Investigation of the relationships of maternal pre-gravid weight and weight gain to birth weight and condition of the infant at birth
by Lanette Haas Moehling

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of MASTER OF NURSING
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Abstract:
The purposes of this study were three-fold: 1) To determine the relationship, if any, between maternal pre-pregnancy weight status and the birth weight of the infant; 2) to determine the relationship, if any, between amount of weight gained during pregnancy and the birth weight of the infant; and 3) to determine the relationship, if any, between amount of weight gained during pregnancy and the condition of the infant at birth.

This investigation was undertaken by means of reviewing existing post-partum medical records. A sample of 324 patients was selected and patients were grouped according to pre-pregnancy weight status and/or weight gained during pregnancy for analysis of the above relationships. A statistical analysis was done using simple correlations and coefficients of determination.

Conclusions reached were that: 1) A significant correlation exists between maternal pre-pregnancy weight status and the birth weight of the infant, especially among underweight pregnant patients; 2) a significant correlation exists between amount of weight gained during pregnancy and birth weight of the infant, but, a large percentage of the variation in infant weight cannot be explained by this relationship; and 3) a significant negative correlation exists between amount of weight gained and the Apgar score of the infant at one minute of life when considered at $r = 0 \leq p.10$.

It must be noted that the conclusions of this study are based on a study of a restricted population and generalizations, therefore, may not be reliable outside of this population.

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INVESTIGATION OF THE RELATIONSHIPS OF MATERNAL PRE-GRAVID WEIGHT AND WEIGHT GAIN TO BIRTH WEIGHT AND CONDITION OF THE INFANT AT BIRTH

by

LANETTE HAAS MOEHLING

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree

of

MASTER OF NURSING

Approved:

Mrs Laura Walker RN. Ph D
Head, Major Department

Margaret H. Wojnovich, B.N., M.N.S.
Chairman, Examining Committee

Henry L. Parsons
Graduate Dean

MONTANA STATE UNIVERSITY
Bozeman, Montana

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To Coral Collins, who so deeply touched my life with her faith, courage, hope, perseverance, and love of life.

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TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

The purposes of this study were three-fold: 1) To determine the relationship, if any, between maternal pre-pregnancy weight status and the birth weight of the infant; 2) to determine the relationship, if any, between amount of weight gained during pregnancy and the birth weight of the infant; and 3) to determine the relationship, if any, between amount of weight gained during pregnancy and the condition of the infant at birth.

This investigation was undertaken by means of reviewing existing post-partum medical records. A sample of 324 patients was selected and patients were grouped according to pre-pregnancy weight status and/or weight gained during pregnancy for analysis of the above relationships. A statistical analysis was done using simple correlations and coefficients of determination.

Conclusions reached were that: 1) A significant correlation exists between maternal pre-pregnancy weight status and the birth weight of the infant, especially among underweight pregnant patients; 2) a significant correlation exists between amount of weight gained during pregnancy and birth weight of the infant, but, a large percentage of the variation in infant weight cannot be explained by this relationship; and 3) a significant negative correlation exists between amount of weight gained and the Apgar score of the infant at one minute of life when considered at $r = 0 \leq p.10$.

It must be noted that the conclusions of this study are based on a study of a restricted population and generalizations, therefore, may not be reliable outside of this population.

CHAPTER I

INTRODUCTION

The restriction of total weight gain during pregnancy has been an emphasis by obstetricians for many years. Past practice has been to limit weight gain to a total of 15 to 20 pounds.[1] However, speculation as to the advisability of such weight restriction began to be raised. In 1963, W. J. McGanity, M.D., posed these questions: "Have we induced a fear complex in our prenatal patient? Will she literally starve herself for the few days before she comes to her obstetrician?"[2] In 1970, this same problem of crash dieting by the pregnant woman before every prenatal checkup was reiterated and led the National Academy of Sciences-National Research Council to issue this warning to obstetricians: "Overemphasis on weight control during pregnancy is not only unnecessary, but quite possibly dangerous."[3]

The tendency now is to avoid the extremes. It is thought that weight gains of under 11 pounds are associated with infants of low-birth-weight and increased perinatal mortality and morbidity,[4] while

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[1]Henry L. Woodward and Bernice Gardner, Obstetric Management and Nursing (Philadelphia: F. A. Davis Company, 1954), p. 103.

[2]William J. McGanity, "Obesity," Journal of the American Medical Association 196:adv. 39, November 9, 1963.

[3]"Pleasingly Pregnant," Newsweek 76:66, August 10, 1970.

[4]E. Stewart Taylor, Beck's Obstetrical Practice (Baltimore: The Williams and Wilkins Company, 1971), p. 136.

excessive weight gains are associated with increased incidence of complications for both mother and child, such as toxemia and diabetes.[5] Also, women fear that excessive weight gain will cause them to have larger babies, thus increasing the difficulty and pain of labor.[6]

Dr. Howard N. Jacobson believes that there is no correlation between weight gained during pregnancy and the size of the infant at birth, especially when the components of the diet are not known.[7]

There is also an increasing emphasis being placed on the mother's pre-pregnancy weight status as an influencing factor in the birth weight of the infant. Tompkins, in his study of pregravid weight status and its effect on the infant concluded that pre-pregnancy weight and the size of the infant at birth are independent of prenatal weight gain, but the amount of weight gained can affect the ability of the mother to withstand the stresses of pregnancy, thus, reducing the risk of complications.[8]

In light of the controversial nature of the subject, a limited investigation was undertaken to determine the correlation, if any,

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[5]McGanity, *loc. cit.*

[6]"How Much Weight to Gain During Pregnancy," Good Housekeeping 169:149, August, 1969.

[7]*Ibid.*

[8]Winslow T. Tompkins, Dorothy G. Wiehl, and Robert McN. Mitchell, "The Underweight Patient As An Increased Obstetric Hazard," American Journal of Obstetrics and Gynecology 69:114-123, January, 1955.

between pre-pregnancy weight status and birth weight of the infant, and between various amounts of weight gained during pregnancy and the condition of the infant at birth.

Statement of the Problem

The problem of this study is to determine if there is a relationship between the pre-pregnancy weight status of the mother and the weight of the infant at birth; and, to determine if there is a relationship between the amount of weight gained during pregnancy and the condition of the infant at birth.

Purposes of the Study

The purposes of this study were three-fold: 1) To determine the relationship, if any, between the pre-pregnancy weight status of the mother and the weight of the infant at birth; 2) to determine the relationship, if any, between the amount of weight gained during pregnancy and the weight of the infant at birth; and 3) to determine the relationship, if any, between the amount of weight gained during pregnancy and the Apgar score of the infant at birth in order to justify routine restrictions of total weight gain during pregnancy.

Hypotheses

1. There is no relationship between the pre-pregnancy weight status of the mother and the weight of the infant at birth.

2. There is no relationship between the amount of weight gained during pregnancy and the weight of the infant at birth.
3. There is no relationship between the amount of weight gained during pregnancy and the Apgar score of the infant at birth.

Definition of Terms

Amount of weight gained during pregnancy

The number of pounds added by the mother to the pre-pregnancy weight from conception to the time of delivery of the infant.

Pre-pregnancy weight

Normal, non-pregnant weight of the mother.

Pre-pregnancy weight status

Maternal weight in relation to height prior to conception.

