WEIGHT GAIN OF INFANTS AS RELATED TO DIET COUNSELING OF MOTHERS

A THESIS

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We hereby recommend that the thesis prepared under our supervision by Rory C. Gaber entitled "Weight Gain of Infants as Related to Diet Counseling of Mothers"

be accepted as fulfilling this part of the requirements for the Degree of Master of Science.

Committee:

Chairman

Accepted:

Dean of The Graduate School

DEDICATION

To my parents, who will always be with me in my heart;

To Steve, who is my present and future;

To Bill, for his technical assistance on the production of this paper

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CHAPTER I

INTRODUCTION

The trend in infant nutrition across the United States over the last four decades has been one of a decline in the incidence of breast feeding with a rise in the use of commercially prepared formulas. There has also been a growing tendency to introduce solid foods at an early age.

It has been found that formula fed babies double their birth weight sooner than do breast fed babies (Neumann and Alpaugh 1976, p. 114). The causes for this are probably multifactorial; formula alone versus breast milk is not the key. Modern cow's milk formulas and soybean formulas, both with added iron, have reached a stage of refinement where they are now considered by leading experts to be adequate to an infant's nutritional requirements for the first six months of life. Protein, fat, and carbohydrate content of human milk and cows' milk formula

are now roughly equivalent, with soybean formulas having twice the protein and carbohydrate content of breast milk.

The introduction of solid foods into the infant's diet, generally by the age of six weeks, is an acceptable practice among American mothers. One reason which is frequently given is that this helps the infant sleep through the night. Experts consider sleeping through the night to be a developmental milestone unrelated to food intake. Early feeding of solid foods which provide approximately 80 percent of their calories from carbohydrates is probably one of the major reasons why infantile obesity is a significant health problem in the United States today. Therefore, this study was concerned with the possible effects of diet counseling to mothers who formula feed their infants as it may relate to the infants' weight gain. The following problem was investigated.

Statement of the Problem

What is the effect, if any, of diet counseling to the mothers of newborn infants on the subsequent weight gain of those infants at the age of three months?

Statement of Purposes

The purposes of this study were:

1. To determine the range, mean, and median of the weights of infants in the control versus the experimental group at the age of three months
2. To determine the percentage of overweight infants in each group at three months of age
3. To compare the percentage of overweight infants in each group and to determine whether or not diet counseling to mothers of infants in the experimental group has a statistically significant effect on the weight gains of their infants when compared to the infants in the control group
4. To determine whether or not any demographic variable investigated in this study contributed in a significant manner to the number of overweight infants in the sample population
5. To assess the level of nutritional information regarding infant feeding held by the

mothers of the infants included in this study

6. To assess the effectiveness of dietary counseling to the mothers in the experimental group on subsequent weight gains of their infants at the age of three months

Background and Significance

Obesity in developed nations is now recognized as a major disease entity (Jackson 1977, p. 65). It also gives rise to a variety of related physical conditions which are considered to be detrimental to an individual's state of health and well-being.

Obesity in adulthood has been correlated with obesity in childhood (Lloyd et al. 1961, pp. 145-148). Also, overweight parents tend to produce overweight children (Taitz 1977, p. 111). However, obesity in childhood has not been correlated with obesity in infancy, although current infant nutrition research is focusing on this area. It is likely that the mechanisms contributing to an overweight state are multifactorial, with heredity, as well as culture and environment, all playing important roles.

Babies have been growing larger at an earlier age over the last twenty years, necessitating modifications of standard percentile charts for growth (Tanner and Whitehouse 1973, pp. 786-789). This may be considered as a reflection of the increased affluence in post-war Western countries. Studies have shown that lower socioeconomic status is associated with smaller-sized children (Owen et al. 1974, pp. 597-612). With an increase in family income, children are taller and heavier with greater advancement in skeletal maturity and dental development (Garn and Clark 1975, p. 307). These generalizations tend to cut across racial and ethnic lines.

However, is this increase in height and weight means desirable? When obesity is not a factor, earlier development and maturity is probably of no great significance in the overall state of physical health of the adult.

Since there is no concrete evidence to suggest that excessive rates of weight gain in infancy increase one's predisposition to obesity in later life, any support at all for this hypothesis comes from peripheral information related to the topic. For example, it is known that infants of diabetic mothers are often of a

higher birth weight than the norm (Verdy et al. 1974, p. 576). Whether or not this is the cause of subsequent obesity that is found in this group of children is debatable, but prenatal overnutrition may have played a role. The "fat cell" theory, which holds that overnutrition at some critical stage in early life causes the body to produce an excessive number of fat cells which are not lost as an individual grows older, has not gained wide acceptance (Ashwell and Garrow 1973, p. 1036; Wilkenson and Parkin 1974, p. 1522; Dobbing 1975, p. 224). Research into this area may eventually be shown to be a step in the right direction in the field of nutritional investigation.

The greater incidence of formula versus breast feeding over the last several decades (Meyer 1968, pp. 708-715; Ross Laboratories 1975, p. 16), coupled with a greater tendency to introduce solid foods at an early age, may be a factor in the increase of infantile obesity seen in this country. Formula itself, however, is not the problem. Provided the ratio of calories to osmols to water is correct, no difference can be detected in the weight gains of artificially fed versus breast fed infants (Taitz 1977, p. 110).

Based on the nutritional content of breast milk, the human infant appears to require a diet relatively high in percentage of calories taken from fat, with an intermediate caloric requirement of carbohydrate and a low requirement of calories from protein (Alfin-Slatter and Jelliffe 1977, p. 3). The "average" jar of baby food sold in the United States provides 80 percent of its calories from carbohydrate, 12 percent from fat, and 8 percent from protein (Ross Laboratories 1975, p. 18). As various forms of baby foods are introduced into a baby's diet, a shift toward a high intake of carbohydrate is almost inevitable. This high carbohydrate intake, when started at the average age of six weeks, and in many cases even earlier, may be a primary cause of infantile obesity.

Hypothesis

There is no significant statistical difference in the percentage of overweight infants at the age of three months whose mothers received diet counseling in the newborn period when compared to the percentage of overweight infants at the age of three months whose mothers did not receive diet counseling.

Definitions

1. Newborn period - This was the time between the birth of the child and when the mother and baby were discharged from the hospital
2. Overweight infant - The determination that an infant was overweight was made if the infant's percentile for weight exceeded his percentile for height by 25 percent (Tool Number 2-a)
3. Diet counseling - This consisted of a list of three statements made by the investigator to the mothers in the experimental group (Tool Number 5)

Limitations

The following variables may have influenced the outcome of the study. They were not controlled for, but will be described in Chapter IV.

