HEIGHT AND WEIGHT OF BLACK INFANTS FROM LOW-INCOME FAMILIES FIRST POSTNATAL YEAR: A NORMATIVE AND CORRELATIONAL INVESTIGATION

by

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CHAPTER I

INTRODUCTION

Scholars and research workers in the field of Child Development have an important task to establish norms or general characteristics of physical growth and body build. These norms do not explain, but they assist in establishing a range of acceptable variation which is useful in interpreting growth both physically and psychologically.

A review of literature reveals that over the past few decades the average body weight and length of infants and children have increased all over the world. This trend may be attributed to an increase in caloric intake, an improvement in nutritional quality, a decrease in childhood diseases including those associated with malnutrition, limitations of child labor, and prohibition of early marriage. It is also believed by some investigators that the increase in body build may be related to genetic and environmental factors.

Purpose of the Present Study

This study will:

1. Investigate weight and length norms for 210 North American black infants (birth to 12 months of age) from low-income groups.
2. Develop percentile tables and grids for the infants studied.

3. Investigate the relationship between:

   (a) mother's age and infant's weight at birth

   (b) birth order and weight at birth, at three months of age, at six months of age, at nine months of age, and at 12 months of age

   (c) mother's age and infant's length at birth

   (d) birth order and infant's length at birth and at 12 months of age

   (e) infant's weight at birth and weight at three months of age, at six months of age, at nine months of age, and at 12 months of age

   (f) infant's length at birth and length at three months of age, at six months of age, at nine months of age, and at 12 months of age

4. Compare the results of the present investigation with other studies on black and white infants.

Hypotheses

The following hypotheses will be statistically tested by correlating the relevant variables.

Hypothesis I

There will be no significant relationship between the birth weight of a black infant from low-income level and his mother's age.

Hypothesis II

There will be no significant relationship between the birth length of a black infant from low-income level and his mother's age.

Hypothesis III

There will be no significant relationship between the birth weight of a black infant from low-income level and the order of his birth within the family.

Hypothesis IV

There will be no significant relationship between the weight of a black infant from low-income level at three months of age and the order of his birth within the family.

Hypothesis V

There will be no significant relationship between the weight of a black infant from low-income level at six months of age and the order of his birth within the family.

Hypothesis VI

There will be no significant relationship between the weight of a black infant from low-income level at nine months of age and the order of his birth within the family.

Hypothesis VII

There will be no significant relationship between the weight of a black infant from low-income level at 12 months of age and the order of his birth within the family.

Hypothesis VIII

There will be no significant relationship between the birth length of a black infant from low-income level and the order of his birth within the family.

Hypothesis IX

There will be no significant relationship between the length of a black infant from low-income level at 12 months of age and the order of his birth within the family.

Hypothesis X

There will be no significant relationship between the birth weight of a black infant from low-income level and his weight at three months of age.

Hypothesis XI

There will be no significant relationship between the birth weight of a black infant from low-income level and his weight at six months of age.

Hypothesis XII

There will be no significant relationship between the birth weight of a black infant from low-income level and his weight at nine months of age.

Hypothesis XIII

There will be no significant relationship between the birth weight of a black infant from low-income level and his weight at 12 months of age.

Hypothesis XIV

There will be no significant relationship between the birth length of a black infant from low-income level and his length at three months of age.

Hypothesis XV

There will be no significant relationship between the birth length of a black infant from low-income level and his length at six months of age.

Hypothesis XVI

There will be no significant relationship between the birth length of a black infant from low-income level and his length at nine months of age.

Hypothesis XVII

There will be no significant relationship between the birth length of a black infant from low-income level and his length at twelve months of age.

The Importance of Anthropometric Measurements

Growth is a manifestation of life in the young, and its rate and quality are importantly related to the general health and welfare of the individual. The observable changes in size and proportion which constitute normal growth presumably reflect harmonious physiologic succession; deviations in growth patterns may reflect related physiologic abnormalities (Bayer & Bayley, 1959). Because of this important relationship, the pediatrist must have intimate knowledge of the phenomenon of physical growth. It is an accepted practice in pediatrics to obtain height and weight measurements as a part of routine physical examination. If the height and weight figures are accurate and obtained over a period of time for a given child, his pattern of growth under a given regimen of living will become known. Comparing physical measurements (anthropometric measurements) of a given child with those of a large group of normal healthy children offers a gauge of his normality and documents clinical judgment. Anthropometry makes it possible to analyze body proportions and identify body build and growth. Accurate anthropometric standards are necessary for the study of growth changes, development and nutrition. This requires quantitative measurements and statistical study of the data (Pryor, 1966).

With nearly every disease there is some impairment of growth, and consequently the proper interpretation of height and weight values may make possible early recognition of a disease, and continued observation and measurement may give a good index as to the

success of therapy (Bayer and Bayley, 1959; Garn, 1966; Jackson and Kelly, 1945). There is considerable interest in the therapeutic management of body size, in reducing the potential of the genetically small. An exact description of a growth deviation in terms of its morphologic and temporal aspects may give an excellent clue to its probable etiology (Bayer and Bayley, 1959).

Research Needed on Anthropometric Norms for North American Black Infants

From the beginning of the history of anthropometric studies in 1759 until the middle 1950's researchers in anthropometry have been interested in the development of norms. In the late 1950's and the 1960's there has been a shift toward correlational studies. A large proportion of published studies are based on Caucasian, middle-class, North American infants and children. Most published studies have involved preschool and school age children rather than infants. Of the limited number of studies available on black children, a very few (Meredith, 1952; Michelson, 1943a; Michelson, 1943b) gave only tabular presentations of means and standard deviations at monthly intervals for the first postnatal year. Scott's (1950) data included measures of height and weight of lower-middle-class black infants from birth to twelve months of age during the period 1940 to 1947. The mean birth weight for male and female newborn infants was 7.66 pounds and 7.20 pounds, respectively. At 12 months of age the weights attained were 22.59 pounds for males and 21.33 pounds for females. The mean length at one month of age for males was 21.1 inches and for females 20.9 inches. At 12 months the mean length for

males was 29.8 inches and for females 29.5 inches. When Scott's data were compared with data reported by Bakwin and Patrick (1944), and Woodbury (1921) it was found that the infants measured by Scott and those reported by Bakwin and Patrick maintained superior weight gains throughout the first year of life when compared with those of Woodbury. The rate of increase in length of infants in Scott's series surpassed that recorded by Woodbury. Scott attributed the superior growth of infants in his series and the findings of Bakwin and Patrick to advances in and availability of pediatric care, and to a generally higher economic level.

Adams and Niswander (1969); Billewicz (1967); Chen, et. al. (1970); Garn (1966); Hiernaux (1963);Lasker (1962); and Vandenberg and Falkner (1965) reported that genetic and environmental factors have paramount influence on physical growth of infants and children. Tanner (1970) stated that there are differences in rate and pattern of growth, leading to the racial differences seen in adult body build. Some of these are clearly genetically controlled, whereas others depend perhaps on climatic differences and certainly on nutritional factors.

The boy or girl who has the mean birth length, grows generally at the mean velocity (Tanner, 1970). According to Tanner (1970) subcutaneous fat begins to be laid down in the fetus at about 34 weeks post-menstrual age, increases from then until birth and from birth to about nine months. After nine months, when the velocity of fat gain is zero, the fat actually decreases, that is, has a negative

velocity, until age six to eight years when it begins to increase once more.

Crump, et. al. (1957) studied 2081 Negro infants whose mothers resided in the city of Nashville and who were delivered at Hubbard Hospital. The data included physical measurements: weight, length, head circumference, and chest circumference. The study revealed the presence of sex difference in the mean birth weight of infants. The male infants as a group were heavier than female infants. The authors concluded that all determinants of birth weight act principally through the mother, from conception to delivery, for she provides 100 per cent prenatal environmental control, and at least 50 per cent in genetic background. Therefore, it is reasonable to assume that such factors as maternal age, prenatal care, parity, and socio-economic status should show some degree of correlation with the weight of the infant at birth.

The available anthropometric studies on North American black infants are very few in number and are out-of-date. During the last two decades there have been advances in the availability of pediatric care, knowledge of nutrition, more widespread preventive health programs, and an improvement in the economic level which may result in an increase in body weight and stature of infants, children and adults. Thus new data need to be collected each decade. To the present investigator's knowledge, there are no grids or graphs prepared for black infants to compare a given infant with others of similar age, race and genetic endowment.

In addition, a discussion with the Director of the Children and Youth Project (#625, Guilford County Health Department) confirmed the need for contemporary weight and length norms for black infants who visit the Guilford County Health Centers.

Therefore, there appears to be a need for a contemporary study to yield norms for body measurements for North American black infants.

Rationale for Interest in the Present Study

The investigator is a citizen of India which is a vast country with varied cultures, religious beliefs, and food habits, resulting in a population characterized by widely differing statures and body build. For example, the people in the north of the country are bigger in size, both in height and weight, than are those in the south. Though a few studies in India have provided height and weight tables for children, they cannot be used in all parts of the country because of these variations within the population. On her return to India the investigator plans to have the graduate students of The Central Institute of Home Science, Bangalore, develop height and weight norms for infants and children at different age levels and at different socioeconomic levels in the State of Mysore. The present study is designed to provide the writer with the necessary technical skills and experience to carry out such research in India.

Clarification of Terms Used

The following terms are defined according to their use in the present study:

Body weight is the weight of the infant without clothes except diaper, taken on an infant scale. Weight is measured in pounds and ounces.

Total length refers to stature and it is the distance from the vertex to plantar surface, measured with the infant in dorsal recumbency, in inches. In this study the term height is interchangeable for length, which is most commonly used in the measurement of infants.

Norm denotes a statistical standard of comparison constituted by the average value of the variable on which the items in a population are being measured.

Infant refers to an individual from birth to twelve months of postnatal age.

Normal infant for this study is one who weighed five and a half pounds or more at birth and had no observable physical deformities, or congenital defects.