Underweight patient

For purposes of this study, considered to be a mother whose weight is less than 90% of the standard weight for her height prior to conception.[9]

Overweight patient

For purposes of this study, considered to be a mother whose weight is over 115% of the standard weight for her height prior to conception.[10]

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[9]Marie V. Krause, Food, Nutrition and Diet Therapy (Philadelphia: W. B. Saunders Company, 1972), p. 434.

[10]Corinne Robinson, Basic Nutrition and Diet Therapy (London: Collier-Macmillan Limited, 1970), p. 219.

Condition of the infant at birth

The birth weight and/or Apgar score at one minute of life given the infant in the immediate period following delivery.

Birth weight

The weight in pounds and ounces of the infant in the immediate post-partal period.

Low-birth-weight

Infant of full-term gestational age weighing less than 2500 Gms. (5.5 pounds) at birth.[11]

Full-term gestational age

Delivery occurring between 37 and 42 weeks gestation.[12]

Immature

Infant born between 20 and 28 weeks gestation weighing 500 to 999 Gms. (17 oz. to 2.2 pounds) at birth.[13]

Premature

Infant born between 29 and 36 weeks gestation weighing 1000 to 2499 Gms. (2.2 to 5.5 pounds) at birth.[14]

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[11]Clinical Research Advances in Human Growth and Development, How Children Grow General Clinical Research Centers Branch, Division of Research Resources (Bethesda, Md.: National Institutes of Health, June, 1972), pp. 21-29.

[12]Mae M. Bookmiller and George L. Bowen, Textbook of Obstetrics and Obstetric Nursing (Philadelphia: W. B. Saunders Company, 1968), p. 157.

[13]*Ibid.*

[14]*Ibid.*

High-risk pregnancy

"A woman who either has a physical condition which threatens her pregnancy or is faced by life conditions which may adversely affect the course of her pregnancy and its outcome;"[15] includes pregnancy out-of-wedlock, before the age of 17 years, diabetes, Cesarean-section, or a history of toxemia or several miscarriages.

Apgar score

"A scoring system which assigns a numerical index to the degree of newborn's depression or lack of depression at birth ... determined at one and five minutes of life."[16] The infant is rated on the basis of five signs. Each sign can be scored 0, 1, or 2. The total of the five signs is computed; the lower the score, the greater the degree of infant depression with the maximum possible score being 10. (See Appendix A for the index for determining the Apgar score.)

Normal weight gain expected during pregnancy

Eighteen to 25 pounds; the composition of this weight gain is thought to be as follows:[17]

1) Approximately 15.5 pounds are due to the products of conception and increase in breast tissue: infant - 7½ pounds;

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[15]Violet Broadribb and Charlotte Corliss, Maternal-Child Nursing (Philadelphia: J. B. Lippincott Company, 1973), pp. 43-44.

[16]Taylor, *Op. cit.*, p. 582.

[17]Broadribb, *Op. cit.*, pp. 78-79.

placenta - 1 pound; amniotic fluid - 1½ pounds; uterus - 2 to 3 pounds; breasts - 3 pounds.

2) Increase in protein storage outside the uterus - approximately 4 pounds.

3) Increase in blood volume and water retention - approximately 3 pounds.

Limitations

1. The sample size was limited.
2. The population of the sample was drawn from the records of only one hospital.
3. There were a limited number of physicians including a complete prenatal history and record in the hospital medical record.
4. Data available from the records were limited. Only a limited number of physicians in this area kept sufficient prenatal records to provide the data necessary for this investigation.

CHAPTER II

REVIEW OF LITERATURE

The literature dealing with the relationship of maternal weight gain during pregnancy and the condition of the infant at birth seemed to approach the subject from two standpoints: 1) The quantitative weight gain during pregnancy, and 2) the pre-pregnancy weight and quantitative weight gain during pregnancy.

In considering the first standpoint, the relationship between weight gained during pregnancy and the condition of the infant at birth, a major controversy appears to exist: whether or not quantitative weight gain can actually influence the birth weight of the infant. Dr. W. J. McGanity believes there is satisfactory evidence that one cannot influence the birth weight of the infant by controlling the caloric or protein intake of the mother during pregnancy. As an example, he states that a woman who is obese at the onset of pregnancy need not gain additional weight in order to have a satisfactory prenatal course and a healthy infant.[18] Thus, the "old wives' tale" holds true that the fetus has a competitive advantage for the nutrients it needs from the mother. However, there must be an adequate reserve of these nutrients from which the fetus can draw if the mother

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[18]McGanity, *loc. cit.*

is not furnishing them adequately during pregnancy.[19]

Looking at the other side of this controversy, Drs. Nicholson J. Eastman and Ester Jackson studied 12,000 full-term pregnancies and found that some women who gained less than 14 pounds, actually having lost weight during pregnancy, had larger babies than some women who gained more than the average 22.1 pounds. However, further investigation led them to find that this occurred when the women were obese at the onset of pregnancy and the fetus was, therefore, drawing on the mothers' reserves.[20] Eastman and Jackson concluded from this study that with increased weight gain there was a progressive reduction in the percentage of low-birth-weight infants.[21]

In considering the weight gain of the average woman, non-obese at the onset of pregnancy, "most physicians recommend that a woman gain 18-25 pounds during her pregnancy."[22] Weight gains under 11 pounds in pregnancy are associated with low-birth-weight infants and increased perinatal mortality and morbidity.[23]

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[19]Clinical Research Advances in Human Growth and Development, *loc. cit.*

[20]"Weight Gain in Pregnancy--A New View," Briefs, January, 1969, pp. 6-9.

[21]*Ibid.*

[22]Broadribb, *Op. cit.*, p. 78.

[23]Taylor, *Op. cit.*, p. 136.

In considering the second standpoint, the relationship between pre-pregnancy weight and birth weight of the infant, the original controversy seems to be explained. This standpoint looks at the relationship of weight gain to infant condition at birth from the aspect of pre-pregnancy weight and subsequent weight gain during pregnancy. Tompkins, Wiehl and Mitchell, in a study of 2,076 pregnancies, stated:

> We believe that too much attention has been given to weight as a number, rather than to the objective evidence which an individual's weight at any specified time indicates relative to nutritional status.[24]

The above authors found in their study that average or greater weight gains by underweight patients (referring to pregravid weight) were consistent with a reduction in the percentage of infants of low-birth-weight.[25] However, this is not meant to suggest that weight gain influences the size of the infant at birth. They believe that the underweight patient, by gaining more weight during pregnancy, is adding to her own body increments and not to the weight of the infant.

> Consequently, there is no indication that a relatively high rate of gain by underweight mothers does increase the size of the baby. The increase in her own tissue mass may afford greater protection to meet the stresses of pregnancy.[26]

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[24]Tompkins, Wiehl, and Mitchell, *loc. cit.*

[25]*Ibid.*, p. 121.

[26]*Ibid.*, p. 123.