1. Diet advice given to mothers by those other than the investigator
2. Number of previous children of mothers in the study

3. Successful nutritional patterns used by mothers with older children
4. Ethnic background of mothers
5. Age of mothers
6. Educational level of mothers
7. Family income level
8. Infant weights at birth were done by nursery personnel and not by the investigator
9. Level of knowledge concerning infant nutrition of all the mothers at entry into the study
10. Compliance to the diet counseling by the mothers in the experimental group
11. The study was confined to a military population in central Texas; therefore, the results cannot be generalized to the larger population

Delimitations

The following variables were controlled for in this study:

1. The study was confined to mothers who had chosen to feed their infants with a commercially prepared formula
2. The study included only those infants discharged from the hospital by the investigator acting in her capacity as a pediatric nurse practitioner
3. Only healthy, term infants who were normal in size for their gestational age, and who had experienced an uncomplicated hospital course were included
4. Infants in both groups were seen by the investigator at the intervening six-week well baby visit
5. Infants in both groups were seen by the investigator at the three-month well baby visit. Weights and lengths at that time were done by the investigator to insure accuracy

6. Infants whose mothers spoke English as their second language were excluded from the study
7. Only infants of married mothers were included in the study since infants born out-of-wedlock are not eligible for military medical care after delivery

Assumptions

The following assumptions were made for the purposes of this study:

1. All respondents could read and write English
2. All responses to the questionnaires were truthful

Summary

Nutrition is a subject of critical importance when dealing with mothers and their newborn infants on a primary prevention level. Sound nutrition in early infancy can help set the stage for optimal growth and development in later years. The primary purpose of this study was to determine if diet counseling to mothers

could help prevent an overweight condition in their infants, since obesity in infancy is an undesirable medical state.

Overview of Following Chapters

A discussion of some of the research studies concerning the subjects of infant nutrition, growth and development, and obesity are presented in Chapter II, "Review of Literature." Chapter III, "Procedure for Collection and Treatment of Data," explains: 1) the setting and population chosen for the study; 2) the methodology used in implementing the study; and 3) the procedure for treatment of the data. Chapter IV, "Analysis of Data," presents a straightforward and concise analysis of the findings. Chapter V, "Summary, Conclusions, Implications, and Recommendations,": 1) summarizes the study; 2) presents conclusions derived from the data obtained; 3) presents implications derived from the study; and 4) offers recommendations for further research.

CHAPTER II

REVIEW OF LITERATURE

Introduction

Infant nutrition has long been of concern to all those choosing a career in the field of pediatrics. Sound nutrition is the basis for life; infants who are unable to feed well or absorb nutrients properly may possibly die at a very early age or sustain some degree of physical or mental impairment. For those who survive, a good, basic diet is essential to a state of continuing health and well-being.

One of the major advances in the area of infant nutrition was the introduction of artificial formulas. This enabled many infants to survive who may otherwise have died due to failure to breastfeed adequately, lack of opportunity to breast feed due to maternal death or illness, or lack of ability to survive on anything except a high-nutrient, high-calorie formula. This advance occurred during the first two deacdes of the twentieth

century when safe methods of water sanitation and sterilization were begun to be utilized on a wide scale. Evaporated milk as an infant formula came into general use in the United States in the 1920's (Frantz 1951, p. 59). However, due to its high carbohydrate and caloric density, it was relatively unsatisfactory for infant feeding, and the search was underway to perfect an artificial infant formula. Aggressive investigation which has been rewarded by great advances continues to the present day.

Today's cows' milk-based formulas approximate human breast milk very closely with regard to protein, carbohydrate, and fat ratios (Ross Laboratories 1975, p. 18). However, it has been shown that bottle-fed infants double their birth weight sooner than do breast-fed infants (Neumann and Alpaugh 1976, p. 469). This situation is not necessarily a desirable one, nor is it strictly related to the subject of formula versus breast milk.

Obesity is a disease of affluent societies, and many cases may have their origins in infancy and childhood. Infants who are identified at an early age as having the potential for obesity might be helped if proper nutritional advice and motivation could be instilled in the parents. A good understanding of sound infant

feeding practices by both medical personnel and parents could possibly go a long way toward improving the health of many individuals in the world today.

Obesity

Overnutrition is probably one of the most prevalent forms of malnutrition in the United States. Overeating and limited physical activity combine to make susceptible individuals obese. This particular health problem is not confined to any one ethnic, racial, or socioeconomic group. However, obesity is six times more common among women of low social status than among women of higher status, and it is more widespread among lower-class children than among those of the upper class (MEDCOM Learning Systems 1974, p. 12). Factors contributing to higher obesity rates among low-income, low-status groups could be the higher carbohydrate diet usually consumed by the poor, the lack of motivation to exercise or reduce for social reasons, and a general lack of medical knowledge concerning the hazards of obesity.

The same publication as mentioned above, entitled OBESITY - Data and Directions for the 70's, (MEDCOM Learning Systems 1974) contains information drawn from

symposiums and interviews held across the United States with leading physicians and researchers who are concerned with the subject of nutrition and obesity. Seven major hazards to health were identified by the participants as being substantially aggravated, if not actually caused, by the presence of an overweight condition. They were: heart disease, hypertension, post-surgical complications, hypoventilation, insulin antagonism, gynecological irregularities, and toxemia of pregnancy. The fact that obesity is a major health problem in itself and is related to a variety of other physical ailments cannot be overemphasized.

Eating patterns are probably established relatively early in life when the infant is totally dependent on the mother or mother-substitute for all of his nutritional needs. One well-known axiom that very much applies to the entire subject of overnutrition is "an ounce of prevention is worth a pound of cure." Early infancy is the time to establish sound nutritional patterns that will serve an individual well all his life.

Infants at Risk for Obesity

A family history of obesity is cause for concern when attempting to identify an infant at risk. It has been shown that, if one parent is obese, 40 to 50 percent of the offspring may develop obesity. This figure rises to 70 to 80 percent if both parents are obese (Knittle 1972, p. 1048). Another study has indicated that, when both parents are overweight, their children weigh more at all ages than children of thin parents (Garn 1976, p. 465). Data such as these could be consistent with a genetic origin for obesity, but could also be equally consistent with an environmental origin. Evidence for the latter has come from several studies including ones which show that fat-fold levels for adoptive parent-child families are similar to those of biological parent-child families (Garn and Bailey 1976, p. 1067).

Obesity in infancy is a medical problem that is difficult to correct. In a recent survey conducted in the United States, very obese neonates showed a tendency to retain this condition well into the seventh year of life (Risch et al. 1975, p. 521). The problem, however, does not necessarily reverse itself in childhood. In another study, infants who attained the 90th percentile

for weight during the first six months of life without a similar attainment in the height percentile were two and six tenths times more likely to be overweight as adults than infants of average weight and height at six months of age (Charney et al. 1976, p. 6).

Prenatal factors can also be indicators when identifying infants at risk for obesity. An early study done in 1969 found a positive linear association between the pregnancy weight of the mother and the birth weight of her infant (Niswander et al. 1969, p. 482). A more recent study refined these data and found that the influence of pre-pregnancy weight and weight gain during pregnancy were independent and additive--women who were the heaviest before conception and who gained the most weight while pregnant had infants with the highest mean birth weights (Simpson et al. 1975, p. 481). These data were supported by a subsequent study done in England the following year (Whitelaw 1976, p. 985).

