior Knowledge Scale

The mean Child Health Behavior Knowledge Score for the obese females was 4.81 and for the non-obese females was 4.77 from a total of nine possible points, which is slightly higher than the published mean of 4.3 (Vega et al., 1987). Between-pair differences in the Child Health Behavior Knowledge score were tested using paired t-tests and the Wilcoxon matched-pairs signed-ranks test and are shown in Table 59. There was not a significant difference between obese and non-obese females in Child Health Behavior Knowledge score.

The responses of obese and non-obese West Philadelphia adolescents to the entire Child Health Behavior Knowledge Scale are shown in Table 60. A greater percentage of obese (78.1%) relative to non-obese (40.6%) adolescents knew that butter was a saturated fat ($P \leq 0.002$). There were no significant differences between obese and non-obese adolescents for any of the other questions on the scale. The adolescents scored lowest on the exercise questions (items two, five, and eight) compared to dietary fat (items one, four, and seven), and sodium questions (items three, six, and nine).

Physical Activity Patterns and Sedentary Behavior

Physical activity patterns and sedentary behavior (television watching and sleep patterns) were assessed using the 7-Day Physical Activity Recall method (Sallis et al., 1985). The mean minutes engaged in light to moderate physical activity over a one-week period was 41.72 minutes for the obese and 94.22 minutes for the non-obese females (Table 61). Non-obese females spent a significantly greater number of minutes engaged in physical activity over one week than obese females as tested using paired t-tests ($p \leq 0.002$) and the Wilcoxon matched-pairs signed-ranks test ($p \leq 0.0008$). Physical activity values by obesity status are shown in Figure 68.

The West Philadelphia adolescents spent an average of 91.88 minutes engaged in physical activity during the week surveyed and an average of 2.34 minutes during the weekend, with many females reporting zero minutes of physical activity during the weekend. While there was a significant difference between obese and non-obese adolescents in the total number of minutes spent engaged in physical activity during the week surveyed (t test: $p \leq 0.0012$; Wilcoxon: 0.0004), there was no significant difference between obese and non-obese females for physical activity during the weekend.

Using the seven day Physical Activity Recall method, Sallis et al. (1988b) found very similar results for California female fifth- and sixth-grade children who spent a mean of 92.3 minutes per week engaged in light physical activity. Using national surveillance data (NHANES III), 26.5% of high school female students reported irregular physical activity (any physical activity or pair of activities done for a total of 20 or more minutes in duration or less than three times per week), while 26.6% of females reported regular

physical activity (any physical activity or pair of activities done for a total of 20 or more minutes in duration, three or more times per week at 50% capacity). Only 15.9% of females achieved the Healthy People 2000 objectives for physical activity (Life Sciences Research Office, 1995).

Television watching, a proxy measure of sedentary behavior, was a major activity for these adolescents. The West Philadelphia obese females spent an average of 36.16 hours per week and the non-obese females spent an average of 28.89 hours per week watching television (Table 62). Using the paired t-test and the Wilcoxon matched-pairs signed-ranks test, it was determined that the obese females watched significantly more television per week than the non-obese females ($p \leq 0.04$; Figure 69). The obese females also watched significantly more television during the week than the non-obese females ($p \leq 0.02$), although there was no significant difference in hours of television watched during the weekend. Using the same television recall method, Obarzanek et al. (1994) found that African-American adolescents from the National Heart, Lung, and Blood Institute Health and Growth Study watched an average of 36.5 hours per week. Values for both samples were greater than reported data from the 1990 Nielsen Report on Television, which provided an estimate of 21 hours and 16 minutes spent viewing television for teenage girls (Nielsen Company, 1990).

Sleep, another indicator of sedentary behavior, was assessed for obese and non-obese West Philadelphia adolescents. The obese females slept an average of 62.12 hours and the non-obese adolescents slept an average of 60.63 hours during the week surveyed (Table 63). There were no significant between-pairs differences in hours of sleep during

the week or weekend. The West Philadelphia adolescents got slightly less sleep than California fifth- and sixth-grade females who reported 67.3 hours of sleep per week using the 7-day Physical Activity Recall method (Sallis, et al. 1988b).

Age at Menarche

Age at menarche was assessed using the menarcheal age recall method for month, day, and year of menarche. Age at menarche was 11.95 years for the non-obese and 12.06 years for the obese females (Table 64), which is lower than the national average and is 0.44 years earlier than West Philadelphia African Americans measured in the 1970's (Hediger and Stine, 1987). Although the obese females had a younger average age at menarche than the non-obese females, this difference was not significant. As shown in Table 65, seven females (three obese and four non-obese) in this sample had not yet reached menarche and these females were not included in the analysis. A subsample (n=31) was given the menarcheal recall a second time and no significant differences between the two samples were found. The two measures were significantly correlated ($r=0.784$; $p \leq 0.0001$).

Sociodemographic Variables

Sociodemographic variables were examined by obesity status (Table 66). There were no significant differences between obese and non-obese adolescents in family-owned residence, occupational status of mother, adult supervision after school, more than two siblings, snacks purchased at a store as opposed to at home, and eating fast-food more

than once per week. More than half of the obese and non-obese females lived in a family-owned residence, had a mother who worked full-time, and ate fast-food more than once per week. In just over half of these households, there was an adult present after school. Less than half of these females purchased snacks at a store as opposed to at home. A small percentage of females had more than two siblings.

Multivariate Analysis of Sociocultural and Individual Environment Factors, Physical Activity, and Sedentary Activity Patterns

Results of all of the matched-pair t-tests were compiled for all of the surveys (Table 67). The only statistically significant differences between the obese and the non-obese females were found for the Body Image Assessment scales, Current Body Size ($p \leq 0.00001$), Ideal Body Size (≤ 0.04), and Body Dysphoria Score ($p \leq 0.0001$), minutes of physical activity per week ($p \leq 0.001$) and hours of television viewing per week ($p \leq 0.04$). The obese and non-obese females did not differ in self-esteem, eating attitudes, health behavior knowledge, hours of sleep per week, sociodemographic variables, or age at menarche.

The contribution of dietary intake, physical activity, television watching, sleep, age at menarche, self-esteem, eating attitudes, health behavior knowledge, ideal body size, current body size, body dysphoria, and sociodemographic factors to obesity status were assessed for these adolescents. Correlations between variables were assessed first. Then, multivariate linear regression models were constructed to determine which measure or

combination of measures best explained variation in obesity status.

A stepwise logistic regression model (Table 68) was used to examine the impact of all of the variables upon obesity status. Binary variables were created for Ideal Body Size, ChEAT, and Piers-Harris scale for this analysis. The natural logarithm of physical activity and television watching were used as predictor variables to reduce the influence of outlying observations. The model was adjusted for chronological age. The stepwise analysis removed ChEAT scale, Piers-Harris scale, and age from the analysis. Minutes of physical activity per week ($p \leq 0.013$) had a significant impact upon obesity status. This model was significant ($P > 0.0047$) and correctly classified 71.88% of these adolescents and demonstrated that physical activity and television viewing were important factors in obesity status for these adolescents.

The relationship between physical activity, energy intake, and obesity status was modeled using the regression equation shown in Table 69. Using this model, energy intake ($p \leq 0.0096$) and the interaction between energy intake and obesity status ($p \leq 0.053$) had a significant impact on the amount of physical activity per week. As shown in Figure 70, obese and non-obese adolescents had the same intake at different levels of physical activity. Energy intake increased with increasing levels of physical activity for non-obese adolescents. However, for obese females, energy intake increased with no concurrent increase in physical activity. The same relationship between nutrient intake, physical activity, and obesity status was seen when energy intake was replaced with saturated fat and total dietary fat in the same model.

The relationship between physical activity, television viewing, and obesity status

was modeled using a similar approach as described above. This model was not significant, and there was no relationship between television viewing and physical activity. Thus, there is some indication that television viewing did not replace physical activity as a leisure activity for these adolescents.

Summary

The adolescents scored highly on the Piers-Harris Self-Concept Scale, which provided a measure of self-esteem, and on the Children's Eating Attitudes Test, which provided a measure of eating attitudes. The ChEAT scores were well within the range of normal eating attitudes (with the exception of three adolescents). On average, these adolescents conceived of their current body size (4.89) at a higher body mass relative to ideal body size (3.91), which yielded a mean body dysphoria score of 0.98. The mean Ideal body size of 3.89 for these females selected by their male same-age counterparts, was similar to that selected by the females. This finding indicates that males and females share the same perception of female ideal body size. In addition, these adolescents had a fairly good understanding of health behavior as assessed using the Child Health Behavior Knowledge Scale.

The obese and non-obese adolescents did not have statistically significant differences in self-esteem, eating attitudes, or health behavior knowledge by obesity status. Furthermore, there were no statistically significant differences in family and sociodemographic environment factors by obesity status. However, there were significant differences found for the body image measures by obesity status. On average, obese

females had a significantly higher body mass/weight perception of current body size and ideal body size.

Physical activity patterns assessed in this study indicate that these West Philadelphia adolescents got very little exercise, with a mean of just over one and one-half hours of light to moderate activity per week. Non-obese adolescents spent a significantly greater amount of time engaged in physical activity than their obese counterparts. These adolescents spent an average of 32.53 hours a week watching television, with obese females watching significantly more television per week than non-obese females. The low level of physical activity and the high frequency of television watching is likely to play an important role in the etiology of obesity in these West Philadelphia adolescents.

Table 50

Piers Harris-Self Concept Scores, by Obesity Status

Obesity Status	Mean \pm SD	Min	Max
Obese	59.47 \pm 13.37	24.0	75.0
Non-Obese	61.97 \pm 8.59	44.0	75.0

Table 51
Percentage of West Philadelphia Adolescents to Score Positively on the Following
Statements from the Piers-Harris Self-Concept Scale, by Obesity Status

Item	Obese	Non-Obese	P($\chi^2 \geq x$)
I am a happy person	87.5%	87.5%	NS
My looks bother me	87.5%	87.5%	NS
I have pretty eyes	81.3%	81.3%	NS
I like being the way I am	78.1%	96.8%	0.023
I wish I were different	34.4%	3.1%	0.001
I hate school	71.8%	75.0%	NS
I am good looking	84.4%	90.6%	NS
I am popular with boys	59.4%	71.8%	NS
I am a leader in games and sports	37.5%	59.4%	NS
In games and sports, I watch instead of play	53.1%	56.3%	NS
I am popular with girls	78.1%	71.8%	NS
I have a good figure	53.1%	78.1%	0.035
I am a good person	96.9%	100.0%	NS

Table 52

Children's Eating Attitudes Test (ChEAT) Scores, by Obesity Status

Obesity Status	Mean \pm SD	Min	Max
Obese	8.63 \pm 5.51	0	26.0
Non-Obese	8.84 \pm 6.37	0	22.0

Table 53

Percentage of West Philadelphia Adolescents to Score Positively on the Following Statements from the Children's Eating Attitudes Test (ChEAT), by Obesity Status