Tompkins, Wiehl and Mitchell conclude that pregravid weight status and size of the infant are independent of prenatal weight gain. The relationship of weight gain in pregnancy and size of infant is, therefore, influenced only by the fact that a greater gain reduces the risk of premature labor for the mother and prematurity for the infant, especially in those patients who are underweight prior to pregnancy.[27]

> Failure to gain an average amount, especially during the first two trimesters, increases the likelihood of premature labor, but greater gain has little, if any, effect on the size of the baby.[28]

Another study, along these same lines, by Schram and Raji, found results consistent with the study just cited. They, too, were concerned with pregravid weight status and its effects on the mother and fetus. Consequently, it was found that approximately 85% of the infants born to mothers in the underweight group (referring again to pregravid weight status) were of low-birth-weight.[29]

Thus far, in considering the effect of pregravid weight on the birth weight of the infant, mention has only been made of the underweight patient. However, Love and Kinch, in their study of various factors influencing the birth weight of the infant, found that the

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[27] *Ibid.*

[28] *Ibid.*

[29] Maxwell Schram and Manssour Raji, "The Problem of Underweight Pregnant Patients," American Journal of Obstetrics and Gynecology 94:595-596, February 15, 1966.

heavier the mother before pregnancy, the heavier the infant.[30] They also found that the heavier the woman prior to pregnancy, the less weight she tended to gain during her pregnancy.[31] Thus, these findings would also appear to be consistent with the belief cited previously: that the fetus draws on maternal stores available.

In light of this evidence, experts are now proposing that routine weight gains or weight restrictions should not be advocated for all pregnant women without considering their pre-pregnancy weight status. The trend seems to be to look more at the individual needs of the pregnant woman and adjust advice concerning weight restrictions to her particular circumstances.[32]

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[30]E. J. Love and R. A. H. Kinch, "Factors Influencing the Birth Weight in Normal Pregnancy," American Journal of Obstetrics and Gynecology 91:342-349, February 1, 1965.

[31]*Ibid.*

[32]Broadribb, *Op. cit.*p. 79.

CHAPTER III

METHODOLOGY

Collection of Data

To most effectively facilitate the determination of the relationship, if any, between weight gained during pregnancy and the condition of the infant at birth, the investigative method of research was chosen for this study. It was decided that the greatest sample size could be obtained through review of existing medical records for collection of data pertaining to the problems of this study. A data sheet (Appendix B) was developed to facilitate collection of the information from the records.

To determine the relationship, if any, between weight gained during pregnancy and the condition of the infant at birth, a total of 324 post-partum medical records of patients delivered at Bozeman Deaconess Hospital was reviewed for the patient's past medical history, history of previous pregnancies, if any, present physical condition and course of labor and delivery. The prenatal history and physical data for the most recent pregnancy were recorded for control of variables in this study.

The sample for determining the relationship, if any, between weight gained during pregnancy and the weight of the infant at birth consisted of 313 patients. The patients were assigned to one of three groups according to the amount of weight gained during pregnancy.

Group I consisted of those patients having gained 0-15 pounds; Group II consisted of those patients having gained a total of 16-26 pounds; and, Group III consisted of those patients having gained 27 or more pounds during their pregnancy. The group sizes were 104, 102 and 107, respectively.

Data applicable to the third aspect of this study, dealing with the relationship, if any, between pre-pregnancy weight status and the birth weight of the infant, were derived from the same sample population. Out of the original 313 patients, 240 patients were found to be acceptable for this aspect of the investigation. These patients were divided into three weight groups according to their pre-pregnancy weight status. Group A, consisting of 35 patients, was composed of those patients considered to be underweight prior to conception; Group B, consisting of 171 patients, was composed of those patients considered to be of standard weight for their height prior to conception; and, Group C, consisting of 34 patients, was composed of those patients considered to be overweight prior to conception. (Consult Appendix C for the Table of Standard Weight for Height, Underweight and Overweight.)

The records reviewed ranged over a time span of from 1965 to 1973. The majority of the records were from the years 1971 to 1973 with the remaining years containing only those occasional complete past post-partum records discovered in the patient's file with the most recent post-partum medical record being examined.

Selecting the Sample

The 324 patients constituting the total sample were selected for study on the basis of whether or not their record contained the information necessary for this study, and whether or not they then met the following criteria:

1. Age limit of 18-29 for primiparas; 18-40 for multiparas.
2. No limitation on parity of the patient.
3. No history of diabetes mellitus in either the patient or her husband.
4. Prenatal medications prescribed by the physician restricted to the following: vitamins, iron, folic acid, calcium, anti-nauseants, and diuretics.
5. No history of repeated miscarriages.
6. No family or personal history of congenital defects in either the patient or her husband.
7. No hereditary defects in either the patient or her husband.
8. Vaginal delivery of the infant following a normal labor pattern without the complication of toxemia and/or fetal distress.
9. No history of pre-eclampsia in the pregnancy being studied.

The above criteria pertained to the mothers selected, but certain criteria were also established for the infants that resulted from their pregnancies. The criteria were as follows:

1. No congenital deformities.
2. Product of a single pregnancy. No multiple pregnancies were included in this study.
3. Born past the age of viability. This was considered to be after 20 weeks gestation as this is the lower limit of what is considered to be an immature birth.[33]

The 240 patients selected for the study of pre-pregnancy weight status and its relationship, if any, to birth weight of the infant were drawn from the same sample used to study weight gained and condition of the infant at birth, thus meeting the same criteria.

Variables

There were certain independent variables within this study that the investigator was unable to control due to the nature of the investigation. These variables, however, were not discounted entirely when considering the findings of this study. The variables were as follows:

1. Smoking: Research findings indicate that infants born to mothers who smoked one pack of cigarettes or more per day during pregnancy are more likely to weigh 3/4 of a pound less on the average than infants of non-smokers.[34] Still, this lesser weight does not seem

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[33]Bookmiller, *Op. cit.*, p. 157.

[34]Alan F. Guttmacher, Pregnancy, Birth and Family Planning (New York: The Viking Press, 1973), p. 61.

to affect the infants' chances of survival, unless the infant is also premature.[35] A team of Air Force physicians, in a study of 7,740 mothers and their infants, found no significant difference in the condition at birth of the infants of smokers and non-smokers. Apgar scores were calculated on all babies and no significant difference in occurrence of low Apgar scores was found among infants of smokers and non-smokers.[36]

A controversy still exists as to the possibility of prematurity being increased among smoking mothers. One authority states: "The infants of heavy smokers [more than one pack of cigarettes per day] have no tendency to be born prematurely; they simply weigh less at term,"[37] while another states: "Underwood, *et al.*, have shown that infants of mothers who smoke during pregnancy are smaller, and the incidence of prematurity is increased."[38]

In light of the above findings, the possibility of the mother having smoked during pregnancy was taken into consideration in cases of infants of low-birth-weight where data were available. For average or above average birth weight infants, the effects of smoking were not

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[35] *Ibid.*

[36] "Smoking and Prematurity," Briefs, March, 1966, pp. 36, 45.

[37] Guttmacher, *loc. cit.*

[38] Taylor, *Op. cit.*, p. 138.

considered because of inadequate data available.

2. Edema: Edema is considered to be one of the symptoms of toxemia of pregnancy. "Persistent edema of the hands and the face" is the criteria established for definition of "mild pre-eclampsia" in reference to this symptom.[39] Moderate edema of the feet and ankles is common and it was found that a majority of the patients in this study experienced some pretibial edema. "Mild edema unassociated with other symptoms, such as severe headache, stubborn constipation, excessive gain in weight and proteinuria, is of no special significance."[40] On these bases and for purposes of this investigation, edema of the feet and ankles alone was not considered a symptom of toxemia, unless accompanied by edema of the hands and/or face, elevated blood pressure, or albuminuria, in which case the patient was eliminated from the study.