Race refers to the divisions and distinctions among peoples on the basis of some innate characteristics. The characteristics, depending on which definition is followed, may be physical: pigmentation, shape and size of bone structure, blood, hair, etc.; or geographic: national origin, etc.

Birth order is the sequential position of each child in his family in relation to his brothers and sisters.

The C & Y Project is the Children and Youth Project #625 of the Guilford County Health Department. This Comprehensive Health

Project is described in Appendix A and will hereafter be referred to as the C & Y Project.

Low-income for this study is that income range which makes families eligible for service in the C & Y Project; it is based on the Crippled Children's Service Income Range set by the North Carolina State Board of Health and is given in Appendix B.

Limitations of the Present Study

This study will be limited to North American black infants born on and after January 1, 1969 to March 5, 1971, visiting the C & Y clinics at Hampton Homes, Henry Smith Homes, Morningside Homes, Ray Warren Homes, and Claremont Homes (Public Housing Projects served by Children and Youth Project of the Guilford County Health Department in North Carolina). Since to be a resident of one of these housing projects, a family must have an income below a certain level, the subjects of the study will be considered to be from low-income groups.

Plan for Reporting the Present Study

In chapter II there will be a review of the related literature in three areas: (1) historical background of anthropometirc studies, (2) methodology for anthropometric studies, and (3) studies on anthropometric growth during infancy.

Chapter III will describe the procedures used, including the design of the study, the subjects, and the collection of data. In chapter IV there will be a description of the analysis of the data

which will include both statistical and non-statistical treatment. The final chapter will contain a summary of the study and conclusions from the report.

CHAPTER II

REVIEW OF RELATED LITERATURE

The importance of anthropometric studies of infants and children and of factors influencing anthropometric growth has been widely discussed in the literature for a number of years. This review of such literature is divided into three parts. Part one is a review of the historical background of anthropometric studies. Part two includes a review of literature on methodology of anthropometric studies. A review of studies of anthropometric growth during infancy is included in part three.

Part I: Historical Background of Anthropometric Studies

Jackson and Kelly (1945) traced the historical background of anthropometric studies in the United States of America and reported as follows: Quetelet (1836) made one of the first scientific studies of growth. Wood (1918)using data on boys and girls enrolled in several schools in the east and midwest United States presented tables of average weight for height for boys and girls. In the next decade Wood and Baldwin revised these tables to present mean weight for sex-age-height groups of children at ages between birth and six years. The Baldwin, Wood and Woodbury tables have been widely used. For the most part they have been used to appraise physical status or nutrition at a given time. There has been agreement regarding these

norms, or others that have appeared in the earlier two decades, on the manner in which evaluation should be made. Among those who have used the norms there have been appreciable differences of opinion concerning the amount a child may deviate from the average before he should be considered abnormally overweight or underweight for his sex, height and age.

Jackson and Kelly (1945) cited that in 1929 Kornfeld compiled standards for height and weight for boys and girls from birth to 20 years of age using subjects of Northern European origin. The need for anthropometry in physical examinations was recognized by Stuart (1934). In 1936 the Pryor width-weight tables were published. Burgess (1937) using data compiled on American-born children, published height charts showing height curves for various percentile levels at given ages. In 1943 Wetzel developed his grid for evaluating physical fitness, and made a distinct contribution to the interpretation of physical measurements of height and weight in that he stressed the clinical importance of following the child's progress in height and weight. While he has not elaborated the assumptions and procedures employed in constructing his grid he has illustrated its practical application. Vickers and Stuart (1943) have recognized the place of anthropometry in the practice of pediatrics and have stressed standardization and accuracy of anthropometric measurements if such are to be a helpful part of a child's physical examination.

Jackson and Kelly (1945) stated that in 1941 and 1944 Boyd had emphasized the necessity of careful observation of the growth of the child and stated that satisfactory or unsatisfactory growth is a very important sign in diagnosing or evaluating a child's condition. He maintained that the status of the physique frequently is not subjected to any verification or comparison with average standards. Only when deviations from the usual physique are excessive or when they comprise the entrance complaint, is it customary for the physician to direct his attention toward such careful appraisal.

Bayley (1956) developed growth curves of height and weight by age for boys and girls, scaled according to physical maturity. The curves were designed to match the growth rates of normal individual children. They were based on the measurements of about 300 healthy California children, an equal number of each sex, who were measured repeatedly from birth until 18 to 21 years of age. The data have been grouped so that for each curve the measures at any point on the curve represent averages for children who are alike in their physical maturity. Meredith (1952), Kasius (1957), Scott (1962), and Rauh (1967), conducted height and weight studies on Negro children. Meredith (1952) and Scott (1962), gave tabular presentation of means and standard deviation at monthly intervals for the first postnatal year.

Part II: Methodology of Anthropometric Studies

The methodology of anthropometry includes the selection of the sample, collecting data, analyzing the data and interpreting successive observations. An infant or a child can be compared with a given "norm" only when the norm satisfies at least two practical requirements: (a) it has been derived from a population which is ethnically homogeneous, clearly described, and numerically adequate; and (b) within the framework of such a population the "norm" has been defined in statistically meaningful terms. In order to be clinically reliable, however, not only must growth assessments be precise, but also interpretation of those assessments must be circumspect. Useful growth diagnosis requires an understanding of both central tendencies and normal variations (Bayer and Bayley, 1959).

Collection of Data. Vickers and Stuart (1943) defined the techniques used in obtaining norms. For measurements to serve any useful purpose, especially when the progress of growth is to be taken into account, they must be taken when the child is reasonably relaxed and cooperative, and with care as to the details of position, land marks, use of instruments, and reading of scales. The added time required to check each measurement after changing and re-establishing position is thoroughly justified. The habit of applying all instruments with uniform, moderate pressure is essential.

Apparatus required for securing measurements are scales, examining table anthropometer, upright measuring device, tape, spreading calipers and sliding calipers (Vickers and Stuart, 1943).

Analysis and Interpretation of Data. Bayer & Bayley (1959) stated that certain factors must be considered when applying the norms to an individual case. While ecologic conditions which are less favorable than those which surround the norms do not prevent their use, such conditions must be taken into account. The comparisons may be influenced by family patterns. Tables of means and standard deviation with percentile values facilitate the analysis of data. Concerning the choice of the correct table, it was noted that measurement-values apply to the nearest birthday, not necessarily the last birthday. Age expressed in years and months may be converted to the decimal system. The deviation chart was considered a graphic device for comparing the data from a given child with the set of norms which are appropriate for his age and sex. For all practical purposes the proper position for any given measure can be gauged by the two nearest sigma values in the table of means and standard deviations of anthropometric values. This information is plotted as a dot on the deviation chart. The dots are then connected to form a profile.

Almost four decades ago, Stuart (1934) discussed the various methods of establishing standards based upon measurements obtained on large groups of comparable children by which the frequency of occurrence of particular measurements may be shown. One method is to lay off columns representing given intervals of measurements and to indicate in each column the number of children falling in that interval. Interpretation of these tables involves a comparison of a series of

different numbers, a disadvantage which may be avoided by plotting the numbers under each column as a graph. While using a graphic representation of a distribution of figures, as a norm or standard of reference, one focuses attention upon the position which a particular child adopts in relation to a standard group and upon the number of children like him, rather than upon the measurement itself. It is, however, cumbersome to deal with graphs and preferable to use some expression to show these relationships. One way is to use the mean and the standard deviation from this mean. The position of the mean and one to three positive and negative standard deviations are indicated in a "normal distribution curve." This method is generally conceded to be most useful in research projects, in dealing with figures which have a relatively "normal" or symmetrical distribution.

Stuart (1934) referred also to the use of percentile scales to express position in a distribution. This method can be applied to any set of figures regardless of whether or not they follow closely a "normal" distribution. Under this system the number of cases in any series is divided into succeeding percentage divisions according to increasing measurements. The 25th percentile indicates that 25 percent or one-quarter of the measurements fall below and three-quarters above this figure. The 50th percentile is the median of the group which means that an equal number fall below and above this figure. Positions expressed in percentile rank would seem to be more readily understood and to be a more familiar concept for physicians than those expressed in terms of standard deviations.

Burgess (1937) published height curves for various percentile levels at given ages and specified that norms presented in terms of curves have a decided advantage over tables. When an individual's measurements are plotted on such a growth chart, one has a simple graphic picture of his physical status and progress in the particular trait under study. The evaluation that one makes is that a given child stands at a certain percentile level relative to a large group of children of his own age, and his progress from measurement to measurement can be appraised by comparing it with the pattern of growth shown by the curve of the chart and by reference to his previous record.

Pryor (1966) also noted that the graphic method of plotting a child's body measurements on standard deviation charts shows how consistently he is maintaining his percentile relationship to other children of his own age and sex.

Part III: Studies of Anthropometric Growth During Infancy

Body Size of Contemporary Groups of One-year-old Infants Studied in Different Parts of the World.

Meredith (1970) assembled source materials from 170 investigations reporting findings for human body size at termination of the first postnatal year. Measurements of infants were taken largely between 1950 and 1960 in Africa, Asia, Australia, Europe, North and South America, Oceania, and the Malay Archipelago. Intercomparisons were made for body weight; body length; width, depth, and girth of head; chest and abdomen circumferences; vertex-rump and rump-soles length; and width of hips.

Averages for body weight were categorized with respect to regional source of the samples they represented. Only the studies on body weight and length were reviewed.

Commonly body weight was determined with the subjects nude. In a few investigations, subjects were weighed wearing a light garment, or indoor clothing. To adjust for weight of clothing, averages were reduced 0.1 kg. where light clothing was worn, and 0.3 kg. where weight was taken in outdoor clothing. Averages were considered to represent weight of the naked body. The averages reported were either means or medians.

Meredith (1970) stated that there was a small sex difference in average body weight at age one year (statistics from large samples have shown that the typical boy is heavier than the typical girl by approximately 0.45 kg.). The Worldwide comparisons were considered to be meaningful without constructing separate tables for each sex.