It has been shown that many factors can converge to produce an overweight infant. A careful analysis of both the medical and environmental circumstances surrounding a birth can be helpful to the practitioner in the identification of infants at risk for obesity. Although

the risk is high if an infant is born into a family with overweight parents, environmental factors may be subject to modification if the desire to change is strong enough. Detection and correction of an overweight problem in childhood or adulthood is better than no treatment at all, but prevention of this situation during the first year of life may be the best possible way to decrease the severe adverse effects that overnutrition can have on the health and well-being of individuals. Obesity is a family problem. Prevention could depend upon enlightened parental attitudes and motivation instilled by knowledgeable and concerned health care professionals.

Trends in Infant Nutrition

It is apparent that many aspects of gastrointestinal function are less well-developed during early infancy than in the older child and adult (Koldovsky 1972, p. 261). Due to the immaturity during the first six months of life of many of the body's vital organs such as the kidneys, liver, and endocrine glands, an infant's nutritional intake at this time is vital to his sound growth and development. There is no dispute in the medical literature that human breast milk is ideal for

human infant consumption and is the best available source of nutrients for the average, healthy baby (Hambraeus 1977, p. 17; Jackson 1977, p. 64). Common practice in the past was to nurse infants well into the second year of life (Anderson 1975, p. 17). In addition to its nutritive advantages, breast milk supplies the human infant with a variety of anti-infective substances against various diseases (Goldman and Smith 1973, p. 1082; Gerrard 1974, p. 757; Pitt et al. 1974, p. 384; Hannson et al. 1975, p. 63).

Attempts at finding a suitable substitute for breast milk are documented as early as 1919 (Gerstenberger and Ruh 1919, p. 22). Until 1920 solid foods were seldom offered to infants before one year of age (Salber et al. 1958, p. 707). The 1930's witnessed a trend toward the introduction of solid foods at the age of four to six months (American Medical Association Council on Foods 1937, p. 1259). Commercially-prepared formulas were gaining in popularity during this time, and by the 1940's, only 65 percent of newborn infants in the United States were being breast fed (Bain 1948, p. 313).

A survey conducted among pediatricians in the United States in 1954 indicated that 88 percent of those

sampled were advising mothers to begin solid foods before three months of age, and 66 percent were advising solids before eight weeks (Butler and Wolman 1954, p. 63) A study done in 1956 demonstrated that infants are physically able to tolerate solids at an early age, but no advantage to early solid feedings was evident (Sackett 1956, p. 98).

A national survey done in 1966 and reported on by Meyer is a classic investigation in the field of infant feeding practices (Meyer 1968, pp. 708-715). It compares 1966 data with comparable data collected in 1946 and 1956. The results and comparisons of the three surveys show a steady decline in the incidence of breast feeding, a decline in the incidence of breast plus supplemental formula feedings, and a steady rise in the incidence of bottle feeding only. Subsequent surveys have supported these statistics (Salber and Feinleib 1966, p. 299; DeCastro 1968, p. 703; Ross Laboratories 1975, p. 27; Jelliffe 1977, p. 58).

Only in recent years has there been an upsurge of interest in breast feeding although formula feeding is still the norm (Fomon 1975, p. 350; Jelliffe 1976, pp. 1227-1237; Cunningham 1977, p. 728). The current

recommendation (American Academy of Pediatrics Committee on Nutrition 1977, p. 3) is that: 1) infants be fed a formula fortified with iron until one year of age, 2) 32 ounces is the maximum amount of formula allowable in a twenty-four hour period, and 3) that solid foods not be introduced into an infant's diet until six months of age.

Summary

The review of literature yielded several important facts: 1) obesity is a problem of great concern; 2) overweight parents predispose their children to an overweight condition in infancy; 3) formula as opposed to breast milk is not the key factor leading to infantile obesity; 4) early feeding of solid foods may be a factor in infantile obesity; and 5) the trend in infant nutrition in the United States is still toward formula feeding although breast feeding is currently enjoying an upsurge in popularity. The following chapter outlines the methodology utilized in implementing this study.

CHAPTER III

PROCEDURE FOR COLLECTION AND TREATMENT OF DATA

Introduction

The following methodology was used to determine the effect, if any, of diet counseling to mothers on the subsequent weight gains of their infants. Two of the tools utilized in the study were standardized; the other four were developed by the investigator. All participants in this study were verbally informed of the study's purpose.

This was a quasi-experimental study that is explanatory in nature. The four tools that were developed by the investigator were submitted to an expert panel for validation prior to implementation of the study. Data collection was done by one investigator, thereby eliminating a possible problem of inter-investigator reliability. Collection was done over the period of September 1977 to January 1978. A sample size of twenty infants in each group was obtained.

Setting

The study was conducted at a military hospital and its adjoining well baby clinic located in central Texas. The 285-bed general hospital serves an active duty population of 120,000 troops. It has an average birth rate of 210 per month, with approximately 800 well baby clinic visits per month. All military dependent wives of the troops stationed on the post where the hospital is located have access to the hospital for their prenatal, labor and delivery, and postpartum care. Their infants are entitled to the well baby clinic facilities.

Agency permission for the study was obtained prior to initiation (Appendix A). The postpartum and well baby clinic areas were utilized.

Population

The population from which the samples were derived consisted of healthy, full-term infants born to mothers who delivered at the military hospital between September and October 1977. The mothers had already indicated a desire to formula feed their infants. All infants in the study were discharged from the hospital by the investigator. At the time if discharge, each

mother was asked about participation. Every other mother and infant were assigned to either Group A or B. For example, the first, third, fifth, etc., mother who agreed to participate was assigned to Group A. The second, fourth, sixth, etc., mother was assigned to Group B. Group A was then designated as the experimental group, and Group B was designated as the control group at the convenience of the investigator. It was further explained that those who agreed to participate would be expected to bring their infants back to the well baby clinic at the age of six weeks and again at three months to see the investigator for a routine well baby clinic visit. Infants who were not brought back for either appointment were dropped from the study.

Agreement to participate in the study was written. The mothers were informed that they could withdraw from the study at any time. Each mother signed a permission form on behalf of herself and again on behalf of her infant (Appendix B). Confidentiality was guaranteed by the investigator through the use of coded response sheets.

Tools

The following six tools were utilized in this study. Two were standardized; the other four were developed by the investigator.

Standard Tools

Tool Number One - Scale and Tape Measure

A zero-balanced scale was used to weigh all infants at birth and at the three-month well baby clinic visit. A standard tape measure marked off in inches was used at the three-month visit to assess length.

Tool Number Two - The Children's Medical Center, Boston - Anthropometric Chart

This chart is available in two forms. The first form is for infant boys (Appendix C), and the second form is for infant girls (Appendix D). It is the standard chart used to record serial heights and weights of infants seen at the well baby clinic where this study took place. The chart was derived from an extensive survey of healthy infants living in the Boston, Massachusetts, area. It provides for standards of reference for height and weight of infants from birth to twenty-eight months. It is

divided into percentiles from 3 percent to 97 percent. Each percentile gives a value which represents a particular position in the normal range of occurrences based on any typical series of 100 infants.