3. Analgesia and anesthesia during labor and delivery: Control of the use of analgesics and anesthetics could not be done by the mere fact that this study was done from a review of existing post-partum records. However, control of the effects of these agents used during labor and delivery on the condition of the infant had to be made since one aspect of this study deals specifically with the condition of the

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[39]Elise Fitzpatrick, Maternity Nursing (Philadelphia: J. B. Lippincott Company, 1966), p. 445.

[40]J. P. Greenhill, Obstetrics (Philadelphia: W. B. Saunders Company, 1966), p. 498.

infant as evidenced by the Apgar score at one minute of life.

The agents used for analgesia and anesthesia among the sample studied fell into five categories: Inhalation anesthetics; local anesthetics for regional blocks; narcotics; tranquilizers; and sedatives. The inhalation anesthetics (nitrous oxide with oxygen, penthrane and trilene) are known to rapidly cross the placental barrier and cause the same depressant effects in the fetus as they do in the mother. However, in small concentrations and/or intermittent use during parturition they have no appreciable affect on the infant.[41] Therefore, use of these agents was evaluated accordingly for length of administration in conjunction with the Apgar score of the infant.

The local anesthetics are thought at times to be the cause of fetal bradycardia. However, patients exhibiting fetal distress, which would include bradycardia, have already been eliminated from the study according to the original criteria. Therefore, use of these agents did not appear to have an effect on the Apgar score in the patients selected for this study.

The narcotic analgesics are known to cause fetal depression (respiratory) when used in the later stages of labor.[42] Therefore,

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[41]Greenhill, *Op. cit.*, p. 387.

[42]*Ibid.*, p. 380.

a low Apgar score was evaluated for use of narcotics, which may have been the causative factor, before the patient was included in the sample. The same holds true for the use of sedatives.[43] Tranquilizers appear to cross the placental barrier, but are not considered to be harmful to the fetus.[44] (Consult Appendix D for a complete listing of analgesics and anesthetics used in the sample.)

5. Heredity: There was no possible means in this investigation for control of genetic factors as they affect body build and weight of the infant. Therefore, it may have to be considered as a possible bias on the findings of this study.

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[43] *Ibid.*, p. 382.

[44] *Ibid.*

CHAPTER IV

ANALYSIS OF DATA

The data collected were tabulated according to the groupings as described in Chapter III. A statistical analysis using simple correlations and coefficients of determination was performed. The *t-test* was then used as the test of significance of the calculated r over the groups individually and over all groups as a whole within the relationships being examined. All tests of significance are two-tailed, $p = .05$ *t-tests* unless otherwise indicated.

The relationships examined statistically were as follows: 1) Pre-pregnancy weight to infant birth weight (grouped according to weight gained during pregnancy); 2) pre-pregnancy weight to infant birth weight (grouped according to pre-gravid weight status of the mother); 3) pre-pregnancy weight to weight gain during pregnancy; 4) weight gained during pregnancy to infant birth weight; and, 5) weight gained during pregnancy to condition of the infant at birth as evidenced by the Apgar score at one minute of life. (The raw data are given in Appendix E.) The statistical analysis of these relationships revealed the following:

The statistical relationships of the pre-pregnancy weight of the mother to the birth weight of the infant are summarized in Tables I and II. (Recall that Groups I, II, and III are groupings according to

TABLE I. RELATIONSHIP OF PRE-PREGNANCY WEIGHT TO INFANT BIRTH WEIGHT.

Group	N	r	r^2	t calc	$t = .05$
I	104	0.51	.2601	5.98*	1.99
II	102	0.16	.0256	1.62	1.99
III	107	0.21	.0441	2.20*	1.99
Total	313	0.29	.0841	5.34*	1.96

*Indicates $r = 0 \leq p.05$.

the amount of weight gained during pregnancy and Groups A, B, and C are groupings according to pre-pregnancy weight status of the mother.)

The data in Table I indicate an unquestionable positive association between the pre-gravid weight of the mother and the birth weight of the infant over the total of all three groups, but only 8.4% (r^2 x 100) of the variation in infant birth weight can be attributed to differences in the maternal pre-pregnancy weight summed over all groups. Examining the groups individually, Groups I and III show a definite positive association between maternal pre-pregnancy weight and infant birth weight. In Group I, women who gained less weight than recommended during pregnancy, 26% of the variation in infant weight can be attributed to differences in maternal weight prior to conception, while in Group III, women who gained excessive amounts of weight during pregnancy, only 4% of the variation in infant weight can be attributed to differences in maternal pre-pregnancy weight. These findings seem

to agree with previous studies done.[45] [46]

Secondly, a further examination of the data for the relationship being studied in Table I revealed group means as follows:

TABLE Ia. GROUP MEANS OF PRE-PREGNANCY WEIGHT FOR GROUPS I, II, AND III.

Group	Mean Pre-pregnancy Weight (in pounds)
I	136.26
II	127.79
III	130.06
Total	131.38

Although there does not appear to be wide variation among the group means, an analysis of variance for a completely random design with unequal sample size was performed to determine if the variation was significant.

TABLE Ib. ANALYSIS OF VARIANCE OF GROUP MEANS OF PRE-PREGNANCY WEIGHT FOR GROUPS I, II, AND III.

Source of Variation	Sum of Squares	*DF*	Mean Square	F	F=.05
Total	151695.23	312			
Among Group Means	3977.70	2	1988.85	4.17	3.00
Error	147717.53	310	476.51		

[45]Tompkins, Wiehl and Mitchell, *Op. cit.*, pp. 114-123.

[46]L. Jean Bogert, Nutrition and Physical Fitness (Philadelphia: W. B. Saunders Company, 1968), p. 409.

The data in Table Ib indicate that there is a significant variation among the means of the maternal pre-pregnancy weight for Groups I, II, and III based on the analysis of variance. This suggests the possibility of a slight bias due to differences in weights of the three groups. The correlations reported in Table I suggest, however, that the bias would not be severe, because even with significant correlations only 26% of the variation in infant weight of Group I can be attributed to differences in the pre-pregnancy weight of the mother, and only 4% of the variation in infant weight of Group III can be attributed to differences in the maternal pre-pregnancy weight. Furthermore, the slight difference among means demonstrated to be statistically significant is of questionable biological meaning due to the large sample size. All data could be adjusted using covariance techniques, but, based on the above logic, assumptions underlying data adjustment could introduce as much bias as may be introduced to the correlations as a result of the differences in group means. Finally, because much of the interpretation is based on the correlation summed over the total of the three groups, the weight bias then becomes non-existent due to the fact that the individual group means are not considered when dealing with the total of the groups.

Continuing the original analysis of the relationship of maternal pre-pregnancy weight to the infant birth weight, Table II is derived from correlations run over Groups A, B, and C (groupings according to

pre-pregnancy weight status).

TABLE II. RELATIONSHIP OF PRE-PREGNANCY WEIGHT STATUS TO INFANT BIRTH WEIGHT.

Group	N	r	r^2	t calc	$t = .05$
A	35	0.37	.1369	2.29*	2.03
B	171	0.11	.0121	1.44	1.96
C	34	0.19	.0361	1.09	2.03
Total	240	0.21	.0441	3.31*	1.96

*Indicates $r = 0 \leq p.05$.

Again, looking first at the overall correlation summed over Groups A, B, and C, there is a definite positive correlation between pre-pregnancy weight of the mother and birth weight of the infant. However, when broken down by groups, Group A, those mothers who were underweight prior to conception, shows the only significant correlation. Thus, predictive power for infant birth weight from maternal pre-pregnancy weight comes only within this group. However, it must be noted that only 13.6% of the variation in infant weight can be attributed to differences in maternal weight prior to conception. Therefore, the predictive power would be limited.