Item	Obese	Non-Obese	P($\chi^2 \geq X$)
I have gone on eating binges where I feel that I might not be able to stop	6.2%	3.2%	NS
I think a lot about wanting to be thinner	40.6%	12.5%	0.028
I think about burning up energy (calories) when I exercise	53.1%	37.5%	NS
I eat diet foods	9.4%	6.2%	NS
I have the urge to vomit after eating	0%	6.2%	NS
I am scared about being overweight	31.2%	25.0%	NS
I stay away from eating when I am hungry	6.2%	6.2%	NS
I am aware of energy (calorie) content in foods that I eat	28.2%	28.2%	NS
I think a lot about having fat on my body	40.6%	18.7%	NS
I have been dieting	12.5%	0%	NS

Table 54

Body Image Assessment Test Current Body Size Scores, by Obesity Status

Obesity Status	Mean \pm SD	Min	Max
Obese*	5.91 \pm 1.12	4.0	8.0
Non-Obese	3.88 \pm 0.91	2.0	5.0

*Difference between Obese and Non-Obese Females: $p \leq 0.00001$

Table 55

Body Image Assessment Test Ideal Body Size Scores, by Obesity Status

Obesity Status	Mean \pm SD	Min	Max
Obese*	4.19 \pm 1.12	2.0	6.0
Non-Obese	3.62 \pm 1.10	1.0	5.0

***Difference between Obese and Non-Obese Females: $p \leq 0.04$**

Table 56

The Body Image Assessment Test Body Dysphoria Score (Current-Ideal Body Size) Score, by Obesity Status

Obesity Status	Mean \pm SD	Min	Max
Obese*	1.72 \pm 1.44	-2.0	5.0
Non-Obese	0.25 \pm 1.19	-2.0	3.0

*Difference between Obese and Non-Obese Females: $p \leq 0.0001$

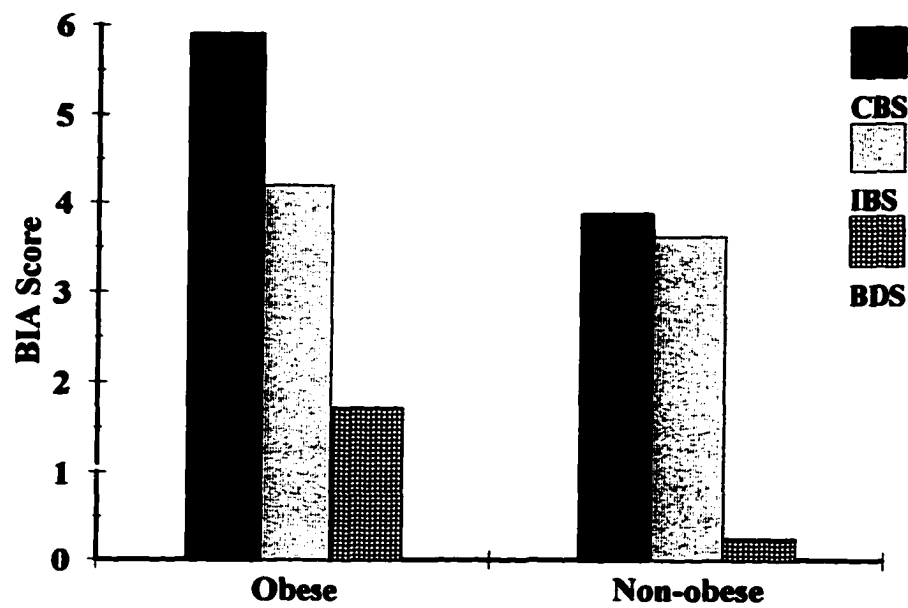


Figure 67. Body Image Assessment Test scores for Current Body Size (CBS), Ideal Body Size (IBS) and Body Dysphoria Score [BDS; (Current-Ideal Body Size)] for obese and non-obese West Philadelphia adolescents. Differences between the obese and non-obese adolescents were greatest for CBS and BDS.

Table 57

Correlation Matrix for Obesity Status (Obesity), Current Body Size (CBS), Ideal Body Size (IBS), and Body Dysphoria Score (BDS)

	Obesity	CBS	IBS	BDS
Obesity	1.0000			
CBS	0.6719	1.0000		
IBS	0.2493	0.3880	1.0000	
BDS	0.4913	0.7185	-0.3623	1.0000

Table 58

Body Image Assessment Test Score for 106 Adolescent Males (Ideal Body Size for a Female)

	Mean \pm SD	Min	Max
Ideal Body Size for a Female	3.89 \pm 0.90	2.0	6.0

Table 59

Child Health Behavior Knowledge Scale (ChBKS) Score, by Obesity Status

Obesity Status	Mean \pm SD	Min	Max
Obese	4.81 \pm 1.53	2.0	8.0
Non-Obese	4.77 \pm 1.50	2.0	8.0

Table 60

Percentage of Correct Responses for Selected Items^a from the Child Health Behavior Knowledge Scale (ChBKS), by Obesity Status

Item	Obese	Non-Obese	P($\chi^2 \geq x$)
1. A saturated fat is? a. Butter, b. Corn oil, c. Walnuts	78.1%	40.6%	0.002
2. Which of these types of exercise is good for your heart? a. Aerobic dance, b. Hop-scotch, c. Baseball	65.6%	68.8%	NS
3. A good low sodium snack is? a. Fresh Fruit, b. Tortilla chips, c. Pickles	90.6%	100.0%	NS
4. A lunch that is healthy for the heart is? a. Lowfat yogurt with fruit, carrot sticks, homemade banana nut bread, nonfat milk b. Balogna sandwich, milk, potato chips, cookies c. Peanut butter sandwich, cheese cubes, celery sticks, milk, apple	75.0%	75.06%	NS
5. To help your heart, how many minutes should you exercise at a time? a. At least 20 minutes; b. At least 5 mins., c. At least 10 mins.	34.4%	31.3%	NS
6. Which of these foods is highest in salt? a. TV dinner and canned tuna b. Hamburger and chicken c. Fresh vegetables and fruit	28.1%	34.4%	NS
7. Some foods that have hidden fat are? a. Olives, avocado, coconut b. Corn, banana, potato c. Broccoli, green beans, lettuce	43.8%	40.6%	NS
8. The least amount of aerobic exercise you should do for a healthy heart is? a. Three times per week b. Two times/wk, c. Once/wk	34.4%	28.1%	NS
9. Most people eat? a. 30 times as much sodium as they need b. One-half as much sodium as they need c. As much sodium as they need	31.3%	53.1%	NS

^a Correct answer presented in this table as answer "A," although this was not format for original questionnaire. Option, "Don't Know," available for each question in the original questionnaire.

Table 61

Mean Minutes of Physical Activity During One Week, by Obesity Status

Obesity Status	Mean \pm SD	Min	Max
Obese*	41.72 \pm 42.38	0	150.0
Non-Obese	94.22 \pm 84.25	0	450.0

*Difference between Obese and Non-Obese Females: $p \leq 0.0012$

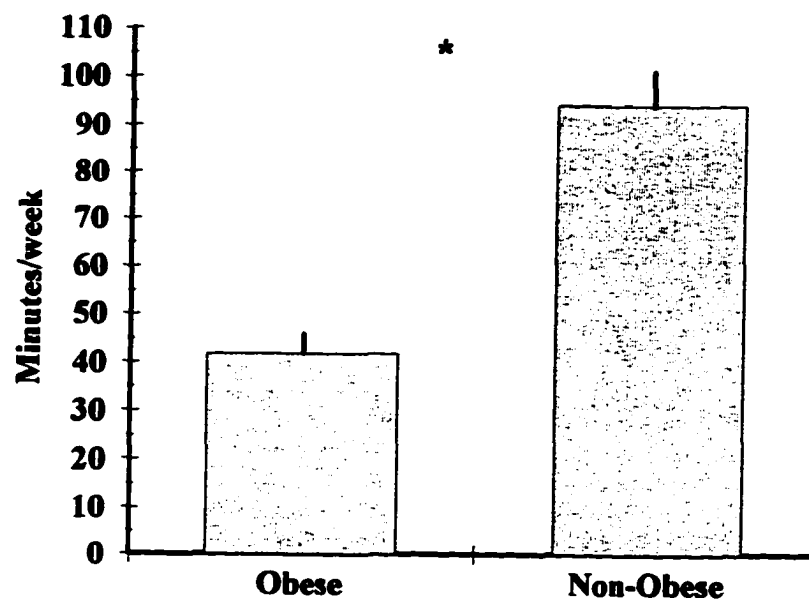


Figure 68. Mean minutes of physical activity during one week for obese and non-obese West Philadelphia adolescents. There was a significant difference between the obese and non-obese adolescents in mean minutes of physical activity per week (* $p \leq 0.0012$).

Table 62

Mean Hours of Television Viewing During One Week, by Obesity Status

Obesity Status	Mean \pm SD	Min	Max
Obese*	36.16 \pm 14.34	0	150.0
Non-Obese	28.89 \pm 14.98	4.0	60.0

*Difference between Obese and Non-Obese Females: $p \leq 0.04$

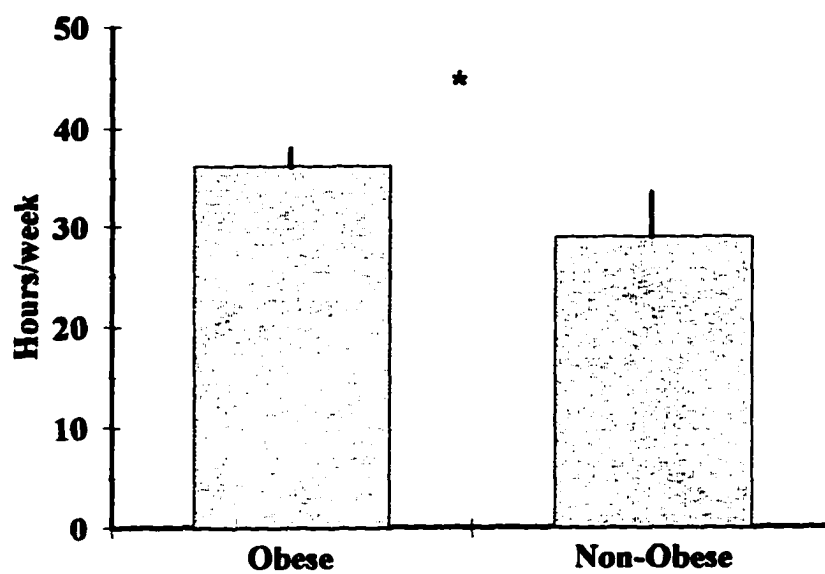


Figure 69. Mean hours of television viewing during one week for obese and non-obese West Philadelphia adolescents. There was a significant difference between the obese and non-obese adolescents in mean hours of television watching per week (* $p \leq 0.04$).