Tools Developed by the Investigator

Tool Number Two (a)

The determination that an overweight condition existed was made if, at the age of three months, an infant's percentile for weight exceeded his percentile for height by at least 25 percent. For example, an infant whose weight fell on the 75th percentile and whose height fell on the 50th percentile was overweight. This arbitrary determination was set by the investigator and approved by the expert panel as a necessary criterion for the purposes of this study. The review of literature yielded no workable methods of determining an overweight status. Frequent references were made to "an out of proportion condition" or to "an overweight status" without explanation of how this determination was made. Some studies utilized a calipers-measured thickness of the skin folds, but that method was beyond the scope of this investigation.

Tool Number Three - Demographic Data Sheet

This tool was administered in a written form (Appendix E) to all mothers in the study prior to their discharge from the hospital. The sheet was coded to guarantee anonymity.

Tool Number Four - Nutritional Knowledge Level Regarding Infant Feeding Sheet

The review of literature yielded three important facts regarding the formula feeding of infants. First, infants should be fed a formula fortified with iron. Second, the maximum amount of formula needed for sound growth in the first six months of life is 32 ounces in a twenty-four hour period. Amounts in excess of this recommendation can contribute to an overweight condition in infancy. Third, solid foods should not be introduced into an infant's diet before six months of age. Solid foods can lead to an increased intake of carbohydrate with a reduction in formula intake. This tool consisted of three questions formulated to assess the mothers' awareness of these facts (Appendix F).

Tool Number Five - Infant Nutrition Information Protocol

This tool was administered in an oral form (Appendix G) to the mothers in the experimental group at the time of discharge from the hospital. It consisted of three statements designed to upgrade their infant nutrition information level to the current, acceptable standards based on the review of literature. Wording was approximate and varied slightly when administered to the mothers in an oral form; however, the important fact contained in each statement remained the same. This tool was coordinated with Tool Number Four.

Validity

Face validity of the tools developed by the investigator was established by an expert panel of three members who: 1) had an interest in the field of infant nutrition, and 2) showed evidence of continuing education in the field of infant health.

Member One

The first member of the panel was a board certified pediatrician. He had three years of post-

graduate training in pediatrics and has practiced for three years as a pediatrician since that time. He is currently the Chief of Pediatrics at a large, general hospital which has the responsibility for the care of 49,000 children under thirteen years of age. This doctor is Chairman of the Child Protection Council for the geographic area which the hospital serves. As a diplomat of the American Board of Pediatrics and as a candidate-fellow of the American Academy of Pediatrics, he has demonstrated a continuing interest in the care and welfare of infants and children. He has recently attended several national symposiums dealing with the subject of infant nutrition.

Member Two

The second member of the panel was a registered nurse with six years of work experience. She has a Masters of Science degree in Education and Counseling. She is currently on the faculty of a state-supported nursing college. She has recently attended regional conferences on the subject of perinatal medicine and has initiated changes in her school's curriculum to reflect the current advances in infant care to include nutrition.

A continuing interest in the fields of maternal and child health is evidenced by her pursuit of a second Masters degree in those areas.

Member Three

The third member of the panel was a board eligible pediatrician. He practices pediatrics in a large, general hospital and has expressed a deep interest in the field of infant nutrition. During his internship and residency, he participated in several studies concerned with the caloric requirements and growth rates of infants. He is a candidate-fellow of the American Academy of Pediatrics and is currently writing a paper for pubiication on the subject of infant nutrition.

Data Collection

The investigator approached the mothers individually at the time of discharge from the hospital. Each mother was given a verbal explanation of the study. Those who agreed to participate were then given informed consent forms to sign which were witnessed by the postpartum nurse on duty at the time. The criteria for participation in the study were explained. The criteria were as follows:

mothers in both the experimental and control groups would complete a Demographic Data Sheet and a Nutritional Knowledge Level Regarding Infant Feeding Sheet in the presence of the investigator and would agree to return with their infants to the well baby clinic at the ages of six weeks and three months. Upon completion of both sheets each mother was then given six-week and three-month visit times on an index card. The mothers in the control group were then discharged with their infants.

After appointment times were given the mothers in the experimental group were verbally administered the information contained in the Infant Nutrition Information Protocol. Any questions regarding the information were answered, and these mothers and their infants were then discharged from the hospital.

Mothers and infants in both groups were then seen at the appointed times for the six-week well baby clinic visit by the investigator. No significant diet information which would affect the outcome of the study was given at that time.

When the infants in both groups reached the age of three months, they were again seen by the investigator at the well baby clinic. The heights and weights at that

time were done by the investigator to insure accuracy and were recorded. If the infants had already started on solid foods, the mothers were asked when they had first begun to feed them to the infants. This information was also recorded. At the conclusion of the three-month visit, the mothers in the control group were then given the diet protocol information which the mothers in the experimental group had received at discharge since the data collection was now complete.

Treatment of Data

All infants were weighed and measured at the three-month well baby clinic visit. The range, mean, and median of the weights of the infants in the control group and the experimental group were calculated. The percentages of overweight infants for both groups were determined and compared.

Demographic data on the mothers were compared between the two groups by computing the range, mean, and median on each of five variables. Analysis of variance using the chi-square method was then employed to determine if a statistically significant difference could be demonstrated between the two groups. Significance was

set at the .05 level for the purposes of this study. A further analysis of variance using binomial distribution was then performed as a second method of data treatment.

The entry level knowledge regarding infant nutrition of all the mothers in the study was ascertained, and subject compliance to the diet counseling advice given to mothers in the experimental group was analyzed.

Summary

Two sample populations consisting of twenty mothers and their infants in each sample were involved in this study. Six tools were utilized in the data collection. Two of the tools were standardized, and the remaining four were developed by the investigator. An expert panel was used to establish face validity of the developed tools.

The data were analyzed using the chi-square method and binomial distribution. The two groups were compared for statistical significance. The following chapter describes the analysis of the data obtained.

CHAPTER IV

ANALYSIS OF DATA

Introduction

Twenty mothers and their infants in each of the control and experimental groups participated in this study. Mothers in the experimental group were given diet counseling on the subject of infant nutrition at the time of discharge from the hospital. Mothers in the control group were given the same information at the conclusion of the data collection when their infants had reached three months of age.

The first purpose of this study was to determine the range, mean, and median of the weights of all infants in the study at the age of three months. Weights at three months were obtained using Tool Number One. The weights of the infants in the control group ranged from 11.00 pounds to 15.50 pounds, with an average weight of 13.12 pounds. In the experimental group, the weights ranged from 10.75 pounds to 15.00 pounds, with an average weight of 12.73 pounds (Table 1).

TABLE 1

RANGE, MEAN, AND MEDIAN OF WEIGHTS OF ALL INFANTS AT THREE MONTHS OF AGE*

Group	Range	Mean	Median
Control (N=20)	11.00-15.50	13.12	13.13
Experi-mental (N=20)	10.75-15.00	12.73	12.53

*Weights expressed in pounds

Exactly six infants in each group were found to be overweight using Tool Number One, Two (Appendices C and D), and Two-a. Given even sample sizes of twenty, the percentage of overweight infants in each group was 30 percent. This determination accomplished the second purpose of this paper.