The second purpose of this investigation was to determine the relationship, if any, between the amount of weight gained during pregnancy and the birth weight of the infant. The analyses are summarized in Table III.

TABLE III. RELATIONSHIP OF WEIGHT GAIN TO INFANT BIRTH WEIGHT.

Group	N	r	r^2	t calc	$t = .05$
I	104	-0.06	.0036	0.61	1.99
II	102	0.25	.0625	2.58*	1.99
III	107	0.11	.0121	1.13	1.99
Total	313	0.20	.0400	3.60*	1.96

*Indicates $r = 0 \leq p.05$.

The data in Table III show that there is a significant positive correlation when the relationship is considered over the total sample. However, only 4% of the variation in infant weight can be explained by the maternal weight gain during pregnancy. Thus, biologically, this is not a highly meaningful correlation. Many other factors must influence infant birth weight. Within the individual groups, a significant correlation is found only in Group II, mothers with recommended weight gain during pregnancy, but this is of minor biological significance because only 6.25% of the variation in infant birth weight can be attributed to differences in maternal weight gain. This leaves 93.75% of the variation in infant weight unexplained.

Thus far, the relationships of pre-pregnancy weight to infant birth weight and amount of weight gain to infant birth weight have been considered. However, a third, possibly intervening relationship, the relationship of pre-pregnancy weight to amount of weight gained during pregnancy, has been suggested by previous studies. Love and

Kinch believe that the heavier the mother prior to pregnancy, the less weight she gained during pregnancy.[47] Tompkins, Wiehl, and Mitchell, on the other hand, believe the size of the baby and pre-gravid weight status to be independent of weight gain during pregnancy.[48] Table IV reveals the analyses of the relationship of pre-pregnancy weight to weight gain during pregnancy.

TABLE IV. RELATIONSHIP OF PRE-PREGNANCY WEIGHT TO WEIGHT GAIN DURING PREGNANCY.

Group	N	r	r^2	t calc	$t = .05$
I	104	-0.15	.0225	1.53	1.99
II	102	0.12	.0144	1.21	1.99
III	107	0.18	.0324	1.86	1.99
Total	313	-0.07	.0049	1.24	1.96

The data show there to be no significant correlation between these two factors. Thus, weight gain during pregnancy cannot be estimated from pre-pregnancy weight for this sample. It must be remembered that grouping of this sample was done in hindsight, after the fact, and may not be completely reliable. Therefore, definite statements about this relationship, within these groupings, cannot be made. Yet, summed over all three groups, r is still non-significant.

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[47]Love and Kinch, *loc. cit.*

[48]Tompkins, Wiehl, and Mitchell, *loc. cit.*

Also, a possible bias has been suggested by the relationship of pre-pregnancy weight to weight gain during pregnancy affecting the relationships of pre-pregnancy weight to infant birth weight, and weight gain to infant birth weight. Although there were some significant associations between pre-pregnancy weight status and infant birth weight and between weight gain and infant birth weight, the fact that there were no significant correlations between pre-pregnancy weight status and weight gain minimized any possible bias to this sample on the relationships examined.

The final relationship to be considered is that of maternal weight gain during pregnancy to condition of the infant at birth determined by the Apgar score at one minute of life. Table V shows the analyses for this relationship. The data show that there are no

TABLE V. RELATIONSHIP OF MATERNAL WEIGHT GAIN DURING PREGNANCY TO CONDITION OF THE INFANT AT BIRTH.

Group	N	r	r^2	t calc	$t = .05$
I	108	-.001	.001	.0093	1.99
II	108	.0453	.0021	.4669	1.99
III	108	-.1664	.0277	1.7374	1.99
Total	324	-.0204	.0004	.3661	1.96
Group	N	r	r^2	t calc	$t = .10$
III	108	-.1664	.0277	1.7374*	1.66

*Indicates $r = 0 \leq p.10$.

significant correlations indicated for this sample at the $t = .05$ level. It is of interest, however, to note that for Groups I and III (less than and more than recommended weight gain during pregnancy) there are negative correlations. Furthermore, if the data are examined at $p = .10$ (two-tailed test) a significant negative correlation is detected for Group III. In other words, as amount of weight gained during pregnancy increased above the recommended amount, the Apgar score of the infant at one minute of life tended to decrease. But, only 2.8% of the variation in Apgar score could be attributed to differences in maternal weight gain during pregnancy, which again suggested that this correlation was not highly meaningful.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purposes of this investigation were three-fold: 1) To determine the relationship, if any, between pre-pregnancy weight status of the mother and the weight of the infant at birth; 2) to determine the relationship, if any, between the amount of weight gained during pregnancy and the birth weight of the infant; and, 3) to determine the relationship, if any, between the amount of weight gained during pregnancy and the condition of the infant at birth in order to justify routine restriction of total weight gain in pregnancy. This was done through a review of existing medical records of post-partum patients in the area of Bozeman, Montana. Patients for the samples used in this three-part study were selected on the basis of specific criteria to eliminate as many biases to the study as possible. The samples were then grouped according to pre-pregnancy weight status (underweight, standard weight, and overweight) and/or according to weight gained during pregnancy (minimal weight gain, recommended weight gain, and excessive weight gain). A statistical analysis of data was performed using simple correlations and coefficients of determination.

All three null hypotheses formulated for this study were rejected based on the following:

The first null hypothesis, there is no relationship between the pre-pregnancy weight status of the mother and the weight of the infant at birth, was rejected because the analysis showed there to be some significant correlations between pre-pregnancy weight status of the mother and the birth weight of the infant. Therefore, some predictive power arises from this correlation. In other words, infant weight may be predicted, on the whole, to be greater as maternal pregravid weight status increases. However, this may prove to be more reliable in the underweight group than in either the standard or overweight weight groups.

The second null hypothesis, there is no relationship between the amount of weight gained during pregnancy and the weight of the infant at birth, was rejected because a significant correlation was found between weight gained during pregnancy and infant birth weight. However, it is not highly meaningful since, on the whole, only 4% of the variation in infant weight can be explained by differences in maternal weight gain. Any attempt at prediction of infant weight will not be very reliable since 96% of the variation in infant weight is still unexplained by this relationship.

Finally, the third null hypothesis, there is no relationship between the amount of weight gained during pregnancy and the Apgar score of the infant at birth, was rejected even though no significant correlation was found between weight gained during pregnancy and the Apgar

score of the infant until considered at the level of $r = 0 \leq p.10$. Then, a negative correlation becomes significant between women who gained excessively during pregnancy and the Apgar scores of their infants. But, again, this is not highly meaningful because only 2.7% of the variation in Apgar scores can be attributed to differences in weight gain among this group of women. Therefore, this affords only a very limited predictive power of the infants' condition based on maternal weight gain.

Although infant birth weight and the condition of the infant at birth could be explained only to a very limited degree by maternal pre-pregnancy weight and weight gain as exemplified by the small percentages (r^2 x 100), it is this researcher's opinion that these factors, pregravid weight and weight gain, should not be disregarded during pregnancy without further investigation and study of the relationships presented in this investigation.

Throughout all these conclusions, it must be remembered that these findings are based on a sample of a restricted population. Therefore, generalizations made outside of this population may not be completely reliable. Another sample drawn from the same population may show similar or very different results, but the probability that the findings of this study were due to chance alone is less than one in twenty.