Table 63

Mean Hours of Sleep During One Week, by Obesity Status

Obesity Status	Mean \pm SD	Min	Max
Obese	62.12 \pm 7.03	51.0	54.50
Non-Obese	60.63 \pm 6.18	49.0	69.75

Table 64

Mean Age at Menarche, by Obesity Status

Obesity Status	Mean \pm SD	Min	Max
Obese	11.95 \pm 1.06	9.39	14.23
Non-Obese	12.06 \pm 0.82	10.18	13.47

Table 65

Obesity Status and Chronological Age of Pre-Menarcheal Females

Obesity Status	Chronological Age
Non-Obese	12.14
Non-Obese	14.41
Non-Obese	14.11
Non-Obese	15.13
Obese	12.14
Obese	12.75
Obese	14.29

Table 66

Percentage of West Philadelphia Adolescents to Respond Positively to the Following Sociodemographic Characteristics, by Obesity Status

Household Variable	Obese	Non-Obese	P($\chi^2 \geq x$)
Family-Owned Residence	71.0%	78.1%	NS
Mother Works Full-Time	62.5%	59.4%	NS
Adult is Home After School	50.0%	60.0%	NS
More than Two Siblings	15.6%	21.9%	NS
Purchase Snacks from Store After School	50.0%	46.9%	NS
Eat Fast Food More than Once Per Week	50.0%	50.0%	NS

Table 67

Matched-Pair Differences in Survey Response, by Obesity Status (Mean \pm Standard Deviation and Level of Significance using Student's t-test Probability $>|t|$)

Questionnaire	Obese	Non-Obese	P
Piers-Harris	59.47 \pm 13.37	61.97 \pm 8.59	NS
Children's Eating Attitudes Test	8.63 \pm 5.51	8.84 \pm 6.37	NS
Body Image Assessment			
Current Body Size	5.91 \pm 1.12	3.88 \pm 0.91	0.00001
Ideal Body Size	4.19 \pm 1.12	3.62 \pm 1.12	0.04000
Body Dysphoria	1.72 \pm 1.44	0.25 \pm 1.19	0.00010
Children's Health Behavior Knowledge Scale	4.81 \pm 1.53	4.77 \pm 1.50	NS
Minutes of Physical Activity/wk	41.72 \pm 42.38	94.22 \pm 84.25	0.0012
Hours of Sleep/wk	62.12 \pm 7.03	60.63 \pm 6.18	NS
Hours of TV viewing/wk	36.16 \pm 14.34	28.89 \pm 14.98	0.0400
Age at Menarche	11.95 \pm 1.06	12.06 \pm 0.82	NS

Table 68

Logistic Regression Analysis to Assess the Likelihood of Obesity Status Using Physical Activity, Television Watching, Ideal Body Size, Eating Attitudes, Self-Esteem, and Age

$R^2 = 0.15$; $P > 0.005$

Obese	Odds Ratio	z	Prob > z
Physical Activity	0.39	-2.49	0.013
Television Viewing	2.03	1.92	0.055
Ideal Body Size	2.21	1.31	0.191

Correctly Classified: 71.88%

Classified	Non-Obese	Obese	Total
Positive	21.0	7.0	28.0
Negative	11.0	25.0	36.0
Total	32.0	32.0	64.0

Table 69

Regression Analysis to Assess the Relationship Between Physical Activity, Energy Intake, and Obesity Status [Physical Activity = Kcal + Obesity Status + Obesity Status * Kcal]

$R^2 = 0.21$

Source	Partial SS	F	Prob > F
Model	82670.77	5.14	0.0013
Kcal	28839.94	7.17	0.0096
Obese	4687.24	1.17	0.2846
Obese*Kcal	15639.02	3.89	0.0533
Age	2800.76	0.70	0.4072

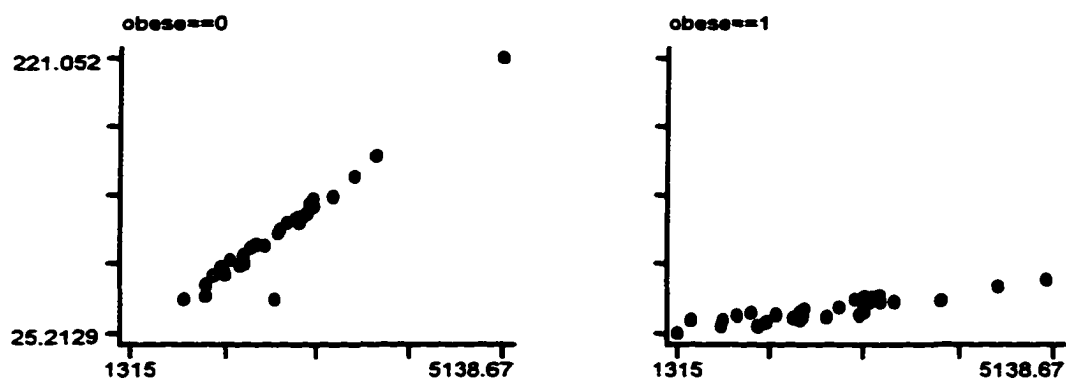


Figure 70. Linear relationship between physical activity, energy intake, and obesity status. Energy intake ($p \leq 0.0096$) and the interaction between energy intake and obesity status ($p \leq 0.053$) had a significant impact on the amount of physical activity of obese and non-obese West Philadelphia adolescents during one week. Non-obese females had energy intake values that increased with increasing levels of physical activity, whereas, obese females had energy intake values that did not increase with increasing level of physical activity.

CHAPTER 10

DISCUSSION

This dissertation research used an ecological framework to examine the relationships between biological, dietary, sociocultural, and behavioral factors to determine how these factors influenced obesity status of West Philadelphia adolescents. First, an anthropometric and dietary survey documented the prevalence of obesity and described the dietary intake of adolescents from a West Philadelphia geographic community. A sociodemographic survey was used to provide background information on the sociocultural correlates of obesity, such as household composition, home ownership, and adult supervision after school. In addition, focus group discussions were used to elucidate cultural concepts of obesity, such as eating habits, the definition of obesity held by these adolescents, concepts of attractiveness, dieting behavior, and health concerns associated with body shape and size. These components of the dissertation provided a biocultural context of obesity in this West Philadelphia community.

The second phase of this dissertation was designed to further investigate factors within the family, physical, sociocultural, and individual environments that impacted dietary and physical activity patterns, which subsequently influenced obesity status. To this end, a subsample of matched-pairs of obese and non-obese female adolescents was drawn from the larger prevalence survey and contrasted on variables within the family,

physical, social, and individual environments. Factors within the family environment to influence obesity status included the following: household composition, home ownership, and adult supervision after school. Within the physical environment, the following correlates of obesity were investigated: availability of certain types of food within a geographic area and accessibility of areas for physical activity and exercise. Factors within the sociocultural environment to impact obesity included the following: knowledge of risk factors for cardiovascular disease, social value of obesity, priority of obesity and cardiovascular disease as health concerns, social value of high-fat, energy-dense fast-foods and snack foods, and social value of settings for food consumption. Within the individual environment, correlates of obesity included the following: pubertal status, body image attitudes, self-esteem, eating and food attitudes, and extent of cardiovascular disease-related knowledge.

This dissertation was designed to place the correlates of obesity for these adolescents within a specific ecological model and to contrast the pattern of relationships among variables for obese and non-obese adolescents. This analysis was designed to determine the most important contributory factors to obesity status and to examine how these factors influenced obesity status on both a proximate and ultimate level. This approach follows Mosely and Chen (1984) who propose that ultimate determinants have a global influence on measures of interest, whereas proximate determinants have a more direct impact. Within this research study, dietary intake variables, and physical and sedentary activity patterns were seen as proximate determinants of obesity. Whereas, ultimate determinants of obesity included variables within the family, physical,

sociocultural, and individual environments. These factors were measured using a variety of quantitative and qualitative measures.

Anthropometry and Secular Trend

The first part of this research documented the prevalence of obesity in West Philadelphia adolescents and the secular increases in overweight and obesity in urban Philadelphia African-American adolescents over the past four decades. Stature, weight, and skinfold data from adolescents from the Ecology of Obesity Project (EOP90s) were compared to stature and weight data from adolescents measured in the mid-1960s (PCRCG60s) and stature, weight, and skinfold data from adolescents measured in the late 1970s (PBPP70s). Adolescents from the EOP90s sample were heavier and only somewhat taller than those from the PCRCG60s and PBPP70s samples, and they were significantly fatter than those from the PBPP70s sample. Adolescents from the PBPP70s sample were similar in stature and weight to the NHANES I reference standards. Adolescents from the EOP90s sample were taller at younger ages (11-12 years) and markedly heavier at all ages than the NHANES I reference standards. A threefold (males) and fourfold (females) increase in the prevalence of obesity (BMI and triceps skinfold measures \leq 95th percentile NHANES I) occurred from the mid-1970s to the mid-1990s. Using BMI, the prevalence of overweight in the EOP90s sample was 17.6% based on the 95th percentile and 34.9% were "at risk" for overweight based on the 85th percentile of NHANES I (Must et al., 1991).

The overweight prevalence estimates for the West Philadelphia adolescents

exceeded those of adolescents from the first phase of NHANES III (10.9% based on the 95th percentile and 22% based on the 85th percentile of Cycles II and III of the National Health Examination Survey; Troiano et al., 1995). However, the NHANES III survey was designed to provide nationally representative reference data and does not fully characterize the prevalence of obesity among subgroups of the American population. This dissertation outlined the severity of obesity prevalence in a subgroup of American adolescents and provided a well defined picture of obesity in one localized segment of American youth.

Overweight and obesity are the primary nutritional problems in America and are of particular public health concern due to the rapid increase in their prevalence over the past few decades among U.S. adults (Shah et al., 1991; Kuczmarski et al., 1994), children, and adolescents (Gortmaker et al., 1987; Troiano et al., 1995). The increasing prevalence of overweight and obesity in American children and adults is associated with increased risk for several chronic degenerative diseases (Berenson, 1980; Garrison et al., 1980; Foster and Burton, 1985; Van Itallie, 1985; Pi-Sunyer, 1993). In addition, overweight and obesity are significant problems for minority populations (Ernst and Harlan, 1991; Kumanyika, 1994) and particularly for African-American women (Kumanyika, 1987; Harlan et al., 1988; Kuczmarski et al., 1994) of whom approximately 49% are estimated to be overweight (Kuczmarski et al., 1994). Furthermore, morbidity and mortality rates for obesity-related chronic degenerative diseases, such as hypertension, diabetes, and heart disease, are disproportionately high among African Americans compared to other ethnic groups (National Center for Health Statistics, 1993; National Heart, Lung, and Blood

Institute, 1994).

Adolescence is a period of heightened concern for the development of overweight and obesity (Dietz, 1994). Men and women who were overweight as children and adolescents have been found to have two times higher risk (than those not overweight as children and adolescents) for morbidity from coronary heart disease and atherosclerosis without regard to their adult weights (Must et al., 1992). In addition, the long-term health consequences are highest for those individuals who were overweight in late adolescence (Must, 1996). The incidence of obesity increases at adolescence (Lawrence et al., 1991; Dietz, 1994; Morrison et al., 1994) and it is believed that a significant proportion of adult obesity originates at this time (Johnston, 1981; Stark et al., 1981; Dietz and Bandini, 1992).

There is evidence that increased adiposity is associated with earlier maturation (Garn et al., 1974; Beunen et al., 1982; Mueller, 1983; Wellens et al., 1992), although the role of earlier maturation in the increasing prevalence of overweight and obesity is unclear. African Americans mature earlier than white Americans (Morrison et al., 1994) as suggested in the 1970s and 1990s samples. It is specifically within the adolescent developmental period that significant differences in prevalence of overweight and obesity between African-American and white-American women begin to appear despite the fact that such differences are absent during infancy and childhood (Gartside et al., 1984; Gillum, 1987; Gortmaker et al., 1987; Morrison et al., 1994). These ethnic differences in prevalence of obesity continue through late adolescence (Must et al., 1994) and adulthood (Harlan et al., 1988; Shah et al., 1991; Kuczmarski et al., 1994).