Meredith (1970) concluded his review of body weight of one-year-old infants in different parts of the world with the following statement:

> Average body weight at age one year varies widely among fairly well-nourished infants of different racial groups. Averages falling below 8.5 kg. lie near 7.1 kg. for Ethiopian infants of fair to good nutritional condition . . . 7.8 kg. for Iraq's infants who did not give an impression of being malnourished . . . 8.0 kg. for Thai infants given solids early, particularly egg yolk, bananas, meat broth, and rice . . . 8.0 kg. for Peruvian infants in generally good physical condition and showing no marked symptoms of nutritional deficiency . . . and 8.1 kg. for Congolese infants receiving supplementary milk in a nutritional program . . . Higher means approximate 9.1 kg. for Sardinian infants whose parents were advised on infant diet and health care . . . 9.9 kg. for Uruguayan infants under private pediatric guidance . . .

> 10.3 kg. for Czeck infants enrolled for longitudinal study at a child health center . . . and 10.3 kg. for infants under private pediatric care at Bologna, Italy, and Newark, New Jersey . . . (Meredith, 1970, pp. 568-569).

In the Meredith report, body length was treated similarly to body weight. The same geographic subdivisions were employed. At age one year stature was usually measured with the infant in dorsal recumbency. Many of the reports used specified that the subjects were measured in this position; others omitted reference to Ss positioning. Meredith (1970) reported that according to one study, at one year of age the recumbent length is greater than the standing height, on the average by about one cm.

Mean and median values for body length at age one year did not differ systematically. There was a systematic sex difference; typically, averages for body length at age one year were higher for boys than for girls by approximately 1.6 cm.

Studies of Negro Infants. Scott, et. al. (1950) stated that

> it has often been reported in the literature that Negro infants grow slower in height and weight than white infants. Some workers believe that separate standards of growth are necessary for the two races (Scott, et. al., 1950, p. 885).

Many reasons have been given for the apparent difference in growth among the two races. Scott, et. al. (1950) referred to Royster (1936) who stressed environmental factors; and to Dodge (1927) who emphasized racial differences in physical anthropology. However, Bakwin and Patrick (1944) reported no significant differences in the weight gain of white and Negro infants during the first year of life. According to their study it seemed likely that the slower growth

observed in earlier studies was due to differences in socioeconomic status rather than to differences in the germplasm.

Genetic and Environmental Factors Influencing Physical Growth. Hiernaux (1963) used two broad categories for studying the relative influence of heredity and environment in anthropometric variability. He concluded that a more favorable environment (with respect to diet and health conditions) tended to increase all physical measurements in a portion inverse to their heritability. An ecological factor could act strongly on the relatively small ecosensitive part of a feature with a high heritability; the specific environmental factors that varied between subgroups could have little differentiating influence on feature with a low heritability. Stature and leg length showed a high heritability and no significant ecosensitivity.

Hoffman and Hoffman (1966) referred to Garn who suggested that the secular increase in stature could, in theory, have a genetic basis, due to the breaking up of genetic enclaves (outbreeding) and the formation of new genotypic combinations. To a large extent, however, the increase in stature that has taken place all over the world has been attributed to an improvement in health and nutrition, to better control of the dysenteries of infancy, of certain childhood diseases, and of intestinal and liver parasites, and to the limitations placed on child labor and early marriage.

Adams and Niswander (1968) studied the birth weight of 14,376 American Indian infants born in United States Public Health Service Hospitals. The study reported a wide range of birth weights which correlated closely to the adult stature of the various tribes, and

both were apparently related to food procurement, utilization, and habits of the various tribal groups.

Tanner (1970) stated that in most European and American data a well-marked seasonal effect on velocity of growth has been noted. Growth in height was fastest in the Spring and growth in weight was fastest in the Fall. The average velocity of height in the March to May quarter is almost twice that in the September to October quarter. Children differed surprisingly, however, both in the time of year at which they grew fastest, and in the degree to which they showed the seasonal trend if at all. The differences probably reflect individual variation in endocrine and hypothalamic reactivity.

Billewicz (1967) collected body weights of children for every quarter year from birth to three years of age from Keneba, a rural village in the Gambia, West Africa, in 1962 and 1963. The study concluded that the body weights and weight increments varied considerably by season, mainly as a result of seasonal changes in the incidence of communicable disease.

CHAPTER III

PROCEDURES OF THE STUDY

This study was planned to establish weight and length norms for a small group of North American black infants (birth to 12 months of age) from low-income level. The investigation was to include also correlations between certain variables: (1) mother's age and infant's weight at birth; (2) birth order and weight at birth, at three months of age, at six months of age, at nine months of age, and at 12 months of age; (3) mother's age and infant's length at birth; (4) birth order and infant's length at birth, and at 12 months of age; (5) infant's weight at birth and weight at three months of age, at six months of age, at nine months of age, and at 12 months of age; and (6) infant's length at birth and length at three months of age, at six months of age, at nine months of age, and at 12 months of age.

Design of the Study

The present research required the following data for black subjects selected for the study:

(1) sex
(2) date of birth
(3) mother's age
(4) number of live births to the mother
(5) weight at birth
(6) weight at three months of age
(7) weight at six months of age
(8) weight at nine months of age
(9) weight at 12 months of age

(10) length at birth
(11) length at three months of age
(12) length at six months of age
(13) length at nine months of age
(14) length at 12 months of age

The investigator had discussions with the Director and the concerned staff at the central office of the C & Y Project of the Guilford County Health Department to confirm the availability of such data and the number of subjects available for the study from the records maintained at the Health Department Clinics. The records maintained on black babies born since January 1, 1969 and who had visited Hampton Homes clinic were reviewed as a pilot study. The conclusion was drawn that sufficient data were available to meet the requirements of the study.

Subjects

The subjects for the study were infants born between January 1, 1969, and March 5, 1971. Subjects were infants attending clinics in the five Public Housing Projects served by C & Y Project. The data needed for the study were obtained from the files maintained on infants who were brought to the clinics in the C & Y Project. The records used were: (1) Family Data Sheet; (2) Health History; (3) Pediatric Health Record; (4) Clinic Interval Note; and (5) Percentile Chart.

Collection of Data

Data were collected only for normal infants whose birth weights were recorded. Data from the records maintained at Hampton Homes clinic were taken first. In order to record the needed data on infants visiting other clinics, the C & Y Project administrators made available

the master list of infants and children admitted to the C & Y Project since 1966. The necessary data on these subjects were then taken from the master folders maintained on the infants and their families in the central office. The weight and length measurements were taken for different age levels by allowing 15 days around each age level anniversary.

Developing Skill in Measuring Infants and Testing the Reliability of Measurements

In order to learn the skill of measuring infants and to test the reliability of measurements the investigator measured the body weight and length of 30 infants (18 infants below six months of age and 12 infants above six months of age) who were brought to Hampton Homes clinic between March and May 1971. The infants were measured on the Pediatric Examination Table. The infants were weighed without clothes except the diaper. Weight was recorded in pounds and ounces. Length was taken in the dorsal recumbent position. The soles of the feet were held firmly against the fixed side of the scale, keeping the head stationary. The scale was moved down to touch the head. The length measurement was recorded in inches. The reliability of weight and length measurements was tested by computing the Pearson product-moment correlation coefficient (r) for the measurements of the same infants taken by the clinic nurse and the investigator on the same day. Essentially there was a perfect correlation of + 1.0 between the measurements taken by the clinic nurse and the investigator.

CHAPTER IV

ANALYSIS OF THE DATA

The collected data were coded as shown in Appendix C. Data were computed by using TSAR (Tele-Storage and Retrieval) Program.

Establishment of Norms

The first purpose of this study was to establish weight and height norms at birth, at three months of age, at six months of age, at nine months of age, and at 12 months of age for North American black infant boys and girls from low-income level families.

Weight and length norms were developed by analyzing the data with descriptive statistics. As the measurements were on an Interval Scale they called for means and standard deviations. Tables of means and standard deviations with ranges were constructed to facilitate the analysis of data.

Tables 1 and 2 show the weight norms with means, standard deviations, and range at different age levels for infant boys and infant girls. The mean birth weight for male and female infants was 7.2 pounds and 6.9 pounds, respectively. The mean weight at three months of age was 13.6 pounds for males and 12.7 pounds for females. Birth weight for both sexes was calculated to have almost doubled by three months of age. The average body weight for infant boys was: 17.3 pounds at six months of age, 20.2 pounds at nine months of age,

TABLE 1

Weight Norms for Black Infant Boys

with Respect to Age

Age in Months	Mean in Pounds	Standard Deviation	Range in Pounds	Number of Subjects
Birth	7.2	1.1	5.6 - 16.0	110
Three	13.6	2.0	8.0 - 18.7	63
Six	17.3	2.6	10.4 - 23.8	55
Nine	20.2	3.1	12.1 - 26.8	35
Twelve	22.6	2.7	17.1 - 28.0	34

TABLE 2

Weight Norms for Black Infant Girls

with Respect to Age

Age in Months	Mean in Pounds	Standard Deviation	Range in Pounds	Number of Subjects
Birth	6.9	1.0	5.3 - 9.9	100
Three	12.7	1.8	9.7 - 16.3	68
Six	16.5	2.2	12.0 - 22.2	49
Nine	19.3	2.0	15.9 - 24.0	34
Twelve	20.9	2.6	17.4 - 26.4	35

and 22.6 pounds at 12 months of age. The average body weight for infant girls was: 16.5 pounds at six months of age, 19.3 pounds at nine months of age, and 20.9 pounds at 12 months of age.

The velocity of increase in weight from three months of age to 12 months of age was fairly steady in both male and female infants. A sex difference in average body weight was found at all age levels studied. The infant boys were heavier than infant girls on the average by .3 pounds at birth, by .9 pounds at three months of age, by .8 pounds at six months of age, by .9 pounds at nine months of age, and by 1.7 pounds at 12 months of age. A wide range in weight at all age levels was found both in male and female infants.

The length norms with means, standard deviations and range at different age levels during the first year of life for both boys and girls are presented in Tables 3 and 4. The velocity of increase in length from birth to 12 months of age was fairly steady in both male and female infants. Sex difference in the mean length at all age levels was observed. On the average, infant boys were longer than infant girls: by .8 inches at birth; by .5 inches at three months of age; by .4 inches at six months of age; by .8 inches at nine months of age; and by one inch at 12 months of age. A wide range in length at all age levels was noted in both male and female infants.