The third purpose of the study was to compare the percentage of overweight infants in each group to determine whether or not diet counseling to the mothers in the experimental group had a statistically significant effect on the weight gain of their infants in comparison to the control group. Since the percentage was the same for each group (30 percent), no further tests were needed,

and it was concluded that diet counseling did not have a statistically significant effect on infant weight gain. Therefore, the investigator failed to reject the null hypothesis.

Demographic Data

Tool Number Three (Appendix E) was administered in written form to all mothers in the study prior to their assignment to either the control or experimental group. It was titled, "Demographic Data Sheet," and aided in the accomplishment of the fourth purpose of this study which was to determine whether or not any demographic variable investigated contributed in a significant manner to the outcome of the study.

Five demographic variables were investigated. They were: age of mothers, number of previous children, highest education level attained by mothers, family income, and ethnic background of the mothers. The range, mean, and median of the first four demographic variables were calculated for both groups. The fifth variable, ethnic background, was treated as a percentage for both groups.

The ages of the mothers in the control group ranged from 16-29 years, with an average of 21.70 years. In the experimental group the range was from 17-35 years, with an average of 22.50 years. In both groups the number of previous children ranged from 0-4, with an average of 1.20 children in the control group and 0.85 children in the experimental group. With regard to the highest education level attained by the mothers the control group ranged from 10-16 years of formal education, with an average of 12.00 years. The experimental group ranged from 9-16 years, with an average of 11.55 years. Family income levels also appeared to be closely matched. The range in the control group was from $4,000-$18,000 per year, with an average of $8,000. In the experimental group, the range was from $5,000-$17,000 per year, with an average income of $7,850. The ethnic background of the mothers was computed on a percentage basis. The control group was found to be composed of 7 Caucasian mothers and 13 non-Caucasian mothers, yielding percentages of 35 percent and 65 percent, respectively. In the experimental group it was found that there were 16 Caucasian mothers and 4 non-Caucasian mothers, yielding percentages of 80 percent and 20 percent, respectively (Table 2).

TABLE 2

RANGE, MEAN, AND MEDIAN OF THE DEMOGRAPHIC DATA ON ALL MOTHERS IN THE STUDY

Demographic Data	Control Group (N=20)			Experimental Group (N=20)		
	Range	Mean	Median	Range	Mean	Median
Age of Mothers	16-29	21.70	21.50	17-35	22.50	22.50
Number of Previous Children	0-4	1.20	1.00	0-4	0.85	1.00
Highest Education Level of Mothers	10-16	12.00	12.00	9-16	11.55	12.00
Family Income	$4,000-$18,000	$8,000	$7,000	$5,000-$17,000	$7,850	$7,000

Ethnic Background of mothers	Control Group Percentage	Experimental Group Percentage
Caucasian	35	80
non-Caucasian	65	20

A further analysis of the demographic data was done using the chi-square method to determine whether or not any of the demographic variables were statistically significant at the .05 level. The data were treated as enumeration statistics from a dichotomous population. The number of observations which fell into each of two classifications were counted, and tests were made based upon the proportion of the characteristic in the sub-population under investigation.

This method was chosen since it was appropriate to treat the dependent variable, weight, as a dichotomous variable with observations classified as overweight and not overweight. Each of the five independent variables such as age of mothers, number of previous children, etc., were also divided into two classes. For example, age was divided into 22 years old and older, and 21 years old and younger; number of previous children was divided into none and one or more, etc.

Tests using the chi-square distribution are suitable for these data. For a two-by-two table where each of two variables has two classes the chi-square statistic computed on the data must exceed 3.84 at the 95 percent confidence level. In no case did the

computations exceed 3.84 which indicated that, with the given sample size, no significant differences were found between the control and experimental groups (Table 3).

TABLE 3

CHI-SQUARE VALUES FOR DEMOGRAPHIC VARIABLES FOR ALL MOTHERS VERSUS NUMBER OF OVER-WEIGHT INFANTS IN THE STUDY

Demographic Variable	Number of Overweight Infants: Control Group (N=20)	Number of Overweight Infants: Experimental Group (N=20)	Chi-square Value (N=40)
Age			
>22	1	3	1.53
≤21	5	3	
Number of Previous Children			
None	2	2	
One or more	4	4	0.04
Education Level			
High school graduate	4	3	
<High school graduate	2	3	0.04
Family Income			
>$8,000	2	3	
≤$7,500	4	3	0.19
Race			
Caucasian	2	5	
Non-Caucasian	4	1	0.08

α= .05, chi-square value must >3.84

A binomial distribution was then performed on the demographic data as an additional method of analysis. The procedure when using the binomial distribution is to establish confidence limits for the proportion of a characteristic found in the sample. If the proportion falls within those confidence limits, there is no significant statistical difference between the two groups under study.

The proportion of overweight infants in each of the variable demographic combinations was computed. Two-way confidence limits were established. The proportion of overweight infants in the total sample (N=40) was .30 (30 percent). This statistic fell within the two-sided confidence limits established for each demographic subgroup. Also, when the data were broken down into control and experimental groups, the new proportion again fell within established confidence limits (Table 4).

TABLE 4

PROPORTION OF OVERWEIGHT INFANTS IN SAMPLE: BINOMIAL DISTRIBUTION

Demo-graphic	Total (N=40) χ_i	Total (N=40) Confidence Limits	Control (N=20) χ_i	Control (N=20) Confidence Limits	Experimental (N=20) χ_i	Experimental (N=20) Confidence Limits
Age						
≥22	.19	.07-.40	.10	.01-.40	.27	.08-.63
≤21	.42	.22-.65	.50	.22-.78	.33	.10-.71
Previous Children						
None	.29	.10-.61	.33	.01-.60	.25	.05-.68
One/more	.31	.18-.54	.29	.10-.61	.33	.12-.65
Education Level						
H.S. grad.	.27	.11-.46	.27	.10-.55	.27	.08-.63
<H.S. grad.	.36	.15-.63	.40	.08-.81	.33	.10-.71
Family Income						
≥$8,000	.38	.17-.67	.29	.05-.66	.50	.15-.85
≤$7,500	.26	.11-.44	.31	.11-.59	.21	.06-.51
Race						
Caucasian	.30	.13-.54	.29	.01-.55	.31	.13-.57
Non-Caucasian	.29	.12-.54	.31	.11-.59	.25	.01-.75

$\alpha = .05$

It was concluded, therefore, that there was no statistically significant difference between the control and experimental groups with regard to demographics, and the fourth purpose of this paper was thus accomplished.

The fifth purpose of this study was to assess the level of nutritional information regarding infant feeding held by all mothers in the sample. Tool Number Four (Appendix F) was titled, "Nutritional Knowledge Level Regarding Infant Feeding Sheet," and was administered in written form to the mothers prior to their division into groups. It was found that approximately 50 percent of all the mothers knew to use formula with iron, and 50 percent did not know; 25 percent of all the mothers knew that 32 ounces was the maximum amount of formula for a twenty-four hour period, and 75 percent did not know; and that only 5 percent of all the mothers knew to wait until six months of age to start solid foods, and 95 percent did not know. When the data were broken down into control and experimental groups, it was found that the mothers were fairly evenly divided with regard to their entry level knowledge concerning infant feeding (Table 5).