Standardized normal deviate scores were used to characterize the distribution of stature and weight of these adolescents relative to national reference data. Z-score values indicated that these adolescents had greater stature relative to reference data at ages 11 and 12 years, potentially as the result of earlier maturation. After 13 years-of-age, stature was similar to national reference data. Mean body weight, Z-scores, however, were consistently between 0.5 and 1.19 standard deviations above the national reference data, which indicates high body weight in these Philadelphia males and females.

The percentage of the EOP90s sample characterized as overweight (Table 19) indicates that there was a disproportionately high prevalence of obesity in this sample. These figures were similar to those published by Johnston and Hallock (1994) from data previously collected on 136 adolescents from the same middle school and are markedly higher than values reported for other North American youth (Malina, 1993). These data indicate a marked upward trend in the prevalence of overweight and obesity in urban African-American adolescents over the past two decades. The upward trend in prevalence of overweight and obesity found in these West Philadelphia adolescents is similar to findings from studies in the U.S. and other countries that indicate increasing prevalence of overweight and obesity during the same time period.

Researchers have found increasing prevalence in overweight (using BMI) over the past two decades in Samoan adults (McGarvey et al., 1993) and young Pima adults (Knowler et al., 1991) and in the past decade in American adults (Shah et al., 1991; Kuczmarski et al., 1994) and children (Campaigne et al., 1994), in Navajo schoolchildren (Sugarman et al., 1990), and Danish young adult males (Sorensen and Price, 1990). A

similar secular increase in weight as well as ponderosity, using the ponderal index, was found in the Bogalusa study between 1973 and 1984 (Shear et al., 1988). During the same time period, Chakraborty et al. (1993) found a similar increase in prevalence of obesity (using skinfold measures) and overweight (using BMI) in Mexican-American children. In addition, Malina et al. (1986) found an increase in the prevalence of overweight and obesity in Mexican-American schoolchildren between 6 and 17 years-of-age (although the authors did find a decrease in overweight and obesity prevalence in 14- to 17-year-old boys). Similar findings for the past decade have also been found using triceps skinfold (Gortmaker et al., 1987) and using self-reported stature and weights for American adults (Schoenborn, 1988; Chung et al., 1992) and Finnish adult men (Jalkanen et al., 1989). However, criteria used to define overweight and obesity differ across studies, making inter-sample comparisons difficult.

Triceps skinfold thickness has also increased over the past three decades in urban African-American youths. Using triceps skinfold thickness, 24% of females and 20% of males from the 1990s sample fell above the NHANES I 95th percentile and 42% of females and 30% of males fell above the NHANES I 85th percentile (Must et al., 1991). In comparison, triceps skinfold thickness of African Americans (6 - 12 years-of-age) of somewhat lower socioeconomic status from the late 1950s and early 1960s had relatively lower mean triceps skinfold values compared to British standards (Malina, 1966). For example, mean triceps skinfolds of males fell between the 25th and 50th percentiles at earlier ages, and were at or below the 50th percentile after 8 years-of-age; whereas mean triceps skinfolds of females fell around the 50th percentile throughout the entire age range

(Malina, 1966). Comparisons of the West Philadelphia data to published obesity prevalence data for U.S. and non-U.S. adolescents was possible using various sets of reference data. However, the difference in percentages of adolescents characterized as obese using these different reference data demonstrates the significant variation in obesity prevalence estimates using various criteria.

In this study, anthropometric indicators of body composition were used to investigate both the absolute amount and the patterning of subcutaneous fat in Philadelphia adolescents. Although triceps and skinfold thickness have increased substantially over the past three decades, body fat centralization has decreased. Regression analyses using fat distribution demonstrated a gender difference in the relationship between measures of growth/body size and centripetal fat patterning. This effect remained when using both Centripetal Fat Ratio (the ratio of subscapular skinfold to subscapular plus triceps skinfold) and Relative Fat Distribution (the standardized regression residual scores from the log of subscapular on triceps skinfold). The pattern of variation in centralized fat distribution was related to stature in males and weight in females, and thus indicated a possible maturation/size effect.

Subcutaneous fat patterning was of particular relevance in this study due to its association with health status. The preferential distribution of body fat over the trunk relative to the extremities is associated with increased risk of heart disease. The risk of heart disease is as great for centralized body fat patterning as it is for hypertension and smoking (Bouchard, 1988). Studies of ethnic variation in fat patterning have indicated that African Americans are more likely than white Americans to have centralized fat

patterning. In addition, cardiovascular disease rates are also higher in African Americans (U.S. Department of Health and Human Services, 1989; National Center for Health Statistics, 1993; National Heart, Lung, and Blood Institute, 1994) as are death rates from heart disease, stroke (Gillum, 1991), cancer, and diabetes (U.S. Department of Health and Human Services, 1985b).

The secular increase in triceps and subscapular skinfold thickness and decrease in centralized fat patterning in this study raise questions related to changing patterns of risk profile. For example, these adolescents may be at higher risk due to their increased obesity, or conversely they may have reduced risk due to their decreased centralized fat distribution. Although there is evidence that the mortality risks associated with body mass index and weight vary with body fat distribution, the majority of current studies linking anthropometric measures with mortality use measures of body mass or weight rather than measures of body fat as indicators of obesity. This is the first study to examine secular changes in fat patterning using CFR.

Both BMI and triceps skinfold were used to estimate the percentage of Philadelphia middle school students characterized as overweight and obese. According to a recent expert panel, BMI is the most appropriate index for assessing overweight during adolescence (Himes and Dietz, 1994). However, BMI is an inferred measure of overweight because it reflects leg length, frame size and does not differentiate between fat and lean body compartments (Lohman, 1992). In addition, BMI may not provide a reliable measure of fatness for adolescents due to differences in maturational development (Killeen et al., 1978; Schey et al., 1984; Kuczmarski, 1993). Triceps skinfold measures,

while providing an appropriate estimate of subcutaneous body fat, are subject to moderate levels of measurement error (Ulijaszek and Lourie, 1994).

The rationale for using both BMI and triceps skinfold measures in this project is that using both measures served to remove some of the uncertainty of using BMI due to differences in muscle mass and pubertal development. Using both BMI and triceps skinfold gave a more conservative estimate of the prevalence of obesity than using either BMI or triceps skinfold measures separately (See Table 19). Similarly, Malina et al. (1986), using the same approach, found a more conservative obesity prevalence estimate with both BMI and triceps skinfold than with either measure separately. The EOP90s males had decreased risk for overweight prevalence using the 85th percentile of BMI and triceps skinfold measures compared to estimates using only BMI measures. In comparison, the decrease in obesity prevalence for females using BMI only was not of the same magnitude, with similar obesity prevalence using BMI alone or both BMI and triceps skinfold measures. This finding suggests that the EOP90s males had a higher BMI due to greater muscle mass, whereas the EOP90s females had a considerable amount of excess subcutaneous fat at a similar BMI value.

Comparative studies using anthropometric data collected by different researchers pose difficulties in terms of interpretation due to methodological issues. However, in this comparative study, findings were based on stature and weight measured under standardized conditions and, as such, were unlikely to represent methodological differences between the three samples. Skinfold thicknesses, although more likely to be subject to methodological error, corroborated the findings from stature and weight data.

Another issue faced by secular trend studies is establishing confidence in the use of appropriate comparative samples. The adolescents in the EOP90s, PBPP70s and PCRCG60s samples were of comparable socioeconomic status, ethnic background and residency in a similar urban environment in the same city. The adolescents participating in the Ecology of Obesity Project attended a middle school in a West Philadelphia neighborhood manifesting high rates of crime and a disproportionately high number of children from low-income families (83.7%; School District of Philadelphia, 1995). The mean poverty rate for the middle school area was 18%, just above the city (Philadelphia City Planning Commission, 1990) and the national average for African Americans (U.S. Bureau of the Census, 1990). Families in the PBPP70s study were reported to be of relatively lower socioeconomic status overall, falling slightly above the national average for African Americans in the 1970s (Myriantopoulos and French, 1968; Hediger et al., 1984). The African-American youths enrolled in the PCRCG60s study have been described as lower socioeconomic status (Krogman, 1970).

This study is unique in its comparison of anthropometric measures collected over three decades from three samples of Philadelphia adolescents of similar SES and ethnic background. These data provide an important source of information about the historical changes in health status of urban African-American adolescents. These data, which confirm increased prevalence of obesity in a group similar in socioeconomic status, ethnicity and region, also confirm the trend toward increased obesity prevalence at a national level. In addition, these data indicate a shifting distribution over time in growth measures related to body shape. This change is important in demonstrating ongoing

evolution in body shape and form related to changes in sociocultural and environmental factors in West Philadelphia. These secular changes have implications for understanding the relationship between growth and the environment in the context of a national and international trend towards increased body size and shape.

Positive secular trends for weight, and particularly fatness, indicate that African-American adolescents have increased their risk profile with regard to obesity-related chronic degenerative diseases. The steps taken in the last three decades to increase awareness of these risk factors and to lower the prevalence of overweight and obesity in urban African-American adolescents appear to have had little effect. Furthermore, the increases in weight and fatness shown here for Philadelphia adolescents may be predictive of future health problems.

Dietary Correlates of Obesity

This dissertation research examined dietary factors, an important component of the energy balance equation, to provide an understanding of the contribution of dietary factors to obesity prevalence in this population. Although 24-hour dietary recall data are not necessarily representative of an individual's usual dietary intake, they do provide an indication of group intake within a given 24-hour period. The West Philadelphia data were assessed for nutritional adequacy relative to age- and sex-appropriate 1989 U.S. Recommended Daily Allowances (RDA) and focused on nutrients of current public health concern because of their association with diet-related chronic degenerative diseases, including coronary heart disease, stroke, certain cancers, and non-insulin dependent

diabetes.

Energy requirements for these West Philadelphia adolescents were estimated using equations for predicting resting energy expenditure from body weight and a factorial method for estimating total energy requirements (WHO, 1985). Median reported energy intake, using dietary recall, was relatively similar to estimated energy requirements using the WHO prediction equations, with intakes exceeding estimated requirements by 264 kcals (males) and 241 kcals (females). Excess energy intake relative to energy requirements can have a substantial impact on excess body weight over a period of time. This over reporting of energy intake may indicate that some of these adolescents were consuming a significantly large amount of excess energy and were thus in positive energy balance relative to their energy needs. Alternatively, these adolescents may have over reported energy intake, with extent of over reporting highest in the lowest two quartiles of BMI. If figures for over reporting were not artifactual, this pattern of potential over reporting may suggest that these adolescents were not aware of the amount of food they consumed. In addition, it is possible that high energy intake was perceived by these adolescents as an equivocal, or perhaps positive, practice.

The West Philadelphia adolescents had macronutrient intakes that were higher than the RDA and higher than age- and sex-specific data from NHANES III. They had high intakes of total dietary fat and protein and a high percentage of energy from these nutrients relative to the RDA. The higher-than-recommended intake of dietary fat consumed by these adolescents may increase their risk for certain chronic disease outcomes, including coronary heart disease, stroke, and some cancers (Doll and Peto,

1981). This increase in dietary fat consumption is particularly important due to its association with serum cholesterol concentrations (Keys et al., 1959) and risk for heart disease (Grundy et al., 1982). Furthermore, there is some indication that total dietary fat intake, independent of total energy intake, may be a determinant of body weight and adiposity (Dreon et al., 1988; Miller et al., 1990; Tucker and Kano, 1992; Gazzaniga and Burns, 1993). Females in this population are potentially at heightened risk for future development of these nutrition-related chronic degenerative diseases due to the increased prevalence of obesity and the high intake of dietary fat among females relative to males.