The mean weight of the entire sample of 210 subjects was observed as follows: 7.1 pounds at birth; 13.1 pounds at three months of age; 16.9 pounds at six months of age; 19.7 pounds at nine months of age; and 21.7 pounds at 12 months of age. The mean length obtained

TABLE 3

Length Norms for Black Infant Boys

with Respect to Age

Age in Months	Mean in Inches	Standard Deviation	Range in Inches	Number of Subjects
Birth	20.8	1.1	19.0 - 23.0	32
Three	24.0	1.3	22.0 - 27.0	57
Six	26.4	1.5	22.0 - 29.0	51
Nine	28.6	1.2	26.0 - 30.0	33
Twelve	30.3	1.5	27.0 - 35.0	31

TABLE 4

Length Norms for Black Infant Girls

with Respect to Age

Age in Months	Mean in Inches	Standard Deviation	Range in Inches	Number of Subjects
Birth	20.0	1.1	17.0 - 21.0	35
Three	23.5	1.3	20.0 - 26.0	64
Six	26.0	1.1	24.0 - 28.0	44
Nine	27.8	1.4	23.0 - 30.0	32
Twelve	29.3	1.5	27.0 - 32.0	34

for the entire sample of infants was: 20.4 inches at birth; 23.7 inches at three months of age; 26.2 inches at six months of age; 28.2 inches at nine months of age; and 29.8 inches at 12 months of age.

Developing Percentile Grids

The second purpose of the study was to develop percentile tables and grids with weight and length measurements for black infant boys and for black infant girls. Percentile values were calculated for weight and length measurements at different intervals: 3, 10, 25, 50, 75, 90, and 97 separately for infant boys and girls. These percentile values are presented in Tables 5, 6, 7, and 8. Using these percentile values grids were constructed. These grids are shown in Figures 1 and 2 (for weight) and in Figures 3 and 4 (for length).

TABLE 5

Percentiles in Pounds for Weight Measurements of Black Infant Boys with Respect to Age

Age in Months	3%	10%	25%	50%	75%	90%	97%	Number of Subjects
Birth	5.6	6.0	6.4	7.2	7.9	8.7	9.3	110
Three	8.9	11.0	12.1	14.0	15.2	15.6	16.6	63
Six	11.2	14.4	15.9	17.4	18.9	20.3	22.7	55
Nine	15.2	16.9	18.3	20.3	22.2	24.4	26.1	35
Twelve	18.4	19.4	20.3	22.5	24.5	26.9	27.7	34

TABLE 6

Percentiles in Pounds for Weight Measurements of Black Infant Girls with Respect to Age

Age in Months	3%	10%	25%	50%	75%	90%	97%	Number of Subjects
Birth	5.3	5.5	6.1	6.8	7.6	8.3	9.3	100
Three	9.8	10.4	11.3	12.8	13.8	15.3	16.0	68
Six	12.4	13.3	14.9	16.8	18.0	19.3	20.1	49
Nine	15.8	16.8	18.1	18.9	20.4	22.3	23.3	34
Twelve	17.1	17.8	19.1	20.4	23.1	24.1	26.2	35

TABLE 7

Percentiles in Inches for Length Measurements

of Black Infant Boys with Respect to Age

Age in Months	3%	10%	25%	50%	75%	90%	97%	Number of Subjects
Birth	18.8	19.5	20.0	20.8	21.7	22.3	22.5	32
Three	21.7	22.2	23.0	23.9	25.0	25.9	26.4	57
Six	23.6	24.2	25.7	26.5	27.4	28.2	28.6	51
Nine	26.0	26.8	27.7	28.6	29.6	30.1	30.4	33
Twelve	27.4	28.2	29.6	30.3	31.0	31.5	33.0	31

TABLE 8

Percentiles in Inches for Length Measurements

of Black Infant Girls with Respect to Age

Age in Months	3%	10%	25%	50%	75%	90%	97%	Number of Subjects
Birth	17.5	18.3	19.5	20.1	20.8	21.2	21.4	35
Three	21.4	21.8	22.6	23.6	24.4	25.3	25.9	64
Six	23.8	24.6	25.4	26.8	27.1	27.5	28.2	44
Nine	23.5	26.1	27.3	27.9	28.7	29.5	30.2	32
Twelve	26.7	27.2	28.0	29.5	30.4	31.3	32.0	34