TABLE 5

NUTRITIONAL KNOWLEDGE ENTRY LEVEL
FOR ALL MOTHERS IN STUDY

Nutritional Information	Control Group (N=20) Percentage	Experimental Group (N=20) Percentage
Formula		
With Iron	50	40
Without Iron	50	60
Maximum Amount of Formula		
32 ounces	20	30
Not 32 ounces	80	70
Age to Start Solids		
6 months	5	5
Before 6 months	95	95

The sixth purpose of this paper was to assess the effectiveness of dietary counseling as presented to the mothers in the experimental group on the subsequent weight gains of their infants at the age of three months. Since no significant differences could be found in any of the data presented, it was concluded that dietary counseling

to mothers as outlined in this paper had no effect on infant weight gain by three months of age.

An area of interest was compliance to the dietary counseling given to the experimental group mothers. The average age when solid foods were started by the control group mothers was 4.35 weeks. The average age in the experimental group was 3.95 weeks. It was noted that the experimental group not only had poor compliance with the dietary counseling, but that it fared worse statistically than did the control group as to when solid foods were started (Table 6).

TABLE 6

RANGE, MEAN, AND MEDIAN OF AGE OF INTRODUCTION OF SOLID FOODS FOR ALL INFANTS IN STUDY*

Group	Range	Mean	Median
Control (N=20)	1-12	4.35	4.00
Experimental (N=20)	0-12	3.95	3.50

*Age expressed in weeks

A number of uncontrolled variables may have influenced the outcome of this study. They were listed under "Limitations" in Chapter I. Six of the ten variables have already been described in this chapter and eliminated as possible sources of influence. The remaining four variables will now be addressed.

The first variable was diet advice given to mothers by those other than the investigator. It was arranged that all infants in the study come back to the investigator for the six-week well baby clinic visit to insure that no other health professionals would give any additional diet advice to the mothers at that time. However, this did not preclude diet advice offered to the mothers at random by their relatives, friends, and hospital personnel at any given time during the study.

The second variable was successful nutritional patterns used by mothers with older children. In these cases the investigator was unable to control for previously established patterns of nutrition which may have contradicted the diet counseling protocol, but which, nonetheless, had produced healthy, older children.

The third variable not yet discussed in this paper was that weights at birth were done by nursery personnel and not by the investigator. One of the delimitations was that healthy, term infants who were normal weight for their gestational age were selected for participation. The investigator had to rely on the accuracy of the nursery personnel in the recording of birth weights on all infants to decide which infants were eligible for the study.

The last variable was that the study was confined to a military population in central Texas. When a particular segment of society is investigated, namely the military, the results cannot be generalized to the larger population.

Summary

Analysis of the data obtained in this study revealed that there was no statistically significant difference between the percentage of overweight infants at three months of age whose mothers received diet counseling, and the percentage whose mothers did not receive diet counseling. Both the control and experimental group mothers exhibited fairly evenly matched entry

level knowledge concerning infant feeding prior to the study.

Exactly six infants out of twenty in each group were found to be overweight at three months of age. Demographic variables showed no significant differences between the two groups. Compliance to the diet counseling was shown to be poor in the experimental group. The following chapter presents a summary of the study and includes conclusions, implications, and recommendations for future research.

CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Summary

A study was conducted on the postpartum floors and in the well baby clinic of a medium-sized, general military hospital in order to determine what effect, if any, diet counseling to mothers would have on the subsequent weight gains of their infants at three months of age. One nurse-investigator was involved in the data collection. Six tools were utilized in the study; two were standardized, and four were developed by the same nurse-investigator.

A total of forty mothers and their infants participated in the study. Twenty mothers and their infants were assigned to the control group, and twenty were assigned to the experimental group. All mothers completed Demographic Data Sheets and Nutritional Knowledge Level Regarding Infant Feeding Sheets prior to

assignment. Experimental group mothers were given additional diet information to upgrade their knowledge concerning infant feeding. All participants were seen by the investigator at the six-week and three-month well baby clinic visits.

The hypothesis, presented in the null form, was: There is no significant statistical difference in the percentage of overweight infants at the age of three months whose mothers received diet counseling in the newborn period when compared to the percentage of overweight infants at the age of three months whose mothers did not receive diet counseling. The review of literature revealed several important facts concerning infant nutrition. They were: 1) infant obesity is a serious medical problem; 2) early feeding of solid foods may be a contributing factor with infant obesity; 3) the trend in the United States is still one of formula feeding with early introduction of solid foods; 4) formula fortified with iron is recommended; 5) the maximum amount of formula fed to an infant should not exceed 32 ounces in twenty-four hours; and 6) solid foods should not be introduced into an infant's diet before six months of

age. These components were incorporated into the investigator-developed tools.

Analysis of the data revealed no significant statistical difference between the control and experimental groups with regard to the percentage of overweight infants at three months of age. Both groups turned out to be fairly evenly matched as to knowledge of infant nutrition at the start of the study. The experimental group mothers showed poor compliance with the additional diet information given to them. Demographic variables were of no statistical significance in this study.

Conclusions

The results of this study cannot be generalized to the larger population due to small sample size and to the fact that the study focused on one segment of society in the central Texas area, namely the military.

Conclusions derived from this study are as follows:

1. Diet counseling as presented in this paper to mothers during the newborn period has no relationship to infant weight gain by three months of age

2. Demographic variables investigated were not significant in the outcome of this study
3. The majority of mothers did not know the correct amount of formula to use nor when to start solid foods
4. Mothers in the experimental group showed no inclination to accept diet counseling

Implications

The implications derived from the findings of this study are directed toward medical and nursing personnel involved with antenatal and postpartum patients and towards physicians and nurse practitioners involved with well baby care. Antenatal counseling should include the topic of infant nutrition. Emphasis should be placed on medically acceptable formula feeding practices for those mothers who choose to formula feed their infants as opposed to breast feeding.

Formula with iron should be recommended over unfortified formula. A maximum amount of 32 ounces in twenty-four hours is allowable. The dangers of possible obesity from too early feeding of solid foods which have a high carbohydrate content need to be explored with expectant parents and re-emphasized during the postnatal period and at well child visits.

This study failed to show a statistically significant difference in the number of overweight infants for the control as opposed to the experimental group. Compliance to the diet counseling was also shown to be poor among the experimental group mothers. The possible implications that these results have for those involved in infant nutrition counseling may be that diet counseling may need to be started in the antenatal period before the parents have already chosen a formula, that the diet counseling protocol as presented in this paper may need to be revised, and that continual reinforcement of diet advice should occur during the well baby clinic visits.

Recommendations

Based on this comparative study additional research needs to be done in the area of diet counseling to mothers of newborn infants involving larger samples. Further research needs to be done, using the investigator-developed tools, to test their reliability.