Intake of most micronutrients was adequate relative to the RDA and was higher in Philadelphia adolescents than national reference data. However, lower-than-recommended intake of calcium, zinc, fiber, and vitamins A and D put these adolescents at increased risk for anemia, osteoporosis (decreased bone mass), and complications associated with pregnancy, such as low birthweight (National Research Council, 1989b). Decreased calcium intake may be particularly detrimental during adolescence because calcium requirements increase substantially during the pubertal growth period (Garn, 1970). In addition, decreased fiber is of particular concern due to its effect of lowering plasma cholesterol levels (National Research Council, 1989b). Dietary fiber is associated with fruit and vegetable intake, which has an inverse relationship with cardiovascular disease, colon cancer, and diabetes (National Research Council, 1989b). The increased intake of sodium by these adolescents may put them at increased risk for development of hypertension, particularly in light of decreased calcium intake (National Research Council, 1989b). Intake of micronutrients by the Philadelphia adolescents were below values found

for NHANES III adolescents, with the exception of sodium, iron, and folate, which were above reported values (Life Sciences Research Office, 1995).

In addition to describing the dietary intake of West Philadelphia adolescents, this analysis also served to ascertain which foods in the diets of these Philadelphia adolescents were the major contributors to total dietary fat and saturated fat intake. For these adolescents, meat, high-fat cheese, fast-foods (mostly McDonald's and Kentucky Fried Chicken), and snack foods (both salty and sweet snacks) were important sources of total and saturated fat and are thus candidates for modification. The greatest contributors of total dietary fat and saturated fat from meat were ground beef, fast-food (McDonald's and Kentucky Fried Chicken), and lunchmeats (bacon, ham, hot dogs, and sausage). Findings were similar to those for white Americans (Block et al., 1985) and African Americans (Windham et al., 1983; Patterson and Block, 1988; Newell et al., 1988; Hargreaves et al., 1989). Knowledge of the nutrient sources of total dietary fat is important for guiding health-promotion efforts in this, and similar, populations.

On average, the daily intake of most vitamins and minerals at least met the U.S. RDA. However, these adolescents were consuming more than the recommended values of certain nutrients, particularly dietary fat, protein, saturated fat, and sodium. This finding is similar to other research findings indicating that diets of American adolescents generally fail to meet current dietary recommendations (Kimm et al., 1990; Wright et al., 1991; Pennington and Young, 1991; Murphy et al., 1990). Adolescents, due to their increased dietary needs as a consequence of the adolescent growth spurt, are considered a nutritionally vulnerable subpopulation. Eating behaviors of these Philadelphia adolescents

were influenced by the surrounding urban environment, which provided easy access to low-cost, energy-dense foods close in proximity to their homes and school. Consequently, these adolescents consumed a significant amount of "urban" foods, such as fast-foods and packaged/prepared foods high in fat and sodium. Although these dietary practices are associated with increased cardiovascular risk, these adolescents consumed adequate amounts of most macronutrients and micronutrients. The dietary intake patterns of these Philadelphia adolescents may be viewed as part of an adaptive strategy to ensure adequate intake of micronutrients.

Sociodemographic Correlates of Obesity

Sociodemographic factors were examined to determine whether such factors modified the degree and type of exposure to the urban environment. Particular attention was paid to the impact of sociodemographic factors on dietary and physical activity patterns. The majority of these adolescents (56%) lived in single parent households (mostly single-mother households). Female single-headed families are more vulnerable to poverty than are other types of families (U.S. Bureau of the Census, 1983), and poverty itself is associated with poor nutritional status. Under half (39%) lived in households with more than two siblings, 18% lived with at least one grandparent, and 35% of the sample lived with more than two non-nuclear relatives. Just over half of the adolescents reported that their mothers worked full-time (52%), and 23% reported that their mothers were unemployed. The high degree of unemployment may predispose these adolescents to poverty and to lack of access to quality health care.

Physical Activity Patterns

Physical activity, an important component of the energy balance equation, was assessed for these adolescents. As a group, the adolescents reported moderate levels of physical activity; however, these reported figures were likely to be overestimates because they were based on forced point questions and not on a recall of all activities completed over a period of time (Sallis et al, 1985). Despite this, the results were informative in terms of general activity pattern. The majority of adolescents (68%) reported that they considered themselves to be “sometimes” or “often” active. In addition, close to a third of the West Philadelphia adolescents (36%) stated that they participated in more physical activity than their peers, and 53% of the males and 37% of the females reported that they participated in a “team sport.” However, the category “team sport” included formal leagues, drill teams, and informal teams, such as neighborhood, after-school program teams, and church teams, which may have encouraged adolescents to report such activities even if these activities did not occur on a regular basis. Overall, these adolescents perceived that they engaged in a fair amount of physical activity.

There were significant sex differences in reported light and moderate physical activity, with females reporting less activity than males. The amount of television watched varied according to reported level of physical activity. For example, the small percentage of adolescents that considered themselves to be moderately active (24.24%) reported watching five or more hours of television per day, while 80.65% of the adolescents that considered themselves to get light activity, watched five or more hours of television per day. This finding varied by sex, with a greater percentage of females than males watching

more hours of television at both the moderate and light levels of activity. It is unclear whether television viewing replaced physical activity or whether individuals who watched television were less likely to engage in less physical activity.

The Ecology of Obesity in West Philadelphia Adolescents

Results from the prevalence study of obesity indicate that there was a high prevalence of obesity for these West Philadelphia adolescents that has increased over the past two decades. The remainder of this dissertation research was designed to examine the complex factors that influenced this secular increase in obesity. To this end, factors within the family, physical, sociocultural, and individual environments were assessed to determine how these factors interacted to influence dietary and physical activity patterns, which were likely to underlie the increased prevalence of overweight in this population. To accomplish this, a subsample of 64 female adolescents was selected from the larger sample based on body mass and triceps skinfold thickness. Matched pairs of obese and non-obese adolescents, matched by age and stature, were compared on measures related to variables within the family environment, physical environment, sociocultural environment, and individual environment.

Dietary intake of the obese and non-obese females were compared using three-day repeated 24-hour dietary recall assessments of dietary intake. These adolescents over reported energy intake, with considerably greater over reporting seen (approximately 300 kcals more) for the non-obese relative to the obese adolescents. This finding suggests that these adolescents were in positive energy balance, meaning that they consumed more

energy than they expended. Conversely, non-obese West Philadelphia adolescents may have been more likely than their obese counterparts to either perceive themselves, or to wish to be perceived, as consuming more energy than they reported consuming. Another possibility is that the prediction equations used to calculate energy requirements were not appropriate for these adolescents.

Although total dietary fat and saturated fat as percentages of the RDA were greater for obese (total fat, 168%; saturated fat, 164%) relative to non-obese (total fat, 149%; saturated fat, 139%) adolescents, these differences were not statistically significant. Similar results were found for percentage of energy from total fat and saturated fat and for intake of total dietary fat and saturated fat. Furthermore, results were similar across all nutrients. Obese females had higher median intake of all micronutrients, except vitamin B-12. In addition, a lower percentage of obese adolescents fell below the criterion of adequacy for iron, zinc, calcium, vitamin D, vitamin A, sodium, and total dietary fiber relative to non-obese females. More obese adolescents also had lower calcium intake than their non-obese counterparts.

A greater percentage of obese, relative to non-obese, adolescents had micronutrient intakes that fell above the criterion of adequacy. This reinforces the idea that over consumption of macronutrients may have been an adaptive strategy to ensure adequate intake of micronutrients within the urban environment. However this strategy, while successful in increasing micronutrient intake, is maladaptive in the sense that the high intake of dietary fats and sodium may put these adolescents at higher risk for development of dietary-related cardiovascular disease later in life.

In comparing the percentage of obese to non-obese adolescents to attain the U.S. dietary goals for intake of cardiovascular health-related nutrients (polyunsaturated to saturated fat ratio, total fat, saturated fat, cholesterol, and carbohydrate), it is clear that both obese and non-obese adolescents were consuming a high cardiovascular-risk diet. A greater percentage of obese adolescents attained goals for polyunsaturated to saturated fat ratio and cholesterol, whereas a greater percentage of non-obese adolescents attained goals for total fat, saturated fat, and carbohydrates.

The lack of a statistically significant relationship between obesity and dietary intake variables found for this sample is not an unusual finding. A recent review of obesity in minority populations concluded that despite a higher prevalence of obesity, dietary intake data from minority groups do not necessarily indicate an excessive intake of energy or fat relative to white Americans (Kumanyika, 1994). For example, Gartside et al. (1984) found excess obesity in African-American relative to white-American women, although nutritional analyses showed decreased energy intake and decreased energy per kilogram of body weight for African-American women. Many population-based studies have not found a positive relationship between diet and obesity in adults (Huenemann et al., 1966; Lincoln, 1972; Baeke et al., 1983; Braitman et al., 1985; Klesges et al., 1991) or in children and adolescents (Johnson et al., 1956; Stefanik et al., 1959; Bradfield et al., 1971; Goth, 1973; Wilkinson et al., 1977; Rolland-Cachera and Bellisle, 1986; Gazzaniga and Burns, 1993), perhaps due to study design, non-dietary confounders, methodological flaw, measurement error, or narrow range of dietary intake (Popkin et al., 1995). Furthermore, very small increases in energy intake over an extended period of time can result in

increased body weight (Garrow, 1974). Thus, the greater (although not statistically significant) intake of macronutrients in obese relative to non-obese adolescents may have had a substantial effect on obesity status. In addition, individuals with low energy expenditure may gain weight with the same energy intake as individuals with high energy expenditure. Another factor is the difficulty associated with assessing food intake due to under reporting in both obese adolescents (Bandini et al., 1990) and adults (Prentice et al., 1986; Schoeller, 1990).

The lack of difference in dietary intake in obese and non-obese individuals has prompted some researchers to investigate energy expenditure as a critical factor in the development of obesity. Although dietary studies of Polynesians have not found a relationship between obesity and physical activity (Bindon, 1982; 1984; Hanna et al., 1986), other researchers have been able to demonstrate a relationship between obesity and physical activity (Darlu et al., 1984; Leslie et al., 1984). An inverse relationship between physical activity and obesity has been shown in various studies (Folsom et al., 1985; Dannenberg et al., 1989; DiPietro et al., 1993) but not in others (Stefanik et al., 1956; Wilkinson et al., 1977; Strazzullo et al., 1988). Several self-report studies have found an association between reduced physical fitness, less physical activity, and heavier body weight among African-American relative to white-American women (Wing et al., 1989; Folsom et al., 1991; Washburn et al., 1992; Williamson et al., 1993). This finding has been replicated using direct measures of energy expenditure (Kushner et al., 1995). The disparity in results of studies investigating the association between obesity and physical activity may be due to difficulties associated with assessment of physical activity (LaPorte,

1985; Saris, 1986; Wachs, 1989; Williams et al., 1989).