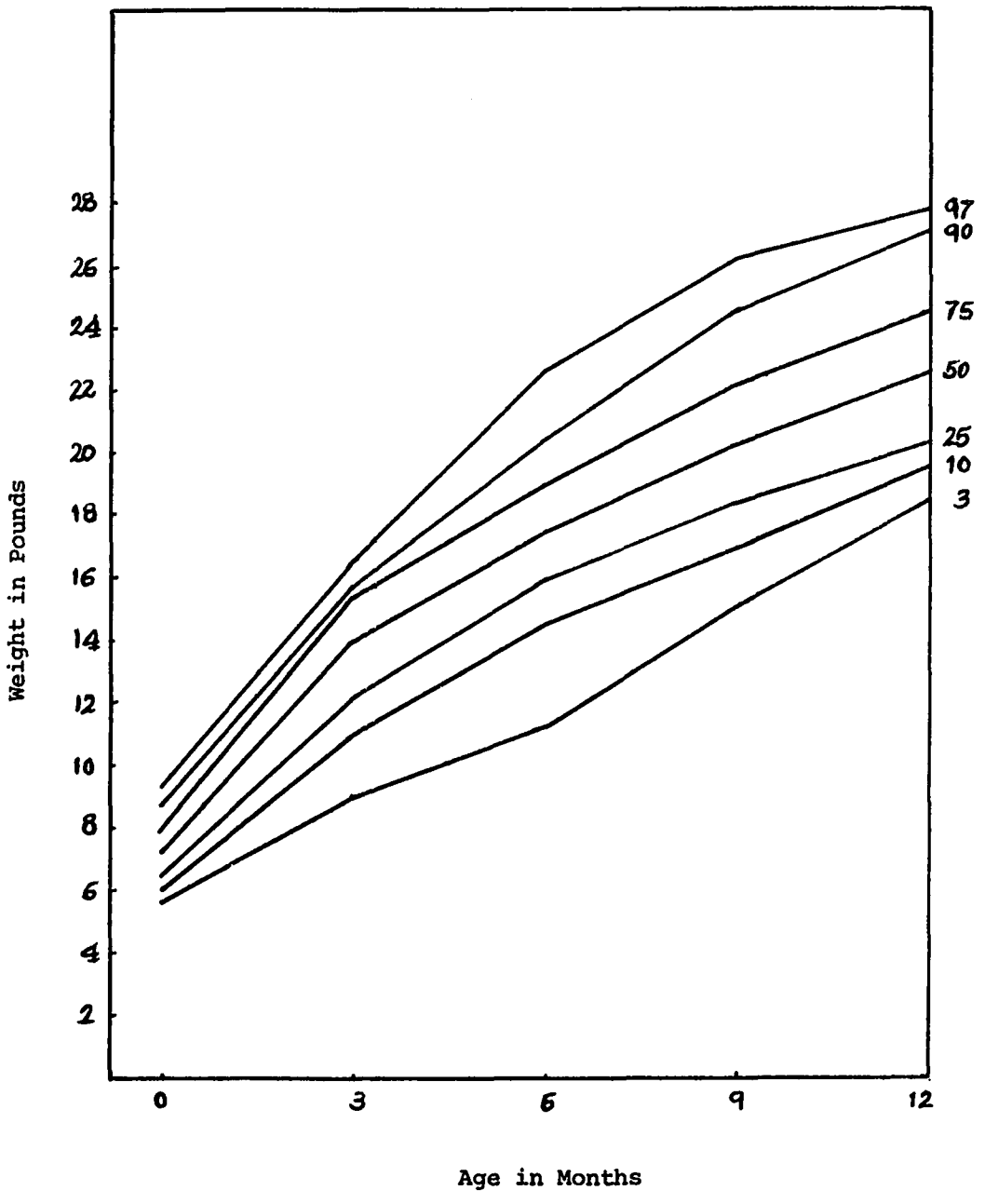

Figure 1.- Percentile Weight Grid for Black Infant Boys

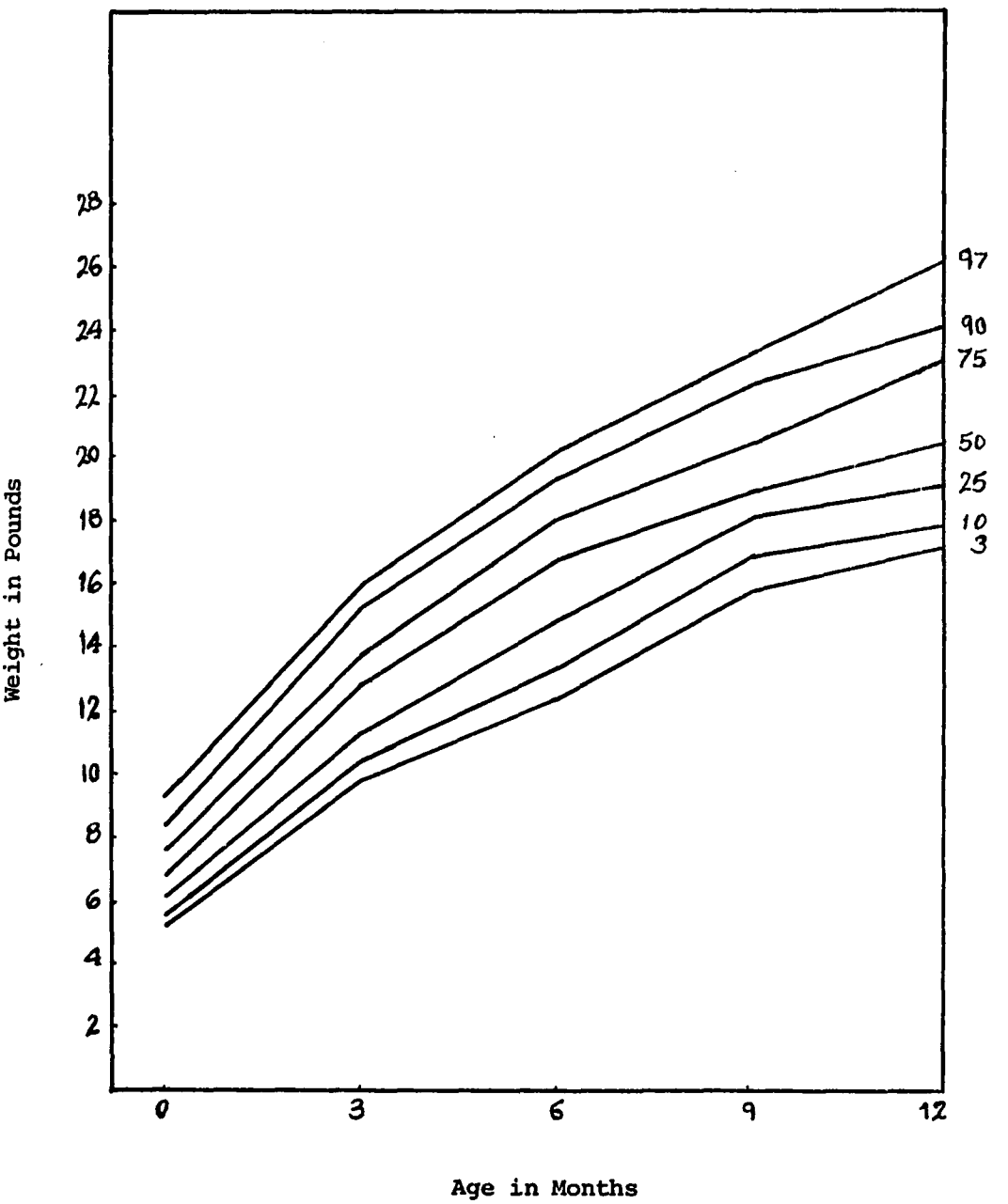

Figure 2.- Percentile Weight Grid for Black Infant Girls

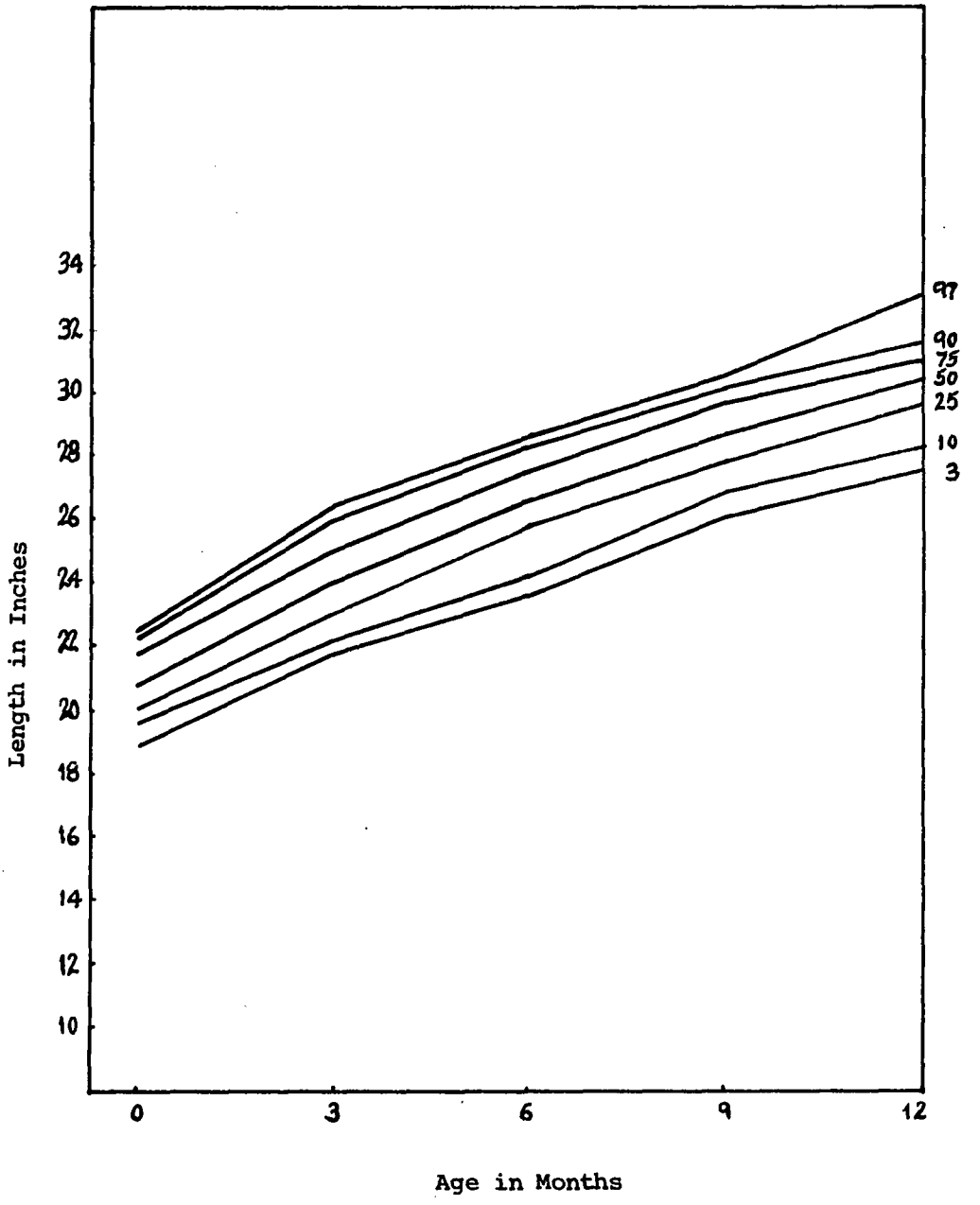

Figure 3.- Percentile Length Grid for Black Infant Boys

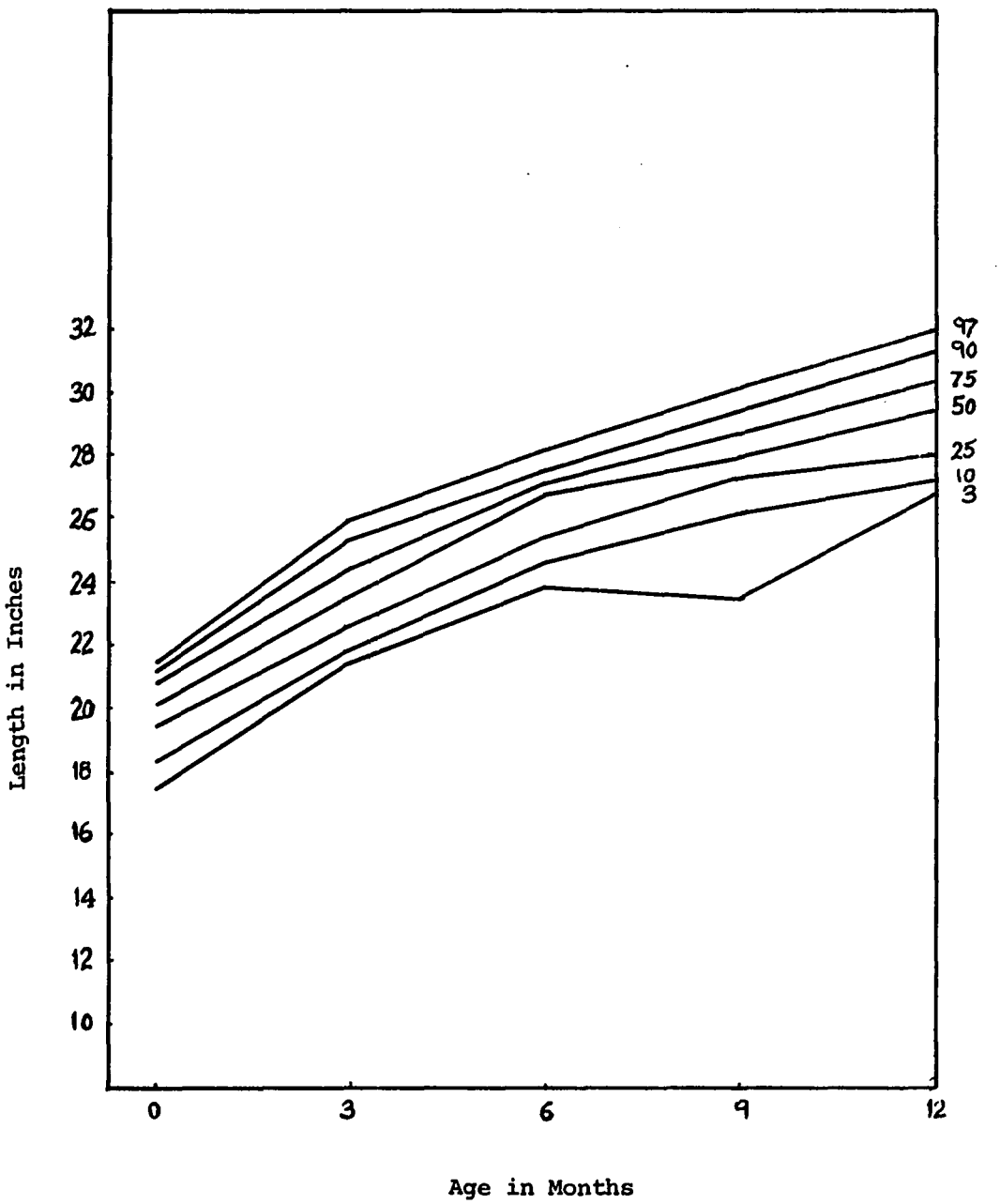

Figure 4.- Percentile Length Grid for Black Infant Girls

Correlational Investigations

The study included as its third purpose the investigation of the correlation between: (1) mother's age and infant's weight at birth; (2) birth order and weight at birth, at three months of age, at six months of age, at nine months of age, and at 12 months of age; (3) mother's age and infant's length at birth; (4) birth order and infant's length at birth, and at 12 months of age; (5) infant's weight at birth and weight at three months of age, at six months of age, at nine months of age, and at 12 months of age; (6) infant's length at birth and at three months of age, at six months of age, at nine months of age, and at 12 months of age.