Recommendations

Recommendations for further study in light of the findings of this investigation were as follows:

1. A replication of this study be done using a larger sample size.
2. A replication of this study be done using data gathered from a more expanded population.
3. A longitudinal study be made of the relationships investigated in this study with more rigid assessment and control of the following factors:
    a. pre-pregnancy weight and height.
    b. weight gain during pregnancy.
    c. edema.
    d. smoking during pregnancy.
    e. nutritional aspects of patients' diets prior to and during pregnancy.
    f. time at which the patient is placed on a low sodium diet during the pregnancy.
    g. Apgar score of the infant at one minute of life.
    h. child spacing or interval between the patients' pregnancies.
4. A study of pre-pregnancy weight status and weight gain during pregnancy be related to the incidence of post-partum complications of the mother, such as infection, hemmorhage, eversion or prolapse

of the uterus, to name a few.

5. A study be done of the correlation of the three variables, pre-pregnancy weight status, weight gain and infant birth weight, considered altogether.
6. A study be done of the correlation of the three variables, pre-pregnancy weight status, weight gain, and infant birth weight, to the incidence of complications occurring during the course of the pregnancy, labor and delivery, such as toxemia, fetal distress, Cesarean-section necessitated by excessive size of the infant, to name a few.

Implications for Nursing

Nurse-midwives and maternity nurses are now beginning to assume an expanded role in the prenatal care of mothers with normal pregnancies.[49] They are becoming, or may become, the major informational and directional source for expectant mothers. Therefore, it is the opinion of this researcher that studies of the sort done in this thesis are of major importance to nurses in teaching and guidance positions for maternity patients. The nurse must know what aspects of care should be of major emphasis for the well-being of both mother and fetus. For example, should the nurse be more concerned

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[49]"Expanding the Nurse's Role." Briefs, February, 1974, pp. 19-21.

with the pregravid weight status of the mother in determining the recommended weight gain for the individual patient rather than becoming bound by routine recommendations of restricted weight gain for all patients? This investigation shows there to be a statistical basis for making decisions along these lines. Therefore, it is recommended that nurses dealing with maternity patients become more involved in and concerned with research dealing with weight restrictions during pregnancy.

APPENDICES

APPENDIX A

APGAR SCORING SYSTEM[50]

Heart rate	Absent	Slow (below 100)	Over 100
Respiratory effort	Absent	Weak cry, Hypoventilation	Good strong cry
Muscle tone	Limp	Some flexion of extremities	Well flexed
Reflex response			
1. Response to catheter in nostril (tested after oropharynx is clear)	No response	Grimace	Cough or sneeze
2. Tangential foot slap	No response	Grimace	Cry, withdrawal of foot
Color	Blue, pale	Body pink, Extremities blue	Completely pink

[50]E. Stewart Taylor, Beck's Obstetrical Practice (Baltimore: The Williams and Wilkins Company, 1971), p. 582.

APPENDIX B

DATA SHEET

Patient File No.: _____

EDC: _____ Date of Delivery: _____

A. CONDITION OF MOTHER:

1. Attending physician: _____
2. Age: _____ 3. Parity: _____
4. Marital Status: S M D W 5. Height: _____
6. Weight:(Pre-pregnancy) _____ (At delivery) _____
7. Total Weight Gain in Pregnancy: _____
8. Medications Taken During Pregnancy:
   a. _____ b. _____
   c. _____ d. _____
9. Length of Labor: _____
10. Type of Delivery: _____
11. Medications Taken During Labor:
    a. _____ b. _____
    c. _____ d. _____
12. Smoker: _____ Non-smoker: _____
13. Complications:

B. CONDITION OF THE INFANT:

1. Gestational Age at Delivery: _____
2. APGAR: _____ 3. Weight: _____
4. General Condition:

APPENDIX C

TABLE OF WEIGHT STATUS FOR HEIGHT*

Height (inches)	Underweight	Standard (pounds)	Overweight
57	95	105	121
58	96	107	123
59	98	109	125
60	101	112	129
61	104	115	132
62	107	119	137
63	110	122	140
64	113	126	145
65	116	129	148
66	120	133	153
67	123	137	157
68	127	141	162
69	131	145	166
70	134	149	171
71	138	153	176
72	141	157	180
73	145	161	185
74	149	165	189

*Underweight and overweight figures were calculated from the standard weight table which was taken from Weight Watchers' Cook Book by Jean Nidetch.

APPENDIX D

ANALGESICS AND ANESTHETICS USED DURING LABOR IN THE SAMPLE

A. Anesthetics:

1. Penthrane
2. Nitous oxide and oxygen
3. Trilene
4. Xylocaine, pontocaine, and carbocaine for Paracervical and Pudendal regional blocks.

B. Analgesics:

1. Narcotics
   a. Demerol (Meperidine)
   b. Mepergan
   c. Nisentil
   d. Talwin
2. Tranquilizers
   a. Largon
   b. Vistaril
   c. Sparine
   d. Meprobamate
   e. Trilafon
   f. Phenergan
3. Sedatives
   a. Placidyl
   b. Seconal
   c. Choloral hydrate

APPENDIX E

RAW DATA USED IN ANALYSIS OF RELATIONSHIPS

GROUP I: (0-15 pounds gained during pregnancy) N = 104

Pre-Pregnancy Weight	Weight Gain (pounds)	Infant Weight (Grams)
145	2.5	3600
115	3	2664
198	3.25	3586
146	4	2948
138	4.5	3033
127.5	4.5	2664
150	5	3005
155	5.25	3529
140	5.5	3713
155	5.75	3798
107	6	3345
130	6	3005
135	6.75	3146
150	7	2962
152.5	7	3912
108	7	2636
150	7	3572
195	7	3713
135	7	3798
150	8	3600
218	8	4791
113	8	3572
130	8.75	3472
130	9	3316
175	9	3543
195	9	3203
123	9	2835
150	9.25	3288
98	9.5	2693
150	9.5	3033
126	9.75	3005
105	9.75	2891
110	10	3415
137	10	3260
114	10	2494

Pre-Pregnancy Weight	Weight Gain (pounds)	Infant Weight (Grams)
105	10	2664
182	10	3515
135	10.5	3458
116	11	2835
115	11	3033
119	11	3203
125	11	2693
156.5	11	2863
130	11	3657
123	11.25	3231
110	11.5	3175
130	11.5	3628
118	11.5	2664
122	11.5	3316
127	12	3444
121	12	3458
150	12	2239
223	12	3883
150	12	2792
143	12	4309
105	12	2409
125	12	3061
180	12.5	3430
137	12.5	2976
118	12.5	3345
104	12.5	3175
113	12.5	2806
123	12.5	2849
135	12.5	2891
160	12.5	3231
138.25	12.75	3316
124	12.75	2438
110	13	2835
175	13	3373
128	13	2721
140	13	3997
135	13	3572
155	13	3770
115	13.25	2296
112	13.75	2494
120	14	2835
117	14	2693

Pre-Pregnancy Weight	Weight Gain (pounds)	Infant Weight (Grams)
125	14	2877
226	14	3345
125	14	3430
106	14	3231
120	14	2211
230	14.25	4139
125	14.25	3926
120	14.25	3118
128.5	14.25	3387
120	14.5	3373
104	14.5	3330
113	14.5	3132
130	14.75	2920
175	15	3657
138	15	3600
115	15	3090
150	15	3146
123	15	3146
125	15	3345
122.5	15	2693
160	15	3742
123	15	2678
145	15	3487
131	15.25	4139
104	15.5	2948
142	15.5	3628
120	15.75	3231