Physical activity patterns assessed in this study indicate that these West Philadelphia adolescents get very little exercise, with a mean of just over one and one-half hours of light to moderate activity per week. Non-obese adolescents spent a significantly greater amount of time engaged in physical activity (94.22 minutes) than their obese counterparts (41.72 minutes). The finding for non-obese adolescents was similar to the 92.3 minutes of activity per week found by Sallis et al. (1988b), using the same physical activity recall method in California youth. The low level of physical activity of these Philadelphia adolescents is likely to play an important role in the etiology of obesity in these adolescents.

Decreased physical activity found for these Philadelphia adolescents was similar to that reported nationally. Physical activity patterns of adolescents have been shown to fall below the goals established by the Centers for Disease Control; in addition, adolescents spend more time engaged in television viewing than in physical activity (U.S. Department of Health and Human Services, 1993; Heath et al., 1994). Results from the National Youth Risk Behavior Survey show that 37% of adolescents reported being vigorously active three or more times per week (Centers for Disease Control, 1990b). Inner city female adolescents reported watching a mean of 30.4 hours of television per week (Fisher et al., 1996), which is similar to figures reported in a recent CDC study (Heath et al., 1994). Furthermore, physical fitness of American youth has decreased over the past two decades (Updyke and Willett, 1989).

Decreased levels of physical activity found for these West Philadelphia adolescents

prompts concern about cardiovascular disease as these children age. Low levels of physical activity have been shown to be inversely associated with cardiovascular risk factors in adults (Haskell et al, 1992; Fox, 1971; Dawber, 1973; Paffenbarger et al, 1978; Powell et al., 1989; Sallis et al., 1988b) and in African-American adolescents (Dyer et al., 1980). In addition, risk-related behaviors, such as physical inactivity, acquired during childhood are likely to persist throughout childhood and into adulthood; thus, inactive children are likely to become inactive adults (Moore et al, 1991; Powell and Dysinger, 1987; Thomas and Chess, 1977). African-American women have been shown to have lower levels of physical activity than white-American women (National Center for Health Statistics, 1988; Wing et al., 1989) and lower cardiovascular fitness (Farrell et al., 1987).

At the other end of the continuum of energy expenditure, television viewing was used as a measure of sedentary activity. Using a television recall questionnaire, hours spent engaged in television watching per week were reported. These adolescents spent an average of 32.53 hours a week watching television, with obese females (36.16 hours) watching significantly more television per week than non-obese females (28.89 hours). Sleep, another indicator of sedentary behavior, was also measured. These adolescents slept an average of 61.37 hours per week, and there was no significant difference in sleep for obese (62.12 hours) and non-obese (60.63 hours) adolescents. In addition to physical activity, television viewing is also likely to play an important role in the etiology of obesity in these Philadelphia adolescents.

Using the same methodology, values for television watching for the West Philadelphia adolescents were similar to those found for African-American adolescents in

the National Heart, Lung and Blood Institute Growth and Health Study (NGHS); the NGHS adolescents watched an average of 36.5 hours of television per week (Obarzanek et al., 1994). Similar figures have been found in other studies of children and adolescents (Thomson and Cruickshank, 1979; Dietz and Gortmaker, 1985; Taras et al., 1989; Shannon et al., 1991; Heath et al., 1994; Fisher et al., 1996). Figures for both the present study as well as the Obarzanek et al. (1994) study exceeded estimates of 21 hours and 16 minutes per week for teenage girls from the 1990 Nielsen Report on Television (Nielsen Company, 1990). Hours of sleep per week found in this study were similar to the 67.3 hours reported for female fifth- and sixth-grade Anglo- and Mexican-American children (Sallis et al., 1988).

Television viewing for 9- and 10-year old girls has been shown to be directly associated with both BMI and triceps, subscapular, and suprailiac skinfold thickness and this relationship was stronger than that found for physical activity or saturated fat (Obarzanek et al., 1994). In addition, research has shown a strong relationship between television viewing, BMI, and triceps skinfold thickness in Pennsylvania sixth grade children (Shannon et al., 1991).

It has been suggested that television viewing influences obesity through the following mechanisms: reduced energy expenditure associated with the act of viewing television and increased energy intake while viewing television, perhaps influenced by TV commercials advertising energy-dense foods (Dietz and Gortmaker, 1985; Taras et al., 1989; Story and Falkner, 1990). Goldman et al. (1990) found that white-American and African-American 9 and 10 year-olds who reported eating while watching television had

higher energy intake than those who did not, and twice as many African-American than white youths reported eating while watching television. It has also been suggested that metabolic rate declines while viewing television (Klesges et al., 1993).

While this dissertation used indirect measures of physical activity and sedentary behavior, other energy expenditure studies have used sophisticated methodologies to investigate the contribution of the various components of energy expenditure to obesity. For example, a recent study found decreased basal metabolic rate in African-American relative to white-American women after adjusting for fat free mass (Kushner et al., 1995). Other researchers have found significantly lower resting metabolic rates in African-American relative to white-American children (Kaplan et al., 1996; Morrison et al., 1996). The difference between the obese and non-obese females in physical activity and television viewing in this study warrants further investigation of energy expenditure in this group of adolescents. With more sophisticated tools for assessing energy expenditure, it may be possible to gain a more complete understanding of the etiology of obesity, given the association of physical activity and television viewing with obesity in this population.

Physical activity and dietary intake are proximate mechanisms for obesity status, which have a direct impact on obesity status, and may mediate the influence of sociocultural, behavioral, and psychological correlates. This study examined the role of these proximate determinants of obesity in mediating ultimate determinants of obesity within the family, physical, sociocultural, and individual environments. Phase II of this dissertation research was designed to investigate factors within each of the four environments of study that impacted obesity status and its secular increase in Philadelphia

adolescents.

Maturation status, which may contribute to obesity onset, was investigated in these adolescents. Age at menarche was 12.00 for the total sample, which is similar to the national average, and is 0.44 years earlier than Philadelphia African Americans measured in the 1970s (Hediger and Stine, 1987). Although obese females had a younger average age at menarche (11.95 years) than the non-obese females (12.06 years), this difference was not significant. The lack of association between obesity and menarcheal status in this study could have been the result of the sample size or cross-sectional study design.

Within this ecological model, hypothesized dietary influences on obesity included the following: a high fat, high protein diet low in vegetable and fruit consumption, high frequency of junk food and fast-food consumption, particularly after school, meal composition defined by a greater frequency of "snacking" as opposed to structured meals, and an attitude toward eating that did not include attention to a low cardiovascular-risk diet. Physical activity hypotheses included the following factors: a high frequency of sedentary behavior, including television and video viewing and a low frequency of high intensity physical activity. Ultimate determinants, or factors which served to influence dietary intake and physical activity patterns, were conceptualized within the family, sociocultural, physical, and individual environments.

Self-esteem, eating attitudes, and body image, correlates of obesity within the sociocultural and individual environments, were assessed for these adolescents. The Philadelphia adolescents scored highly on the Piers-Harris Self-Concept Scale, which provided a measure of self-esteem, and there was no difference between obese and non-

obese adolescents in Piers-Harris score. These adolescents also scored highly on the Children's Eating Attitudes Test, and with the exception of three adolescents, these adolescents scored well within the range of normal eating attitudes. Eating attitude scores did not differ significantly for the obese relative to non-obese adolescents. The findings for both scales were similar to those found for other African-American and white-American adolescents (Kaplan and Wadden, 1986; Casper and Offer, 1990; Fisher et al., 1994; Fisher et al., 1996). Taken together, these two scales indicate that both obese and non-obese adolescents had high self-esteem and healthy eating attitudes.

On average, the obese adolescents conceived of their current body size (5.91) as of a higher body shape/size relative to their ideal body size (4.19), which yielded a body dysphoria score of 1.72. Conversely, the non-obese females conceived of their current body shape/size (3.88) as of a slightly higher body mass relative to their ideal body size (3.62), which yielded a body dysphoria score of 0.25. Thus, the obese females had significantly greater ideal body size, current body size, and a larger discrepancy between these two body size measures than the non-obese females. The greatest difference between obese and non-obese females was found for current body size, followed by body dysphoria score, and ideal body size. Ideal body size for these females, as selected by their male same-age counterparts, was between values selected by the non-obese and obese females. Thus, these males and females shared a similar perception of ideal body size. These findings were similar to those for urban African-American adolescents (Cohn et al., 1987; Desmond et al., 1989) and adults (Dawson, 1988). The body size preference variables indicate that these adolescents (both male and female) appreciated a medium-size

body shape. This preference may serve to increase energy intake, decrease physical activity, and ultimately impact obesity status as adolescents may either desire, or accept a larger body size.

Health behavior knowledge, another dimension of behavior within the sociocultural and individual environments, was assessed. Results of the Child Health Behavior Knowledge Scale indicate that these adolescents had a fairly good understanding of health behavior. These adolescents scored higher than the current published mean for this scale (Veda et al., 1987), perhaps due to their participation in the academically-based community service program, the Turner Nutritional Awareness Program. Although there was no significant difference between obese and non-obese adolescents for the total scale, there was a positive relationship between obesity status and dietary-fat knowledge; the obese adolescents answered a greater percentage of the dietary fat-related questions correctly indicating greater concern for total dietary fat, although this concern may have not been expressed through dietary intake. Both the obese and non-obese adolescents received the lowest score of all three scores (exercise, dietary fat, and sodium) on the exercise scale, indicating a low knowledge of exercise-related behavior.

The impact of factors within the family and sociodemographic environment on obesity was explored to increase understanding of the health implications of the relationship between such factors and obesity. Although there was a hypothesized relationship between obesity status and several sociodemographic variables related to dietary intake and physical activity pattern, there was no significant difference between obese and non-obese Philadelphia females for home ownership, occupational status of

mother, number of siblings, fast-food intake, and place of snack purchases. Thus, there was some indication that these adolescents, whether obese or non-obese, were subject to similar family and sociodemographic environments that may not, in and of themselves, effect obesity status.

The positive findings of high self-esteem, healthy eating attitudes, and lack of extreme body dysphoria indicate that these adolescents were relatively psychologically healthy with respect to self-esteem, eating habits, and concept of ideal body size. This finding is not consistent with other studies of adolescent girls that have considered this age group to be at risk for development of body image disturbance and dissatisfaction with body weight (Wadden and Stunkard, 1987). However, this result is not surprising if examined within the context of African-American perceptions of body size.

African-American women have been shown to have more realistic views of their weight status (Morris and Windsor, 1985) than white-American women (National Center for Health Statistics, 1985). In addition, African-American adolescents (Desmond et al., 1989) and adults (Dawson, 1988) have been shown to be more satisfied with their body weight than their white-American counterparts who prefer a more ectomorphic body shape. Although African-American women do show concern for both dieting and overweight (National Center for Health Statistics, 1988), overweight African-American women often consider themselves to be attractive and do not perceive themselves as having a weight problem (Rand and Kuldau, 1990). In addition, African-American women have not been shown to equate overweight with unattractiveness or with low self-esteem (Thomas and James, 1988; Kumanyika et al., 1993). Urban African-American adolescents

have been shown to score highly on eating attitudes tests, indicating healthy eating attitudes, when compared to suburban and white adolescents (Casper and Offer, 1990; Fisher et al., 1994). African-American college women have also been shown to hold body-size preferences that were heavier and closer to actual body size, and thus to have a greater latitude of acceptance in body fatness perception (Rucker and Cash, 1992). Obesity is perhaps more culturally acceptable for African-American women; this was supported by the present findings.