Null hypotheses tested. Seventeen hypotheses were tested by studying the correlations between the relevant variables. In testing the hypotheses Pearson Product-moment correlations were used. The relationship found between the variables in each hypothesis with the observed level of significance is shown in Table 9.

Table 9

Correlations Between Relevant Variables

Hypotheses	Variables		Degrees of Freedom	Correlation (r)*	Level of Signifance
	X	Y			
I	Mother's age	Birth weight	208	0.127	.05
II	Mother's age	Birth length	65	0.150	N.S.
III	Birth order	Birth weight	208	0.136	.05
IV	Birth order	Weight at 3 months	129	0.212	.05
V	Birth order	Weight at 6 months	102	0.122	N.S.
VI	Birth order	Weight at 9 months	67	0.110	N.S.
VII	Birth order	Weight at 12 months	67	0.123	N.S.
VIII	Birth order	Birth length	65	0.219	N.S.
IX	Birth order	Length at 12 months	63	0.241	N.S.
X	Birth weight	Weight at 3 months	129	0.581	0.01
XI	Birth weight	Weight at 6 months	102	0.481	0.01
XII	Birth weight	Weight at 9 months	67	0.606	0.01
XIII	Birth weight	Weight at 12 months	67	0.516	0.01
XIV	Birth length	Length at 3 months	36	0.506	0.01
XV	Birth length	Length at 6 months	19	0.697	0.01
XVI	Birth length	Length at 9 months	12	0.549	0.05
XVII	Birth length	Length at 12 months	10	0.558	N.S.

*Pearson Product-moment correlation coefficients

Hypotheses I and II relating to mother's age and weight and length at birth will first be presented.

Hypothesis I. There will be no significant relationship between the birth weight of a black infant from low-income level and his mother's age. The null hypothesis was rejected since a correlation of 0.127 significant at the 0.05 level, was found between birth weight and mother's age. An even higher correlation might have been expected. Crump's study (1957) showed a positive relationship between birth weight of the infant and maternal age at delivery. It has been noted in the literature that there is a general tendency for younger mothers to have lighter babies, and for older mothers to have heavier infants. The low correlation observed in this study might be due to the wide age range (13 - 42 years) among the mothers of the infants studied. The average age of the mothers in this study was 21.3 years. A higher correlation might have been obtained if the infants had been categorized by mothers' age, such as mothers: under 15 years, 15 - 20 years, 20 - 25 years, 25 - 30 years, and over 30 years.

Hypothesis II. There will be no significant relationship between the birth length of a black infant from low-income level and his mother's age. The null hypothesis was not rejected since the correlation found between birth length and mother's age was not significant. The record of birth length was not available in many instances. Hence only a small number of subjects (67) were included in this aspect of the study. Perhaps with a larger sample a low positive

correlation might have been found. However, the literature is not clear on whether mother's age is a factor in length at birth. Crump, et. al. (1957) referred to Peckham's study in which it was observed that younger women gave birth to infants smaller in weight but equal in length to that of more mature individuals.

Hypotheses III through IX involving the variables of birth order, weight, and length through the first year of life will be presented.

Hypothesis III. There will be no significant relationship between the birth weight of a black infant from low-income level and the order of his birth within the family. Hypothesis III was rejected since the correlation between birth weight and birth order was significant at the 0.05 level.

Hypothesis IV. There will be no significant relationship between the weight of a black infant from low-income level at three months of age and the order of his birth within the family. Hypothesis IV was rejected since the correlation between weight at three months of age and birth order was found to be significant at the 0.05 level.

Bayley (1954) stated that most of the physical comparisons showed increasing parent-child similarities. Crump, et. al. (1957) believed however that the genetic make-up of the individual was not subject to birth order influences, and observed that the first-born had on the average the smallest birth weight, yet within one or two years he was consistently heavier and taller than were later born

children at the same stage. The smaller size of the first-born was attributed to a more difficult launching through the birth canal and to the expected differences in the intrauterine environment in the course of successive reproductions. Howells (1948) pointed out that there was a rapid growth during infancy of the first-born which was a reflection of his favorable environmental situation and the intensive nurturance he received in the early years. Therefore, a correlation between birth order and weight at birth, and at other intervals during infancy might have been expected.

Hypothesis V. There will be no significant relationship between the weight of a black infant from low-income level at six months of age and order of his birth within the family.

Hypothesis VI. There will be no significant relationship between the weight of a black infant from low-income level at nine months of age and the order of his birth within the family.

Hypothesis VII. There will be no significant relationship between the weight of a black infant from low-income level at 12 months of age and the order of his birth within the family.

Hypotheses V, VI, and VII were not rejected since the correlations between birth order and weight at six, nine, and 12 months of age were found not to be significant. This non-significant relationship may perhaps be attributed to the participation of the mothers and infants in a program of comprehensive health care. Another perhaps related explanation may be that the parents of these infants have given essentially the same nurturance to first-born and later born

children, possibly reflecting informed attitudes toward child rearing, an increase in economic standard, and a decrease in family size.

Hypothesis VIII. There will be no significant relationship between the birth length of a black infant from low-income level and the order of his birth within the family.

Hypothesis IX. There will be no significant relationship between the length of a black infant from low-income level at 12 months of age and the order of his birth within the family.

Hypotheses VIII and IX were not rejected since non-significant correlation coefficients were found between: (1) length at birth and birth order; and (2) length at 12 months of age and birth order. To the writer's knowledge there have been no studies in which birth length and birth order have been correlated. It was not known whether birth order was a factor in length measurement during infancy. Hence the present study set up the two hypotheses (VIII and IX) but found no significant relationship between the variables of birth order and length measurements in infancy.

Hypotheses X through XIII have to do with the relationship between birth weight and weight at other intervals through the first year of infancy.

Hypothesis X. There will be no significant relationship between the birth weight of a black infant from low-income level and his weight at three months of age.

Hypothesis XI. There will be no significant relationship between the birth weight of a black infant from low-income level and his weight at six months of age.

Hypothesis XII. There will be no significant relationship between the birth weight of a black infant from low-income level and his weight at nine months of age.

Hypothesis XIII. There will be no significant relationship between the birth weight of a black infant from low-income level and his weight at 12 months of age.

Hypotheses X, XI, XII, and XIII were rejected since a significant difference at the 0.01 level was found between: (1) weight at birth and weight at three months of age; (2) weight at birth and at six months of age; (3) weight at birth and at nine months of age; and (4) weight at birth and at 12 months of age. Most of the studies in the literature have revealed a positive relationship between birth weight and postnatal weight. Crump, et. al. (1957) stated that postnatal weight was influenced by birth weight. The findings of the present study confirm the results of other studies as well as having a common sense validity.

Hypotheses XIV through XVII relate to the variables of birth length at quarterly intervals during the first postnatal year.

Hypothesis XIV. There will be no significant relationship between the birth length of a black infant from low-income level and his length at three months of age. Hypothesis XIV was rejected since a correlation coefficient signigicant at the 0.01 level was found between length at birth and length at three months of age.

Hypothesis XV. There will be no significant relationship between the birth length of a black infant from low-income level and his length at six months of age. Hypothesis XV was rejected since a correlation significant at the 0.01 level was found between length at birth and length at six months of age.

Hypothesis XVI. There will be no significant relationship between the birth length of a black infant from low-income level and his length at nine months of age. Hypothesis XVI was rejected since a correlation significant at the 0.05 level was found between length at birth and length at nine months of age.

Hypothesis XVII. There will be no significant relationship between the birth length of a black infant from low-income level and his length at 12 months of age. The null hypothesis was not rejected since a non-significant correlation was found between length at birth and length at 12 months of age.

Although many studies have emphasized the relation between birth weight and weight throughout infancy, little attention has been paid to length measurements. Since the research literature on physical measurements gave no clues as to a possible relation between birth length and length during the postnatal period, the writer proposed to test hypotheses XIV, XV, XVI, and XVII. The findings were: (1) there was a correlation (significant at the 0.01 level) between birth length and length at three months of age, and length at six months of age; (2) a correlation significant at the 0.05 level was found between birth length and length at nine months of age; and

(3) non-significant correlation was found between birth length and length at 12 months of age. The relatively low significance of the correlation at nine months of age and the non-significant correlation at 12 months of age may be explained in part on the basis of the size of the sample on which the correlation coefficients were computed. As indicated earlier many of the records lacked the information about length at birth. Information as to length at nine and 12 months was also lacking in many records. It is conceivable that a larger sample might have produced significant correlations at the upper age levels. On the other hand, by nine and 12 months of age the length factor may be influenced by many other factors such as health, motor and physical development, and exercise.

Comparison of Results of Present Study With Other Studies of Black and White Infants

Scott, et.al. (1950) compared data on weight and length measurements of Negro infants from lower-middle class with similar data from other studies on Negro and white infants. Meredith (1952) compared the mean weight and length measurements of North American Negro and white infants from available studies. Of the investigations chosen by Meredith for comparison, the studies by Bakwin and Bivings involved Negro and white infants from low-income families. Michelson's study was based on black and white infants from lower-middle class homes. Pasamanick included Negro infants from economically "average or below average" homes and white infants from "average or somewhat above average" homes. From the comparison table presented

of Meredith (1952) and from Scott's (1950) data the mean weight and length of infants at different age levels during the first year of life were taken for comparison with the results of the present study.

Data in Tables 10 and 11 facilitate the comparison of the mean weight and length obtained on black infants in the present study with other studies of Negro infants.