GROUP II: (16-26 pounds gained during pregnancy) N = 102

Pre-Pregnancy Weight	Weight Gain (pounds)	Infant Weight (Grams)
120	16	3090
108	16	3657
110	16	2863
109	16	3628
130	16	3912
120	16	2579
139	16	3231
123.5	16.25	2778
141	16.25	3430
120	16.5	3515
124	16.5	3132
121	17	3090
127.25	17	3373
120	17.5	2948
120	17.5	3090
122	18	2409
117	18	2466
120	18	3387
125	18	3090
94	18	2835
112	18	3586
125	18.25	2083
133	18.25	3316
105.5	18.5	2891
140	18.5	3628
135.5	19	3997
129	19	3572
108	19	3529
120	19.5	3260
114	19.5	3572
115	19.5	2891
157	19.5	3330
123	19.5	3373
140	19.5	3628
127	20	2976
110	20	3033
140	20	3146
158	20	3487
130	20	3033
107	20.25	2012

Pre-Pregnancy Weight	Weight Gain (pounds)	Infant Weight (Grams)
185	20.25	2608
110	20.5	3671
143	21	3742
133	21	3316
143	21	4053
125	21	1701
135	21	2636
120	21.25	3713
155	21.25	3033
115	21.5	4309
108.5	21.5	3175
135	21.5	3940
105	22	2948
135	22	3260
110	22	2267
218	22	3671
115	22	3458
140	22.25	3189
140	22.25	3118
125	22.5	3543
127	23	3756
122	23	3430
116	23	3444
169	23.25	4167
130	23.5	3742
110	23.5	3359
125	23.5	3274
103	23.5	3118
110	23.75	3572
123	23.75	3827
112	23.75	3515
144	24	3770
120	24	3033
139	24	3487
125	24	3543
145	24.25	3203
140	24.25	3855
150	24.25	2366
145	24.5	3770
125	25	3600
130	25	3345
195	25	3146

Pre-Pregnancy Weight	Weight Gain (pounds)	Infant Weight (Grams)
130	25	3231
112	25	2891
110	25	3175
120	25.5	3997
142.5	25.75	3912
123	25.75	3600
140	26	3160
105	26	2693
126	26	3515
130	26	3330
113	26	3600
129	26	3146
125	26	4096
165	26	3373
105	26.25	3005
120	26.25	3827
117	26.25	3727
145	26.5	4195
114	26.5	3019
123	26.75	4082

GROUP III: (27+ pounds gained during pregnancy) N = 107

Pre-Pregnancy Weight	Weight Gain (pounds)	Infant Weight (Grams)
118	27	1856
130	27	3175
136	27	2962
130	27	3515
120	27	3146
100	27	2749
130	27	3345
90	27.25	2920
115	27.25	2778
133	27.25	3430
125	27.25	3203
165	27.25	4479
120	27.5	3345
108	27.5	3118
112	27.5	3231
144	27.75	4025
192	28	3798
105	28	2551
130	28	4110
145	28	3742
120	28	2962
142	28	4167
124	28.5	2863
135	28.5	3557
135	28.5	3628
125	28.75	3146
119	29	3997
110	29	3940
130	29	2579
140	29	3883
147	29	3572
135	29	3203
125	29.25	3515
136	29.5	3146
107	30	3614
135.5	30	3118
110	30	3146
132	30	3146
133	30	3401
130	30	3770

Pre-Pregnancy Weight	Weight Gain (pounds)	Infant Weight (Grams)
132	30	3940
119	30	3316
116	30	4224
110	30.25	3600
125	30.25	3260
126	30.25	3316
110	30.5	3175
145	30.5	3515
155	30.75	3685
125	30.75	3175
125	31	3401
118	31	3288
137	31.5	3401
146	31.5	2905
135	31.5	3543
140	32	2763
131	32	2352
130	32	3203
115	32	2920
152	32	3572
98	32.25	2976
98	32.25	3657
137	32.25	3997
110	32.75	3373
149	33	3175
116.5	33	3572
120	33	3572
134	33	4082
170	33.5	5131
134	33.5	2948
155	34	3628
105	34	3628
89	34	3430
140	34	4153
175	34.25	2693
137	34.75	3827
117	35	3827
115	35.5	3288
145	36	3061
127	36	3160
125	36	3260
140	37.5	3373

Pre-Pregnancy Weight	Weight Gain (pounds)	Infant Weight (Grams)
132	38	3231
124	38	3345
175	38.75	3628
123	39	3600
127	39.5	3912
140	40	3685
130	40	3175
128	40	3883
141	42	2934
130	42	3954
130	42.25	3373
145	43	3685
120	43	3231
120	43.25	4139
155	45	3628
132	45	4139
115	46	3146
135	49	2721
132	50	3798
115	50.75	4110
148	52.25	3090
115	54.5	3940
135	55.5	3373
170	56	3090
153	58.5	3345

GROUP A: (Patients underweight prior to pregnancy) N = 35

Height (Inches)	Pre-Pregnancy Weight (Pounds)	Infant Weight (Grams)
60	89	3430
60	100	2749
62	100	1743
62	105	2551
62	105	2693
63	94	2835
63	104	2948
63	107	3614
63	108.5	3175
64	103	3118
64	105	2409
64	107	3345
64	107	2012
64	113	3572
65	110	3359
65	112	3231
65	112	2891
65	112	3515
65	114	3019
65	115	2664
65	115	1927
65	115	4110
66	104	3175
66	110	3175
66	116.5	3572
66	119	3316
66	120	2962
67	110	2267
67	120	3231
68	122	3316
68	125	3926
69	130	3770
69	130	3345
69	130	3316
70	120	3090

GROUP B: (Patients of standard weight prior to pregnancy) N = 171

Height (Inches)	Pre-Pregnancy Weight (Pounds)	Infant Weight (Grams)
59	105	2948
59	110	2863
60	105	3401
60	114	2494
60	123	3231
60	125	3543
61	105	3657
61	106	3231
61	115	3543
61	115	2920
61	117	3827
61	120	2948
61	121	3458
62	108	3203
62	108	3657
62	108	3529
62	110	3415
62	110	3175
62	110	3572
62	110	3600
62	113	2806
62	113	3600
62	114	3572
62	115	2891
62	117	2693
62	120	2211
62	120	3118
62	120	3231
62	120	3515
62	120	3572
62	120	3146
62	125	3090
62	130	3203
62	133	3316
62	134	3260
62	135	3146
63	112	3586
63	113	3132
63	115	4309
63	115	3401
63	115	3458

Height (Inches)	Pre-Pregnancy Weight (Pounds)	Infant Weight (Grams)
63	115	3288
63	118	3288
63	120	3033
63	120	3090
63	122	2409
63	123	2835
63	123	3146
63	123	2678
63	123	4082
63	124	2863
63	124	3345
63	125	3274
63	125	3175
63	130	3373
63	132	3146
63	135	3572
64	115	3033
64	115	2296
64	115	3090
64	116	3444
64	116	4224
64	118	1573
64	120	4139
64	120	3387
64	120	3827
64	122.5	2693
64	124	708
64	125	3260
64	125	3061
64	125	3430
64	125	1701
64	125	3260
64	125.5	3614
64	127	3912
64	127	3160
64	127.5	2664
64	128	3883
64	130	3657
64	135	3373
64	135	2891
64	137	3827
64	139	3231
64	140	3373