During the physical changes of the adolescent period, adolescents are in the process of developing a secure concept of body and self-image and are concerned with physical appearance and body shape (Rosenberg, 1965; Dwyer, 1967; Offer and Offer, 1971). The Philadelphia adolescents did express considerable concern for body image, although it was not in the direction of an ectomorphic preference. Rather, the concern these adolescents held was for attractiveness, mostly related to clothing, hair style, and attitude as opposed to body shape or size. These adolescents evaluated their appearances positively and did not report many negative thoughts about their bodies, despite their extensive television viewing and consequential bombardment with messages about the American preoccupation with thinness.

The significant amount of time spent engaged in television viewing meant that these adolescents were also exposed to various messages about food and eating. An earlier study in the Turner middle school population yielded a list of television shows that were watched with most frequency (Gordon, unpublished manuscript). The top three shows, *Cosby Show*, *Simpsons*, and *Studs*, were analyzed for the frequency and type of

commercial advertisements. The majority of commercials advertised energy-dense fast-food (McDonald's, Burger King, Roy Rogers, Domino's Pizza, and Wendy's), followed by soft drinks (Coke and Pepsi), and breakfast cereals (Kellogg Corn Flakes, Wheaties Honey Gold, and Crispix). Thus, the types of television shows the students reported watching have advertisements for foods high in fat, energy, and sodium.

Television may also have influenced body image attitudes held by these adolescents through body size and shape of actors and actresses portrayed in shows and advertisements. The adolescents mentioned several actresses whom they found attractive. For example, Queen Latifah and Janet Jackson were mentioned by several adolescents as examples of attractive women. Neither Queen Latifah nor Janet Jackson may be considered to be extremely ectomorphic. In discussions of attractiveness, the adolescents rejected various examples of more ectomorphic models and actresses, such as Latoya Jackson, Whitney Houston, Madonna, and Naomi Campbell, agreeing that these women were too thin. The body image ideals expressed by these adolescents did not seem to be persuaded by the many thin women held as archetypes of attractiveness in mainstream media.

Perhaps these media messages did not influence these West Philadelphia adolescents, or perhaps sociocultural influences superseded those of mass media. Concepts expressed in the focus group discussions pointed towards a concept of attractiveness less focused on body shape and size. Rather, it seems that attitude (or personality), clothing, and hair style were much greater determinants of attractiveness for these adolescents. In addition, these young women possessed positive body image

attitudes and demonstrated an acceptance and preference for larger body size.

Obesity is defined within the cultural context in which it is situated, with culturally accepted preferences guiding the way body size and shape are viewed by society. In mainstream western society, obesity has become medicalized (Sobal, 1995) and has been called a culture-bound syndrome (Ritenbaugh, 1982) due to the stigmatization of the obese. The body image attitudes expressed by the Philadelphia adolescent are characterized by a greater latitude of acceptance for larger body size and a concept of attractiveness that rewarded larger body size and shape. This preference for larger body shape and size demonstrates the considerable variability and plurality of body shape and size preferences in American society.

The West Philadelphia adolescents expressed a concept of ideal body shape and size including the recognition of obesity. However, this concept was reserved for individuals who were markedly or morbidly obese, whereas the body size considered acceptable or even attractive was shifted towards a heavier body shape. Body shape and size were important symbols for these West Philadelphia adolescents. For example, adolescents with higher body mass and weight were considered by their peers to be more attractive than those of lower body mass. Conversely, thinness was recognized by these adolescents as a symbol of drug use and poverty. In addition, larger body size was recognized as a weapon that could be used in self defense. Thus, the positive value of overweight, but not necessarily morbid obesity, held by these adolescents may predispose them to development of overweight and obesity.

The adolescents recognized a link between diet and health, although they had many

misconceptions about this relationship. Dieting techniques were focused on food intake, with little concern for physical activity. The adolescents also recognized the role of obesity in health. This relationship was reserved for adults and morbidly obese people of any age. In addition, the adolescents indicated that curative efforts were principal to health status, whereas preventative efforts were not mentioned.

In all cultures, food is a symbolic object situation within an environmental and cultural context. For the West Philadelphia adolescents, food was a symbolic object situated within the West Philadelphia cultural context. Certain food items carried prestige value for these adolescents, particularly foods high in fat, energy, and sodium, which were likely to influence macronutrient and micronutrient intake. For example, the adolescents reported frequent consumption of fast-foods and snack foods such as salty snacks and snack cakes. Snack foods were often purchased at the corner stores in the neighborhood and these establishments were hubs of social activity for these adolescents. The snack foods were relatively inexpensive; one dollar allowed an adolescent to purchase an ounce of potato chips, a package of snack cakes, and a hug (a drink similar to Kool-Aid). The snack foods also played an important role in social interactions. For example, sharing these foods with others was considered a sign of friendship. The same activity seen around the corner store was also played out in the lunchroom where snack foods either brought into school or purchased at the vending machines (sold at twice the cost of identical snacks sold outside of the school) were shared amidst clusters of social activity. Within this context, the federally subsidized school lunch was rejected, and those who consumed it were socially stigmatized.

The tendency for these adolescents to stigmatize their peers who participated in the federally subsidized school lunch program is just one indication of the strong link between food and social prestige for these adolescents. These low-income adolescents paradoxically had disposable income as indicated by reported household material goods and by reported purchase of snack foods from corner stores, from the vending machine, and from the parent-run snack line at Turner. The fact that these students relied on spendable income and did not, on average, take advantage of the available federal food-assistance program has important implications for understanding malnutrition in America. In addition, these findings also suggest that the federal school lunch program does not meet the needs of this community, and this may be true of similar communities across the nation. This nutritional contradiction indicates that public policy should move toward providing programs that promote healthy foods that fill the both nutritional and social needs of adolescent recipients so dietary alternatives are not necessary.

Another important factor in the cultural context of obesity in West Philadelphia was the urban environment. In anthropology and human biology, human-food-environment interactions are primarily investigated within non-western, and less urbanized, populations (Thomas et al., 1988; Leonard, 1989; Johnston, 1990). In an urban environment, sociocultural factors play an important role in distancing urbanites from the natural environment. In all environmental contexts, sociocultural variables can be viewed as both stressors that directly effect human behavior and biology and as buffers that modify the effects of environmental stress. In the present study, the role of behavioral and cultural variables in obesity were examined.

The urban environment of West Philadelphia may be characterized as an environment of disadvantage associated with low socioeconomic status. The adolescents living in West Philadelphia were exposed to crime and violence (Schwarz et al., 1994), physical/environmental deterioration (Center for Community Partnerships, 1995), and decreased access to health care and educational resources. In addition, as urban residents, these adolescents also had increased access to store-bought foods dense in energy, sodium, and fat through the proximity of a multitude of corner stores in their neighborhoods. These corner stores do not offer a wide variety of grocery items, such as fresh produce. Rather, the stores predominantly offer a wide variety of small packaged non-perishable snack goods. A recent study of the 96-block catchment area of the school showed that in 1993, 49% of food establishments were convenience stores, 47% were restaurants, and 4% were grocery stores (Green, unpublished manuscript). The proximity of the corner stores resulted in easy access to store-bought snack foods and to social interaction with peers who gathered there. Safety issues associated with the urban environment (e.g., crime, violence, and traffic accidents) led to decreased opportunities for physical activity and increased preference for sedentary activities, such as television watching. Several Philadelphia adolescents reported that violence kept them from playing outside. Thus, this urban environment provided proximity to an obesity-promoting and easily accessible high-fat diet, and decreased options for physical activity. The impact that these factors had on the health status of these adolescents was evident in decreased physical activity, increased television viewing, and increased consumption of energy, dietary fat, and sodium. These confirmed other research findings, showing an association

between urbanization, increased fat intake, and reduced physical activity (Popkin and Bisgrove, 1988; Popkin et al., 1995; Sobal and Stunkard, 1989).

In Phase II, among the factors within the sociocultural and individual environments, physical activity and television viewing emerged as the most important contributory factors to obesity status. Analyses of dietary intake, sleep, age at menarche, self-esteem, eating attitudes, health-behavior knowledge, ideal body size, current body size, body dysphoria, and sociodemographic factors showed that ideal body size and self-esteem play an important, although indirect, role in influencing obesity status. For example, obese females had higher current body size ($p \leq 0.0001$), ideal body size ($p \leq 0.04$), and greater body dysphoria ($p \leq 0.0001$) than non-obese females. However, none of these body image variables emerged as significant factors in the logistic analysis or in the multivariate regression models.

The relationship between physical activity, energy intake, and obesity status was a complex one ($r^2 = 0.21$); both energy intake ($p \leq 0.0096$) and the interaction between energy intake and obesity status ($p \leq 0.05$) had a significant impact on the amount of physical activity per week. The analysis showed that obese and non-obese adolescents had similar energy intake at different levels of physical activity. Thus, obese adolescents had a level of physical activity insufficient to offset energy intake, whereas the non-obese adolescents with high energy intake had corresponding high levels of physical activity.

Although certain factors in the energy balance equation have a proximate influence on obesity status, such factors are often isolated and investigated as the primal factors in obesity. This approach is common in biomedical research studies and serves to take

obesity out of the ecological context, thereby neglecting important ultimate determinants of obesity in the family, physical, sociocultural and individual environments that influence proximate determinants of obesity. Without knowledge of these ultimate determinants of obesity, strategies for obesity reduction and concomitant improvement in health status are incomplete. The ecological approach used in this dissertation placed obesity within a greater biosociocultural system to understand how the proximate and ultimate determinants of obesity operate. This dissertation demonstrated the central role of physical activity in the etiology of obesity in these West Philadelphia adolescents. In addition, there were factors in the physical environment (proximity to high-fat, energy dense convenience foods and restriction of safe areas for physical activity), sociocultural environment (sociocultural acceptance of obesity, low priority of obesity and cardiovascular disease as health concerns, social value of high-fat, energy-dense fast-foods and snack foods, and social value of settings for food consumption that promoted high-fat, energy-dense foods, such as fast-food restaurants or corner stores), and factors in the individual environment (body image preference that promoted acceptance of a larger body size or shape) influenced obesity status directly and indirectly through physical activity patterns. Several biocultural correlates of obesity were identified in this dissertation and has thus increased the current understanding of the etiology of obesity in this and similar groups.

The relationship between energy intake, obesity status, and the interaction between these two factors was the strongest found in this analysis ($r^2 = 0.21$). However, it was not clear that age at menarche, self-esteem, eating attitudes, health-behavior knowledge, ideal

body size, current body size, body dysphoria, and sociodemographic factors were unimportant to obesity status. There were many reasons for the lack of predictive value of these variables. For example, studies of self-esteem, health-behavior knowledge, and eating attitudes may require more culturally specific and sensitive instruments and more sophisticated analyses than those used here. The study may not have had a large enough sample size to detect meaningful differences in these measures. In addition, there may have been other important factors not measured in this study that impact obesity status.

Another important issue is that the study design of this dissertation may not have captured a purely non-obese sample of adolescent females. A subgroup of the non-obese adolescents in this project may have been non-obese at the time of measurement but may have been in the process of developing obesity while participating in this project. As such, some of the non-obese females may have scored similarly to the obese females on several measures thereby reducing the differences in these measures by obesity status. This study design should be replicated longitudinally in younger female adolescents.