There has been a gradual increase in the mean weight at birth and at three months of age since Bakwin's study in 1928-1929 up to the present time (Table 10). Such increase may be due to better and more easily available pediatric care, and to generally improved nutrition. The mean weight at six months of age has generally remained at a constant level over four decades. The higher means found by Pasamanick may be due to the fact that the subjects of that study were not from low-income groups.

Table 10

Mean Weight in Pounds at Selected Ages:

Comparison of Black Infants of Present

Study with Black Infants in Other Studies

Investigations	Birth		3 Months		6 Months		9 Months		12 Months	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Bakwin [a]	187	6.6	102	11.2	97	16.8	99	20.1	95	22.6
Bivings [b]	3,255	6.9								
Michelson [c]	929	7.0	1714	11.8	981	16.0	589	18.8	338	20.90
Pasamanick [d]	53	7.3	53	14.08	53	17.9	53	20.9	53	22.6
Scott [e]	638	7.4	613	12.5	600	16.9	580	20.2	553	22.0
Present Study	210	7.1	131	13.1	104	16.9	69	19.7	69	21.7

a - Negro infants from low-income groups studied in 1928-29; reported by Meredith (1952).
b - Negro infants from low-income groups studied in 1932; reported by Meredith (1952).
c - Negro infants from lower-middle class studied during 1935 - 1936; reported by Meredith (1952).
d - Negro infants from "average" homes studied in 1944; reported by Meredith (1952).
e - Negro infants from lower-middle class studied during 1940 - 1947; reported by Scott (1950).

Mean length at selected ages for subjects of the present study compared with subjects from lower-middle class and economically "average and below average" families from other studies is shown in Table 11. Length at birth was not reported in any of the three studies. The mean length at the selected ages in the present study was rather strikingly similar to the mean length reported in the other studies. Average length does not appear to be changing as fast as weight averages over the decades. The reason may be that height is not as responsive to economic and social factors as is weight, being perhaps largely genetically determined.

Table 11

Mean Length in Inches at Selected Ages: Comparison of Black Infants of Present Study with Black Infants in Other Studies

Investigations	Birth		3 Months		6 Months		9 Months		12 Months	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Michelson [a]			153	24.0	135	26.8	98	28.4	68	29.9
Pasamanick et.al.[b]			35	24.6	35	27.0	35	29.0	35	29.8
Scott et.al.[c]			419	23.5	434	26.3	421	28.1	424	29.7
Present Study	67	20.4	121	23.7	95	26.2	65	28.2	65	29.8

a - Negro infants from lower-middle class studied during 1935 - 1936; reported by Meredith (1952).
b - Negro infants from "average" homes studied in 1944; reported by Meredith (1952).
c - Negro infants from lower-middle class studied during 1940 - 47; Scott (1950).

In Tables 12 and 13 some comparisons between black infants in the present study and white infants in other studies are shown. In Table 12 the mean weight at selected ages in the present study were compared with similar data in Bakwin's and Michelson's studies. The black infants in this study were found to be slightly smaller at most age levels than the white infants studied thirty to forty years ago. The differences are small, however, and are probably not statistically significant.

Table 12

Mean Weight in Pounds at Selected Ages: Comparison of Black Infants of Present Study with White Infants in Other Studies

Investigations	Birth		3 Months		6 Months		9 Months		12 Months	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Bakwin [a]	1217	7.3	218	11.4	164	16.8	115	20.0	90	22.8
Michelson [b]	270	7.5	180	12.9	219	17.1	167	20.3	100	22.8
Present Study	210	7.1	131	13.1	104	16.9	69	19.7	69	21.7

a - White infants from low-income groups studied during 1928 - 1929; reported by Meredith (1952).
b - White infants from lower-middle class studied during 1935 - 1936; reported by Meredith (1952).

Table 13 compares the mean length at selected ages in the present study with Michelson's study carried out in the mid-1930's. (Michelson did not report birth length.) The mean length at other ages in the present study were found to be slightly lower than reported by Michelson. In spite of the comprehensive health care program available to infants in the present study, their heights were shorter than the lower-middle class white infants studied nearly thirty-five years ago. This leads the investigator to question whether height may be largely genetically determined and not be particularly responsive to economic and health factors.

Table 13

Mean Length in Inches at Selected Ages: Comparison of Black Infants of Present Study With White Infants Michelson's Study

Investigations	Birth		3 Months		6 Months		9 Months		12 Months	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Michelson [a]			180	25.0	219	27.8	167	30.6	100	31.3
Present Study	67	20.4	121	23.7	95	26.2	65	28.2	65	29.8

a - White infants from lower-middle class studied during 1935 - 1936; reported by Meredith (1952).

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Purpose of the Study

The purpose of the present study was to establish weight and length norms for a small group of North American black infants from low-income level families in Guilford County, North Carolina: at birth, at three months of age, at six months of age, at nine months of age, and at 12 months of age. Percentile grids for weight and length measurements were to be developed separately for boys and girls.

The study included the investigation of the correlation between certain variables: (1) mother's age and infant's weight at birth; (2) birth order and weight at birth, at three months of age, at six months of age, at nine months of age, and at 12 months of age; (3) mother's age and infant's length at birth; (4) birth order and infant's length at birth and at 12 months of age; (5) infant's weight at birth and weight at three months of age, at six months of age, at nine months of age, and at 12 months of age; and (6) infant's length at birth and length at three months of age, at six months of age, at nine months of age, and at 12 months of age.

Subjects

The 210 subjects selected for this study were normal infants born between January 1, 1969 and March 5, 1971 who were attending clinics served by the C & Y Project in Guilford County, North Carolina.

The data needed for the study were taken from the clinic records. In order to acquire the skills for measuring infants and to test the reliability of measurements obtained from the records, the investigator measured the body weight and length of 30 of the infant subjects. Results of the measurements were compared with those of clinic nurses. A correlation coefficient of + 1.0 was obtained.

Data

Data for the present study included information on sex and date of birth of each infant; age of mother; number of live births; weight and length measurements of infants at birth, at three months of age, at six months of age, at nine months of age, and at 12 months of age. Data were analyzed by use of descriptive statistics to establish norms and to develop percentile grids; and by correlational techniques to test hypotheses. The results of the study were compared with other studies of both Negro and white infants.

Findings

Weight and length norms were established for the first year of life at quarterly intervals. The mean birth weight for male and female infants was 7.2 pounds and 6.9 pounds, respectively. The mean weight obtained for infant boys at three months of age was 13.6 pounds, at six months of age was 17.3 pounds, at nine months of age was 20.2 pounds, and at 12 months of age was 22.6 pounds. The mean weight for infant girls at three months of age was 12.7 pounds, at six months of age was 16.5 pounds, at nine months of age was 19.3

pounds, and at 12 months of age was 20.9 pounds. The mean birth length for male and female infants was 20.8 inches and 20.0 inches, respectively. The mean length for boys at three months of age was 24.0 inches, at six months of age was 26.4 inches, at nine months of age was 28.6 inches, and at 12 months of age was 30.3 inches. The mean length for girls at three months of age was 12.5 inches, at six months of age was 26.0 inches at nine months of age was 27.8 inches, and at 12 months of age was 29.3 inches.

A relationship at the 0.05 level of significance was found between birth weight and mother's age. Perhaps a higher correlation might have been expected. The relatively low correlation observed in this study might have been due to the wide age range among the mothers of the infants studied. If the mothers had been categorized as "very young," "young," and "older," perhaps a higher correlation might have been obtained. Correlation coefficients significant at the 0.05 level were found: between birth weight and birth order and between weight at three months of age and birth order. Based on the literature reviewed a positive correlation between birth order and weight at birth, and at quarterly intervals during infancy was to be expected.

A relationship at the 0.01 level of significance was observed between birth weight and weight at three months of age, at six months of age, at nine months of age and at 12 months of age for the infants studied. The high correlation was what would be expected on the basis of findings of earlier studies.

A relatively high correlation at the 0.01 level of significance was found between birth length and length at three months of age, and length at six months of age. A lower correlation, but significant at the 0.05 level, was found between birth length and length at nine months of age. There was a non-significant correlation between birth length and length at 12 months of age. The low correlation at nine months of age and no correlation at 12 months of age may have been due to the size of the sample studied. A larger sample might have produced a significant correlation. By later infancy, however, it is conceivable that the length factor may be strongly influenced by such other factors as health, motor and physical development and exercise.

Few studies in the literature have dealt with length measurements of infants. This study has made a special contribution through investigating the correlation between: birth length and mother's age; birth length and birth order; and birth length and length at quarterly intervals during infancy.

Conclusions

Black infant boys weigh more and measure taller than black infant girls at the selected ages studied.

Velocity of growth is fairly steady in both male and female infants in low-income black families. This may be attributed to the comprehensive health care the infants receive from the C & Y Project.

Black infants in this study are somewhat heavier and taller at birth and at three months of age than black infants studied several decades ago.

Compared to white infants from comparable economic levels, studied some years ago, black infants are observed to be smaller both in length and weight.

Recommendations for Further Studies

Chest and head measurements made on the same sample as the present study would make it possible to analyze body proportions and identify body build.

Using records available in the C & Y Project, anthropometric norms may be established for different age levels beyond one year of age.

Anthropometric studies of infants from low-income groups not receiving comprehensive health care would make possible an investigation of some effects of such a program.

Similar studies are recommended to be carried out with white infants from low-income groups since such contemporary studies are lacking in the literature.

A research project is planned at Central Institute of Home Science in Bangalore, India, in collaboration with Bangalore University to establish anthropometric norms for infants and children at different ages and from different income groups in Mysore State.

REFERENCES

Adams, M. S. & Niswander, J. D. Birth weight of North American Indians. Human Biology, 1968, 40, 226-234.

Bakwin, H. & Patrick, J. The weight of Negro infants. Journal of Pediatrics, 1944, 24, 405-407.

Battaqlia, F. C. & Lubchenco, L. O. A practical classification of newborn infants by weight and gestational age. Journal of Pediatrics, 1967, 71, 160-163.

Bayer, L. M. & Bayley, N. Selected method for interpreting and predicting physical development from one year to maturity. Chicago, Ill.: The University of Chicago Press, 1959.