Height (Inches)	Pre-Pregnancy Weight (Pounds)	Infant Weight (Grams)
64	146	2948
65	118	2664
65	119	3203
65	120	2835
65	120	3373
65	120	3713
65	120	3260
65	120	3997
65	122	3430
65	125	3345
65	125	3543
65	127	3444
65	128.5	3387
65	130	2579
65	131	4139
65	131	2352
65	132	3798
65	132	4139
65	133	3401
65	137	3997
65	142	3245
65	145	3600
66	124	3132
66	125	2877
66	125	4096
66	125	3515
66	126	3005
66	126.75	3713
66	127.25	3373
66	128	2721
66	130	3005
66	130	3628
66	130	2920
66	130	3458
66	130	3912
66	135	3798
66	135	3458
66	135	2636
66	135	3940
66	135	3260
66	135	3557
66	135	3628

Height (Inches)	Pre-Pregnancy Weight (Pounds)	Infant Weight (Grams)
66	135	3543
66	136	2962
66	138	3033
66	140	3997
66	140	3146
66	140	2763
66	142	4167
66	145	3203
66	145	3685
66	148	3090
66	150	3572
66	150	3288
66	150	2976
67	125	2083
67	127	3756
67	129	3146
67	130	3033
67	130	3231
67	132	3940
67	140	3940
67	140	4153
67	140	3685
67	145	3742
67	145	3515
67	146	2905
68	130	3345
68	135	2721
68	137	3260
68	138.25	3316
68	139	3487
68	140	3160
68	141	3430
68	143	4053
68	143	4309
68	150	2239
68	150	2962
68	156.5	2863
69	135.5	3997
69	140	3628
69	142	3628
69	145	3770
69	150	3061

Height (Inches)	Pre-Pregnancy Weight (Pounds)	Infant Weight (Grams)
70	140	3855
70	142.5	3912
74	180	3430

GROUP C: (Patients overweight prior to pregnancy) N = 34

Height (Inches)	Pre-Pregnancy Weight (Pounds)	Infant Weight (Grams)
60	134	4082
62	150	3600
62	302	4110
63	140	3713
63	145	3061
63	145	3487
63	150	2366
63	155	3798
63	155	3529
64	153	3345
64	155	3685
64	160	1077
64	160	3742
65	150	3005
65	152.5	3912
65	157	3330
65	165	3373
65	192	3784
66	160	3231
66	165	4167
66	192	3798
66	198	3586
66	230	4139
67	158	3487
67	195	3203
67	195	3146
67	204.5	2863
67	226	3345
69	169	4167
69	170	3090
70	175	3657
70	175	3628
70	175	2693
70	195	3713

GROUP I: (0-15 pounds gained during pregnancy) N = 108

Weight Gain	Apgar at 1 minute
2.5	9
3	8
3.25	10
4	10
4.5	10
4.5	9
5	10
5	10
5.25	9
5.5	10
5.75	9
6	10
6	9
6.75	9
7	7
7	10
7	8
7	8
7	9
7	8
8	9
8	9
8	9
8.75	9
9	9
9	9
9	9
9	10
9.25	9
9.5	9
9.5	10
9.75	9
9.75	9
10	8
10	9
10	8
10	9
10	10
10.5	9
11	9
11	9

Weight Gain	Apgar at 1 minute
11	9
11	10
11	9
11	8
11.25	10
11.5	9
11.5	10
11.5	10
11.5	8
12	9
12	9
12	10
12	9
12	10
12	9
12	7
12	9
12	8
12	8
12	8
12.5	9
12.5	9
12.5	8
12.5	10
12.5	10
12.5	9
12.5	7
12.5	9
12.75	10
12.75	9
13	10
13	9
13	10
13	10
13	8
13	9
13.25	9
13.75	9
14	9
14	9
14	10
14	8
14	9

Weight Gain	Apgar at 1 minute
14	9
14	8
14.25	9
14.25	9
14.25	10
14.25	9
14.5	9
14.5	9
14.5	8
14.75	10
15	10
15	10
15	10
15	9
15	8
15	10
15	9
15	9
15	10
15	9
15.25	10
15.5	10
15.5	8
15.75	9

GROUP II: (16-26 pounds gained during pregnancy) N = 108

Weight Gain	Apgar at 1 minute
16	8
16	9
16	9
16	9
16	9
16	9
16	10
16.25	7
16.25	9
16.5	10
16.5	8
17	9
17	9
17.5	10
17.5	10
18	10
18	8
18	9
18	9
18	10
18	8
18.25	9
18.25	9
18.5	10
18.5	9
19	8
19	10
19	9
19.5	8
19.5	9
19.5	8
19.5	9
19.5	8
19.5	9
20	9
20	9
20	9
20	9
20	10
20	10
20.25	10

Weight Gain	Apgar at 1 minute
20.25	10
20.5	10
21	10
21	9
21	7
21	8
21	10
21.25	10
21.25	10
21.5	8
21.5	9
21.5	10
22	8
22	10
22	8
22	9
22	8
22.25	10
22.25	9
22.5	10
23	9
23	8
23	10
23.25	9
23.5	10
23.5	9
23.5	10
23.5	10
23.75	10
23.75	8
23.75	9
24	10
24	8
24	9
24	9
24.25	9
24.25	10
24.25	7
24.5	9
25	8
25	10
25	9
25	9

Weight Gain	Apgar at 1 minute
25	9
25	10
25	9
25	10
25	10
25	9
25	10
25.5	9
25.75	9
25.75	9
26	10
26	10
26	9
26	8
26	10
26	10
26	10
26	9
26.25	10
26.25	7
26.25	5
26.5	8
26.5	10
26.75	10

GROUP III: (27+ pounds gained during pregnancy) N = 108

Weight Gain	Apgar at 1 minute
27	10
27	10
27	8
27	9
27	9
27	10
27	10
27.25	10
27.25	10
27.25	9
27.25	9
27.25	10
27.5	9
27.5	9
27.5	10
27.75	9
28	10
28	9
28	9
28	10
28	10
28	9
28.5	9
28.5	9
28.5	9
28.75	9
29	10
29	10
29	9
29	8
29	10
29	9
29.25	9
29.5	8
30	10
30	10
30	9
30	9
30	10
30	8
30	9

Weight Gain	Apgar at 1 minute
30	9
30	7
30	10
30.25	9
30.25	10
30.25	8
30.5	9
30.5	10
30.75	8
30.75	8
31	9
31	9
31.5	10
31.5	10
31.5	10
32	10
32	9
32	10
32	10
32	9
32.25	9
32.25	8
32.25	8
32.75	9
33	10
33	9
33	10
33	9
33.5	9
33.5	10
34	10
34	9
34	9
34	9
34.25	9
34.75	10
35	9
35.5	9
36	9
36	10
36	9
37.5	8
38	9
38	9

Weight Gain	Apgar at 1 minute
38.75	8
39	9
39.5	9
40	6
40	10
40	9
42	10
42	4
42.25	9
43	10
43	9
43.25	8
45	8
45	8
46	10
49	8
50	10
50.75	8
52.25	10
54.5	9
55.5	10
56	10
58.5	8

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