An additional confounding issue is that some of these adolescents may have been experiencing high velocity of growth in stature, weight, and fatness at the time of measurement perhaps causing dietary consumption to have been in a state of flux. Thus, values for over reporting may have reflected increased consumption of energy. Also, a small percentage of these adolescents had high energy expenditure due to increased level of physical activity, which may have impacted energy balance. Overall, these data were skewed in the direction of increased energy intake and increased body weight and fatness. This is likely to influence dietary intake measures because adolescents of larger body size

would be more likely than those of smaller body size to have increased energy consumption.

This dissertation research, as an academically-based community service project, made a direct contribution to the West Philadelphia adolescents that were part of this project. In addition to increasing knowledge of obesity in an underserved community, this project directly engaged community members in health-promotion activities, including the following: an extracurricular club aimed at promoting healthy lifestyles of adolescent females, a component of a nutrition-based curriculum for the middle school students, and a nutrition-monitoring project directed at teaching middle school students how to measure and analyze nutritional data. In addition, information gained as a result of this project provided information that contributed to current efforts at the school, including nutrition-education efforts, a school lunch improvement project, and a student-run school store that provided inexpensive fruits and vegetables to students in conjunction with curricular efforts to teach students about small-business management, food production and distribution, and nutrition. In addition, the present analysis increased current knowledge permitting direct improvement of health-promotion and intervention efforts in this population.

To better define the relationship between physical activity, television viewing, and obesity status in these Philadelphia adolescents, future analyses in this population should use direct measures of energy expenditure. In addition, more sensitive surveys for self-esteem and body image should be developed in this population to assess whether or not these factors are important correlates of obesity. Hereditary and familial patterns of food

and nutrient intake, physical activity, obesity, and health status are also likely to be profitable directions for further research. Future health-promotion efforts should be aimed at increasing physical activity in this population and should be phrased in terms of health, pride, and "attitude" as opposed to physical attractiveness.

In this dissertation, the ecological perspective was used to address the distribution of obesity over time and within a geographic community. This analysis explored the relationship between this community and its ecosystem. Ecological models have been used in anthropological studies to investigate the adaptive mechanisms of human populations over time in relation to environmental stressors in their ecosystems. For example, researchers have investigated the human biocultural response to the following stressors: high altitude hypoxia (Frisancho, 1975; 1979), heat stress (Roberts, 1978; Frisancho, 1979; Hanna and Brown, 1979; Hanna et al., 1989), cold stress (Steegman, 1975; Roberts, 1978; Frisancho, 1979; Moran, 1979; Hanna et al., 1989), solar radiation (Loomis, 1967; Frisancho, 1979), illness (Thomas et al., 1988), and nutritional stress (Thomas, 1973; Jerome et al., 1980).

In this dissertation, aspects of lifestyle were "decomposed" and contextualized (Bindon and Dressler, 1992) by examining lifestyle from four environmental perspectives: family, physical, sociocultural, and individual. This approach is different from other studies that have examined lifestyle as a single variable, operationalized either as education or socioeconomic status. Within each of the four environments of this study, factors that may influence the development of obesity were identified and examined. For example, within the sociocultural environment the following factors were addressed: knowledge of

risk factors for cardiovascular disease, sociocultural acceptance of obesity, priority of obesity and cardiovascular disease as health concerns, social value of high-fat, calorie-dense fast-foods and snack foods, and social value of settings for food consumption that promoted high-fat, calorie-dense foods, such as fast-food restaurants or corner stores.

The role of all four of these environments in impacting obesity status was viewed within a systems perspective in order to determine the factors that may have influenced obesity status. As such, factors within the family, physical, sociocultural, and individual environments were visualized as ultimate determinants of obesity that interacted with one another to influence the proximate determinants of obesity, physical activity and dietary patterns. These factors were operationalized through quantitative and qualitative measures. In examining the ecology of obesity in one geographic community, this dissertation sought to determine why one segment of American society is at increased risk for development of obesity.

Within this system, obesity status conferred a cultural advantage due to a distribution of body size that was shifted to the right, with higher body weight recognized as a form of beauty. In addition, these West Philadelphia adolescents did not seem to associate obesity with poor health status, except at extreme levels of body mass. Furthermore, cardiovascular diseases were seen as diseases of adulthood with very little connection to health status during adolescence or young adulthood. Obesity status provided a biological advantage as a tool for self-defense and perhaps as an adaptive strategy to ensure adequate intake of micronutrients within an urban context with characteristically low availability of fresh produce. Acceptance of obesity was indicated

by measures of self-esteem, eating attitudes, health-behavior knowledge, body image, and definitions of attractiveness. There was a clear sociocultural predisposition to obesity; it was determined to be part of a strategy for bettering health status and well being in this geographic community.

The secular trend analysis in this dissertation documented a secular increase in body size and shape that was sensitive to the sociocultural and physical environment. This secular change in body habitus was associated with a set of factors in the sociocultural and physical environment that served to promote larger body size and shape. Although this analysis did not include descriptive information about the ecological context of obesity in the past two decades, data presented in this dissertation suggest that factors in the sociocultural and physical environment are related to obesity status in a population over time. This concept, which has been well recognized in the anthropological literature, has been less acknowledged in the biomedical literature. This research demonstrated the role of the sociocultural and physical environment in changing human shape and form, which has direct implications for human health and well-being over time. This research also demonstrated the adaptive significance of dietary over consumption, increased social value of larger body size and shape, and body image preference for larger body size and shape in this population.

In placing these findings into the ecological model presented in the introduction of this dissertation, it is clear there were factors in the physical, sociocultural, and individual environments that were mediated by physical activity and that impacted obesity status for these adolescent females (Figure 71). In the physical environment, the urban environment

with its proximity to fast-food restaurants and corner stores, provided inexpensive, high fat, high sodium, and energy-dense foods to these adolescents. Thus, the corner stores had a direct influence on diet composition. In addition, it was shown to impact obesity through decreased opportunities for physical activity as a result of the high rate of violence and accidents common in an urban environment. Both restricted play areas and corner stores had a direct influence on dietary intake and physical activity; in addition, these factors also influenced the sociocultural environment of obesity and the individual environment that then had a secondary influence on obesity through these two environments. Although dietary intake was not found to have a strong influence on obesity, as seen in the lack of a statistically significant difference in dietary intake between obese and non-obese adolescents, a strong relationship between dietary intake and physical activity emerged in this analysis. Non-obese female adolescents were shown to have high levels of physical activity concordant with high levels of energy intake. Conversely, obese adolescents had low levels of physical activity regardless of amount of energy intake, which would result in energy imbalance due to the excess intake of energy without high energy expenditure.

In the sociocultural environment, there was an increased sociocultural acceptance of obesity, which served to promote obesity at an ultimate level. The sociocultural acceptance of obesity was influenced by the physical environment and, which in turn, influenced body image and other behavioral factors in the individual environment. In the individual environment, body image attitudes reinforced wider sociocultural acceptance of a larger body size or shape. These factors also had a direct influence on level of physical

activity. In this study, factors within the family environment were not found to exert a strong influence on obesity either as a proximate or ultimate determinant.

All of these factors were most clearly associated with physical activity as correlates of obesity. Thus, it appeared that at an ultimate level of influence, physical, sociocultural, and individual factors, as part of the ecological fabric of West Philadelphia, promoted obesity for all of these adolescents. However, some adolescents became more or less likely to participate in physical activity and to watch a significant amount of television. Those adolescents who were less likely to participate in physical activity were also more likely to have a low level of physical activity regardless of energy intake, total dietary fat intake, or percentage of energy from total dietary fat. This pattern was highly associated with obesity. Conversely, adolescents who were not likely to be obese increased their level of physical activity with higher energy intake, total dietary fat intake, and percentage of energy from total dietary fat.

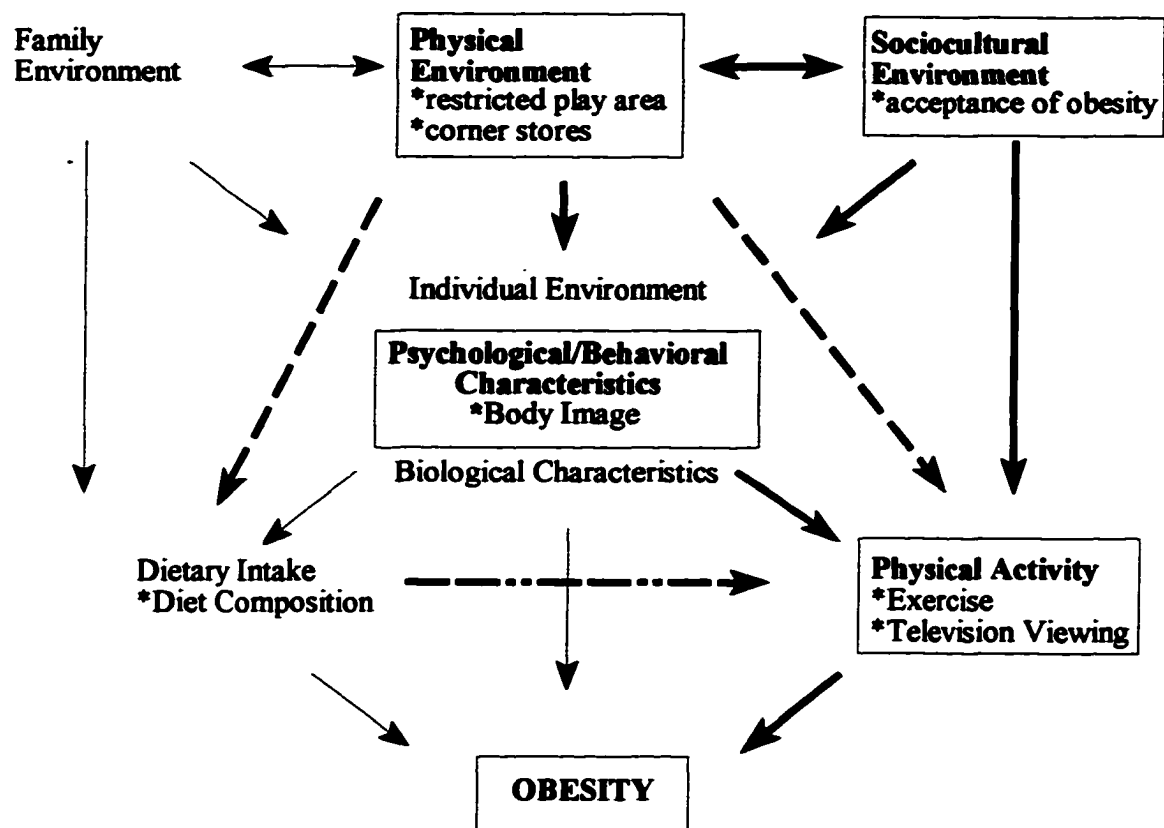


Figure 71. Ecological model (adapted from Jerome et al., 1980:14) used to examine the relationships between biological, dietary, sociocultural and behavioral factors and how these factors impact obesity status during adolescence in West Philadelphia adolescents. Physical Environment, Sociocultural Environment, and Psychological and Behavioral Characteristics within the Individual Environment impacted Physical Activity, which exerted further influence on Obesity Status.

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