Bayley, N. Growth curves of height and weight by age for boys and girls, scaled according to physical maturity. Journal of Pediatrics, 1956, 48, 187-194

Bayley, N. Some increasing parent-child similarities during the growth of children. Journal of Educational Psychology, 1954, 45, 1-21.

Billewicz, W. Z. A note on body weight measurement and seasonal variation. Human Biology, 1964, 36, 229-234.

Bivings, L. Racial, geographic, annual, and seasonal variations in birth weights. American Journal of Obstetrics and Gynecology, 1934, 27, 725-728.

Bobson, G. S. Growth of low-birth-weight infants. Journal of Pediatrics, 1970, 77, 11-18.

Boyd, Julian D. Clinical appraisal of growth in children. Journal of Pediatrics, 1941, 18, 289-299.

Burgess, May Ayres. The construction of two height charts. Journal of American Statistical Association, 1937, 32, 290-310.

Chen, T. L. Sergovich, F. R., McKim, J. S., Barr, M. L., & Gruber, D. Chromosome studies in full-term, low-birth-weight, mentally retarded patients. Journal of Pediatrics, 1970, 76, 393-398.

Crump, E. P., Horton, C. P., Masuoka, J., & Rhyan, D. Growth and development. I. Relation of birth weight in Negro infants to sex, maternal age, parity, prenatal care, and socioeconomic status. Journal of Pediatrics., 1957, 51, 678-697.

Falkner, F. Some physical growth standards for white North American children. Pediatrics, 1962, 29, 467-474.

Garn, S. M. Body size and its implications. In L. W. Hoffman & M. L. Hoffman (Ed.), Review of child development research. New York: Russell Sage Foundation. 1966.

Hiernaux, J. Heredity and environment: Their influence in human morphology. A comparison of two independent lines of study. American Journal of Physical Anthropology, 1963, 27, 545-589.

Hoffman, L. W. & Hoffman, M. L. Review of Child Development Research. New York: Russell Sage Foundation. 1966.

Howells,W. H. Birth order and body size. American Journal of Physical Anthropology, 1948, 6, 449-460.

Jackson, R. & Kelly, H. Growth charts for use in pediatric practice. Journal of Pediatrics, 1945, 27, 215-229.

Jenss, R. & Bayley, N. A mathematical method for studying the growth of child. Human Biology, 1937, 9, 556-563.

Kasius, R., Randall, A., Tompkins, W., & Wiehl, D. Maternal and newborn nutrition studies at Philadelphia lying-in hospital: Newborn studies - size and growth of babies during the first year of life. Milbank Memorial Fund Quarterly, 1957, 35, 323-372.

Lasker, G. W. Differences in anthropometric measurements within and between three communities in Peru. Human Biology, 1962, 34, 63-70.

Linde, L. H., Dunn, O. J., Schireson, R., & Rasof, B. Growth in children with congenital heart disease. Journal of Pediatrics, 1967, 70, 418-419.

Mehrizi, A. & Drash, A. Birth weight of infants with cyanotic and acyanotic congenital malformations of the ears. Journal of Pediatrics, 1961, 59, 715-718

Meredith, H. North American Negro infants: size at birth and growth during first postnatal year. Human Biology, 1952, 24, 290-308.

Meredith, H. Body size of contemporary groups of one-year-old infants studied in different parts of the world. Child Development, 1970, 41, 551-578.

Michelson, N. Investigation in the physical development of Negroes: I. Stature. American Journal of Physical Anthropology. 1943, I, 191-288(a).

Michelson, N. Studies in the physical development of Negroes: II Weight. American Journal of Physical Anthropology. 1943, I, 289-354(b).

Muhsam, H. Correlation in growth. Human Biology, 1947, 19, 260-269.

Mussen, P. H. (Ed.) Handbook of research methods in Child Development. New York: John Wiley and Sons, Inc., 1960.

Pasamanick, Benjamin. A comparative study of the behavioral development of Negro infants. Journal of Genetic Psychology, 1946, 69, 3-44.

Pryor, H. B. Charts of normal body measurements and revised width-weight tables in graphic form. Journal of Pediatrics, 1966, 68, 615-631.

Rauh, J., Schumsky, D., & Witt, M. Heights, weights and obesity in urban school children. Child Development, 1967, 38, 515-530.

Scott, R., Cardozo, W., Smith, A., & DeLilly, M. Growth and Development of Negro infants: growth during first year of life. Journal of Pediatrics, 1950, 37, 885-896.

Scott, R., Hiatt, H., Clark, B., Kessler, A., & Ferguston, A. Growth and development of Negro infants: Studies on height, weight, pelvic breadth, head and chest circumference during the first year of life. Pediatrics, 1962, 29, 65-98.

Spence, Janet T., Underwood, Benton J., Duncan, Carl P., & Cotton, John W. Elementary statistics. New York: Appleton Century-Crofts. 1968.

Stuart, H. Standards of physical development for reference in clinical appraisement. Journal of Pediatrics, 1934, 5, 194-209.

Tanner, J. M. Physical Growth. In P. H. Mussen (Ed.), Carmichael's Manual of Child Psychology. Vol. I. New York: John Wiley and Sons, Inc., 1970.

Tanner, J. M. Some notes on the reporting of growth data. Human Biology. 1951, 23, 93-159.

Vandenberg, S. G. & Falkner, F. Hereditary factors in human growth. Human Biology. 1965, 37, 357-365.

Vickers, V. & Stuart, H. Anthropometry in the pediatrician's office: Norms for selected body measures based on studies on North European stock. Journal of Pediatrics, 1943, 22, 155-170.

Wetzel, Norman C. Assessing the physical condition of children. Journal of Pediatrics, 1943, 22, 208-225.

Woodbury, Robert M. Statures and weights of children under six years of age. U. S. Children's Bureau Publication, 1921, 87, 117.

APPENDIX A

Income Range used for Eligibility for Services Under C & Y Program for Comprehensive Health Care

Number in Family	Weekly Income	Annual Net Income*
2	57.00 - 77.00	3,000 - 4,000
3	63.00 - 90.00	3,300 - 4,700
4	75.00 -106.00	3,700 - 5,500
5	80.00 -113.00	4,200 - 5,900
6	90.00 -119.00	4,700 - 6,200
7	98.00 -127.00	5,100 - 6,600
8	105.00 -134.00	5,500 - 7,000
9	113.00 -142.00	5,900 - 7,400
10	120.00 -150.00	6,300 - 7,800

*Net income means take-home pay.

APPENDIX B

The Children and Youth Project #625 of the Guilford County Health Department

In September 1966 a grant for Comprehensive Health Services for children and youth under Public Law 89-97, Title V, Part IV, Section 532, was received by the Guilford County Health Department. The project was originally designed to provide comprehensive health services for approximately 18,000 children from low-income families in Guilford County, between the ages of birth through 17 years. A revision in the project in August 1967 extended the age limit for pregnant girls through 19 years. The geographic area covered by this project has consistently included all of Guilford County - an area, both rural and urban, covering 630 square miles. There are nine clinics per week in the Greensboro central office of the project to provide child health services.

APPENDIX C

Data Code Sheet

Column	
1 - 4	Code No.
6	Sex 1 = Male; 2 = Female
8 - 9	Year of birth of infant
10 - 11	Month of birth of infant
12 - 13	Day of birth of infant
15 - 16	Age of mother
21 - 22	No. of live births
24 - 26	Birth weight in ounces
28 - 30	Weight at three months in ounces
32 - 34	Weight at six months in ounces
36 - 38	Weight at nine months in ounces
40 - 42	Weight at twelve months in ounces
44 - 47	Birth length in inches
49 - 52	Length at three months in inches
54 - 57	Length at six months in inches
59 - 62	Length at nine months in inches
64 - 67	Length at twelve months in inches

DAS, P. SELVIE. Height and Weight of Black Infants from Low-income Families in the First Postnatal Year: A Normative and Correlational Investigation. (1971) Directed by: Dr. Mary Elizabeth Keister. Pp. 64

The purpose of this study was to establish weight and length norms for black infants from low-income families in Guilford County, North Carolina: at birth and at three, six, nine, and 12 months of age. Percentile grids for weight and length measurements were to be developed separately for boys and girls. The study included the investigation of the correlation between certain variables: (1) mother's age and infant's weight at birth; (2) birth order and weight at birth, at three months of age, at six months of age, at nine months of age, and at 12 months of age; (3) mother's age and infant's length at birth; (4) birth order and infant's length at birth and at 12 months of age; (5) infant's weight at birth and weight at three months of age, at six months of age, at nine months of age, and at 12 months of age, and (6) infant's length at birth and length at three months of age, at six months of age, at nine months of age, and at 12 months of age.

The 210 subjects selected for the study were normal black infants born between January 1, 1969 and March 5, 1971 who were brought to the clinics served by the Children and Youth Project of the Guilford County Health Department. The data needed for the study were taken from the clinic records. Data included information on sex and date of birth of each infant; age of mother, number of live births; weight and length measurements of infants at birth, at three months of age, at six months of age, at nine months of age, and at 12 months

of age. Data were analyzed by use of descriptive statistics to establish norms and to develop percentile grids; and by correlational techniques to test hypotheses.

Weight and length norms were established. Percentile grids for weight and length measurements were developed separately for boys and girls. A significant relationship at the 0.05 level was observed between: birth weight and mother's age; birth weight and birth order; and weight at three months of age and birth order. A relationship at the 0.01 level of significance was observed between birth weight and weight at three months of age, at six months of age, at nine months of age, and at 12 months of age. A relationship at the 0.01 level of significance was observed between length at birth and length at three months of age, and at six months of age. The relationship between length at birth and length at nine months of age was found to be significant at the 0.05 level.

There was a wide range in weight and length measurements in both male and female infants from low-income levels. Infant boys weighed more and measured taller than infant girls at the selected ages studied. Black infants in the study were somewhat heavier and taller at birth and at three months of age than black infants studied several decades ago. Compared to white infants from comparable economic levels, studied some years ago, black infants in this present study were observed to be smaller both in length and weight.