It is also recommended that future studies be conducted for a period of time longer than three months. It is possible that the percentages of overweight infants may change if infants were followed for six months or one year. Continual reinforcement of diet counseling over a period of time may prove to be of more benefit than counseling in the newborn period alone.

Finally, it is recommended that research be done to follow-up on weight gain past the first year of life. Do overweight infants become overweight children? Do infants of normal weight during the first year become overweight in subsequent years? How do family nutrition and eating patterns affect weight gain in the pre-school years? The possibilities for research are numerous. The family-centered pediatric practitioner can only benefit from research of this nature, for it may offer the

practitioner vital information needed for effective prevention, assessment, and treatment with regard to infant and child overnutrition.

APPENDIX A

PERMISSION FOR THE STUDY

TEXAS WOMAN'S UNIVERSITY
COLLEGE OF NURSING
DENTON, TEXAS

DALLAS CENTER
1810 Inwood Road
Dallas, Texas 75235

HOUSTON CENTER
1130 M.D. Anderson Blvd.
Houston, Texas 77025

AGENCY PERMISSION FOR CONDUCTING STUDY*

THE (Study Institution)

GRANTS TO Rory Catherine Gaber

a student enrolled in a program of nursing leading to a Master's Degree at Texas Woman's University, the privilege of its facilities in order to study the following problem:

What is the effect, if any, of diet counselling to the mothers of newborn infants on the subsequent weight gain of those infants at the age of three months?

The conditions mutually agreed upon are as follows:

1. The agency (~~may~~) (may not) be identified in the final report.
2. The names of consultative or administrative personnel in the agency (~~may~~) (may not) be identified in the final report.
3. The agency (~~wants~~) (does not want) a conference with the student when the report is completed.
4. The agency is (willing) (~~unwilling~~) to allow the completed report to be circulated through interlibrary loan.
5. Other: _____

Date 19 Aug 77

Signature of Agency Personnel

Signature of student

Signature of Faculty Advisor

*Fill out and sign three copies to be distributed as follows: Original --

TEXAS WOMAN'S UNIVERSITY
DALLAS, TEXAS 75235

COLLEGE OF NURSING

August 8, 1977

Ms. Rory Gaber

Dear Ms. Gaber:

Your prospectus, "Weight Gain of Infants as Related to Diet Counseling of Mothers", has been approved by the Human Research Review Sub-committee. A copy of this letter will be forward to Dr. Phyllis Bridges, Graduate Dean, by the chairperson of your thesis committee. Also, the prospectus will be forwarded to Dr. Carolyn Rozier, chairperson for the main committee on the Denton Campus. If she has any question she will notify you. In the meantime, proceed with your plans to collect data following the acquisition of agency and/or client permission.

Thank you.

Sincerely,

Geri Goosen

Geri Goosen, R.N.,M.S.
Assistant Professor
Graduate Medical/Surgical Nursing

cc: Dr. Phyllis Bridges
Graduate Dean

GG:cw

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APPENDIX B

CONSENT FORM

Appendix B

TEXAS WOMAN'S UNIVERSITY

(Form B-- Oral presentation to subject)

Consent to Act as a Subject for Research and Investigation:

I have received an oral description of this study, including a fair explanation of the procedures and their purpose, any associated discomforts or risks, and a description of the possible benefits. An offer has been made to me to answer all questions about the study. I understand that my name will not be used in any release of the data and that I am free to withdraw at any time.

_____ _____
Signature Date

_____ _____
Witness Date

I, _____, legal guardian of _____, hereby authorize the person whose signature appears below to use information from my child's outpatient chart pertinent to the ends of the study already explained to me. I understand that my child's name will not be used in any release of the data.

_____ Date _____
Signature

_____ Date _____
Witness

Certification by Person Explaining the Study:

This is to certify that I have fully informed and explained to the above named person a description of the listed elements of informed consent.

_____ _____
Signature Date

_____
Position

_____ _____
Witness Date

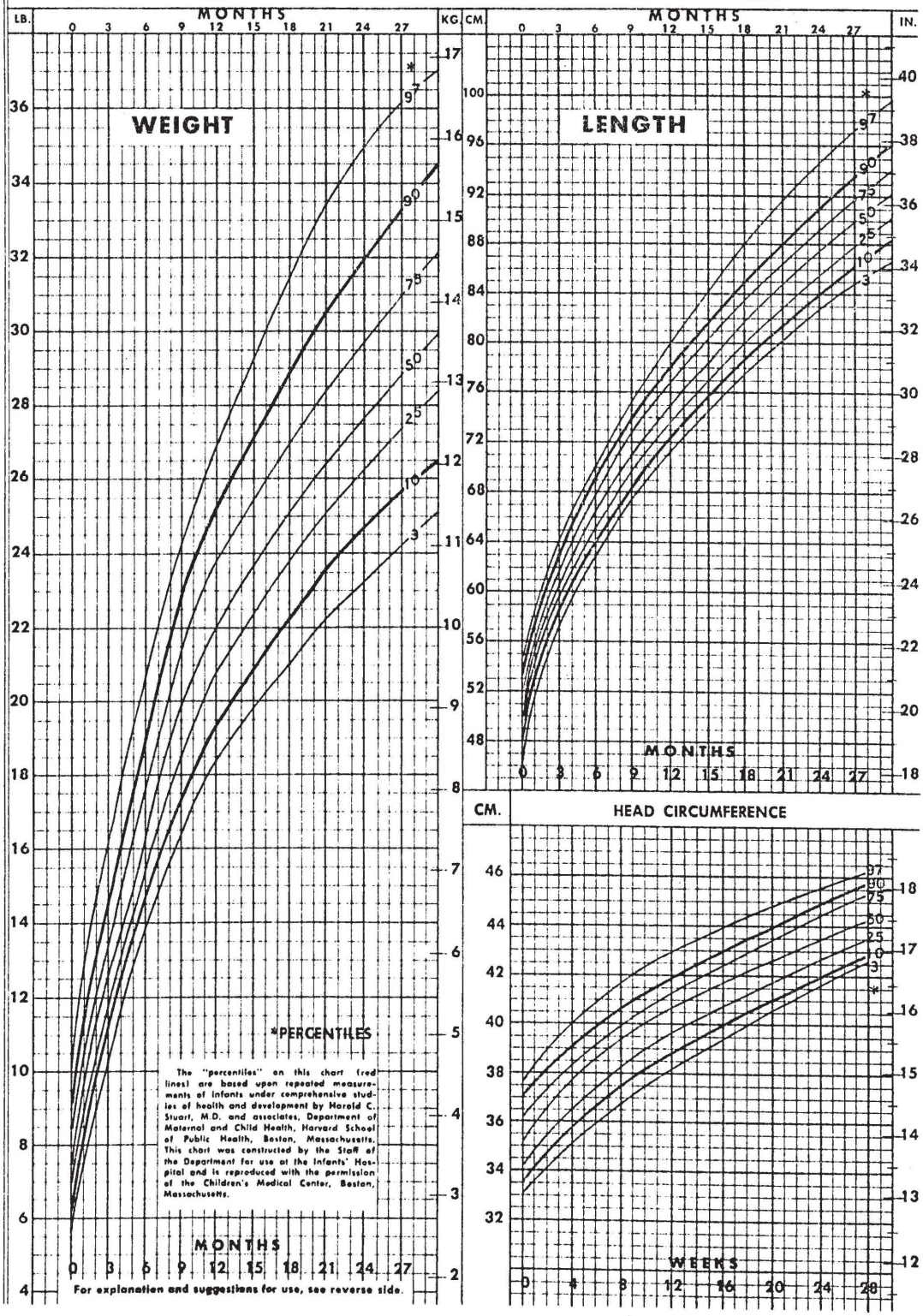
APPENDIX C

THE CHILDREN'S MEDICAL CENTER, BOSTON - ANTHROPOMETRIC CHART

Infant Boys

INFANT BOYS

NAME Appendix C- BIRTH DATE Tool #2 NO.



THE CHILDREN'S MEDICAL CENTER, BOSTON - ANTHROPOMETRIC CHART

APPENDIX D

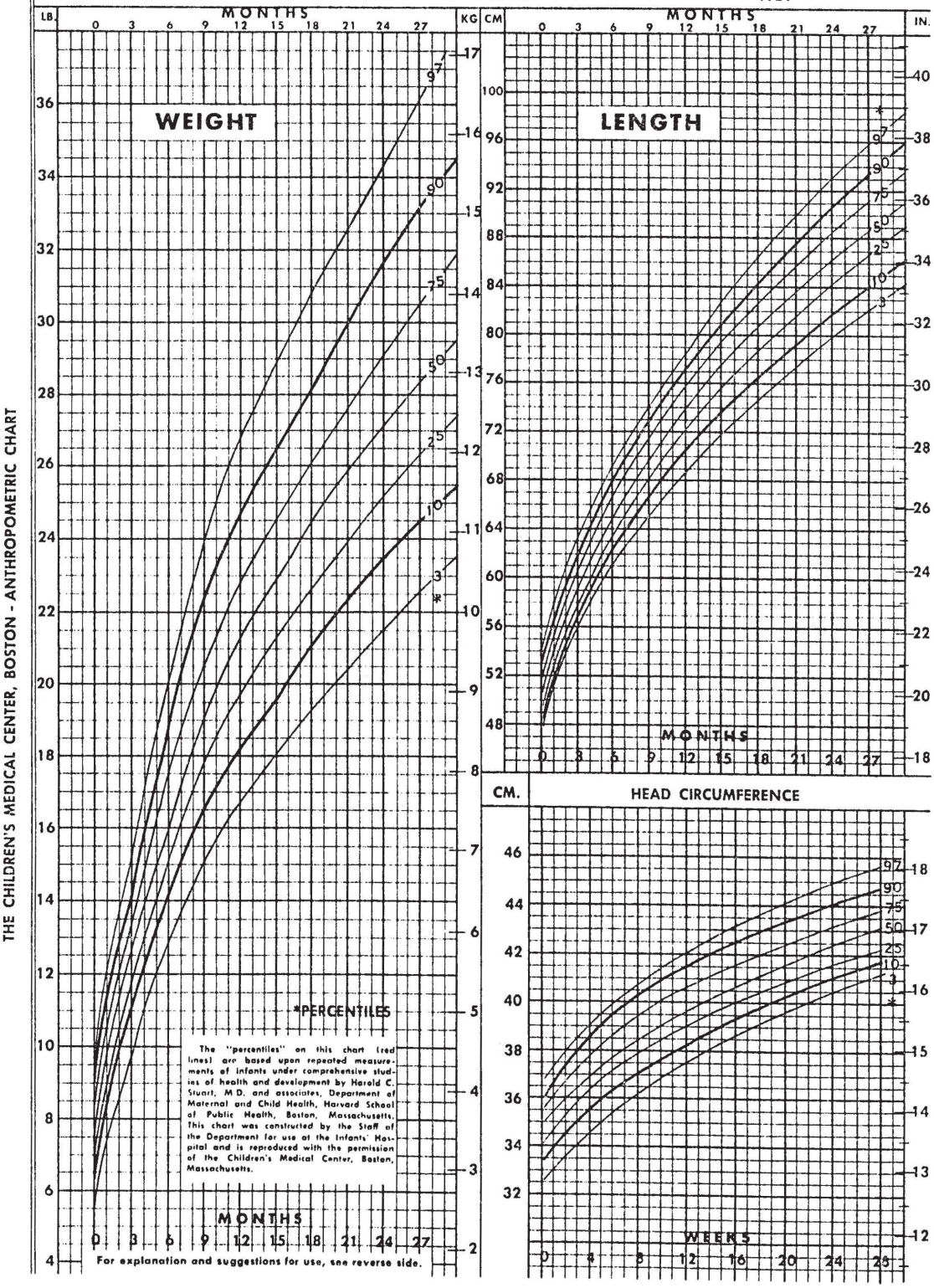
THE CHILDREN'S MEDICAL CENTER, BOSTON - ANTHROPOMETRIC CHART

Infant Girls

Appendix D- Tool #2

INFANT GIRLS

NAME BIRTH DATE NO.



THE CHILDREN'S MEDICAL CENTER, BOSTON - ANTHROPOMETRIC CHART

APPENDIX E

DEMOGRAPHIC DATA SHEET

APPENDIX E - DEMOGRAPHIC DATA SHEET (Tool Number Three)

Age_____

Race_____ (C-Caucasian, B-Black, O-Oriental, S-Spanish)

Number of Previous Children_____

Highest Grade Attained in School_____

Family Income Level per Year _____

APPENDIX F

NUTRITIONAL KNOWLEDGE LEVEL REGARDING INFANT FEEDING

APPENDIX F - NUTRITIONAL KNOWLEDGE LEVEL REGARDING INFANT FEEDING (Tool Number Four)

Question Number One:

What brand of formula do you plan to feed your baby?

_____

Question Number Two:

What is the maximum amount of formula in ounces that a baby should eventually take during a twenty-four hour period?

_____

Question Number Three:

At what age should solid foods be introduced into the baby's diet?

_____

APPENDIX G

INFANT NUTRITION INFORMATION PROTOCOL

APPENDIX G - INFANT NUTRITION INFORMATION PROTOCOL (Tool Number Five)

Statement Number One:

There is some medical evidence available today to suggest that when an infant is overweight during the first several months of life, he has a higher than average chance of being overweight as a child.

Statement Number Two:

Formula with iron is recommended for all infants who are being formula fed. When feeding you should slowly increase the amount in response to his needs. It has been found that infants grow very well on a quart of formula a day. Therefore, you should limit him to a maximum of 32 ounces in a twenty-four hour period.

Statement Number Three:

Solid foods do not need to be started until the baby is six months old. Formula with iron has been found to be totally adequate for a baby until that time. Starting solid foods too early may be one of the reasons why so many infants in this country are overweight.

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