The incidence and duration of breast feeding were determined via telephone questionnaires from a sample of 95 women who delivered healthy infants during the month of September 1982, in the greater metropolitan area of Portland, Oregon. This sample was limited in that the women were married, predominately white, over 25 years of age, and well-educated. According to the literature, these factors have a positive correlation with the incidence and duration of breast feeding. Consequently, the reported values for the incidence of breast feeding in the hospital of 88 percent and the duration of breast feeding for six months of 44 percent is higher than reported values on a national level. However, the average duration of breast feeding by women who had weaned their babies at the time of this survey (6.2 weeks) is consistent with other studies.

The information obtained from the questionnaires was used to measure the association between the incidence of breast feeding and the amount of information women received during their pregnancy; the duration of breast feeding and support system(s); and the
relationship between the incidence and duration of breast feeding to the social factors of income, education, age, and race.

Chi Square was the statistic used to compare the distribution of responses among the three subgroups: women who breast fed only, formula fed only, or both breast and formula fed.

Significant associations were not observed between the incidence of breast feeding and information or between the duration of breast feeding and support system(s). There was, however, an observed significant association between the incidence of breast feeding and the social factor of income. Additional findings revealed that women most likely to breast feed had themselves been breast fed as a baby, had breast fed their other children, and did not smoke cigarettes. Possible explanations for these results are discussed.
The Incidence and Duration of Breast Feeding Among Women in the Greater Metropolitan Area of Portland, Oregon

by

Joyce M. Marshall

A THESIS
submitted to
Oregon State University

in partial fulfillment of the requirements for the degree of
Master of Science

Completed May 2, 1983
Commencement June 1983
APPROVED:

Professor of Foods and Nutrition in charge of major

Head of department of Foods and Nutrition

Dean of Graduate School

Date thesis is presented May 2, 1983

Typed by Christina Pyle for Joyce M. Marshall
ACKNOWLEDGEMENTS

My deepest appreciation is extended to the many people who have helped me during this endeavor. Although I cannot list them all, the following people deserve special recognition. First and foremost, I wish to thank Dr. Elizabeth Johnson, my major advisor, who contributed significantly to my educational and personal development with her guidance, support, advice, and optimism throughout this study.

I am grateful to Helen Berg and Pamela Bodenroeder of the Survey Research Center. Special thanks are due to Ms. Berg for her time and patience as a statistical consultant.

I would also like to express my thanks to the staff and students of the Educational Opportunities Program.

I owe special thanks to my closest friends while I was in Corvallis--Dianne, Macceo, Christina, and Tony.

Above all, I wish to express my deepest gratitude and appreciation to my parents, my sister Donna, and my brother Jerry who have always been a source of encouragement, love, and support throughout my educational career.

Finally, my love and appreciation goes to Rhett and our daughter Kemi whose birth inspired my interest in infant feeding practices and breast feeding.
# TABLE OF CONTENTS

## INTRODUCTION
- Goals and Objectives 3
- Hypotheses 4

## REVIEW OF LITERATURE
- Historical Trends of Breast Feeding 5
  - Incidence of Breast Feeding 8
  - Duration of Breast Feeding 16
  - Age of Mother 17
  - Parity 20
  - Race 20
  - Education 21
  - Income 21
- Advantages of Breast Feeding 22
  - Colostrum 22
  - Nutritional Advantages of Breast Milk 22
    - Protein 23
    - Lipids 28
    - Carbohydrates 31
    - Minerals 32
    - Vitamins 34
  - Immunological Advantages 36
    - Immunoglobulins 37
  - Other Protective Factors 37
    - Lactoferrin and lysozyme 37
    - "Bifidus factor" 38
  - Psychological Advantages 39
  - Economic Advantages 39
  - Maternal Health Advantages 40
- Contraindications to Breast Feeding 41
- Availability of Information and Support 42
- Promotion of Breast Feeding 44

## METHOD
- Population 48
- Survey Instrument 49
- Data Collection 50
- Data Analysis 52
- Definition of Terms 52
RESULTS AND DISCUSSION

Hypothesis 1 56
Hypothesis 2 63
Hypothesis 3 64
Knowledge Statements 64
Additional Findings 68

SUMMARY AND CONCLUSION 81

BIBLIOGRAPHY 82

APPENDICES

Appendix A: Questionnaire 94
Appendix B: Communication with Women Without Listed Phone Numbers 104
Appendix C: Introductory Letter to Women with Listed Telephone Numbers 107
<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Percentage of Infants Breast Fed in Hospitals as Related to Income</td>
<td>15</td>
</tr>
<tr>
<td>2.</td>
<td>Number of Months of Breast Feeding, Up to 1973</td>
<td>18</td>
</tr>
<tr>
<td>3.</td>
<td>Number of Months of Breast Feeding for 1971 and 1980</td>
<td>19</td>
</tr>
<tr>
<td>4.</td>
<td>Nutrient Composition of Human and Cow's Milk</td>
<td>24</td>
</tr>
<tr>
<td>5.</td>
<td>Protein and Nonprotein Nitrogen Composition in Human Milk and Cow's Milk</td>
<td>25</td>
</tr>
<tr>
<td>6.</td>
<td>Fatty Acid Content in Human and Cow's Milk</td>
<td>29</td>
</tr>
<tr>
<td>7.</td>
<td>Demographics of Women Interviewed</td>
<td>57</td>
</tr>
<tr>
<td>8.</td>
<td>Relevant Factors Reported by Women Interviewed</td>
<td>58</td>
</tr>
<tr>
<td>9.</td>
<td>Percentage of Women Who Received and Who Did Not Receive Information on Breast Feeding from Their Doctors</td>
<td>60</td>
</tr>
<tr>
<td>10.</td>
<td>Percentage of Women Who Received and Who Did Not Receive Information on Breast Feeding from Babies' Doctors</td>
<td>61</td>
</tr>
<tr>
<td>11.</td>
<td>Percentage of Women Who Received and Who did Not Receive Information on Breast Feeding from Childbirth Educators</td>
<td>62</td>
</tr>
<tr>
<td>13.</td>
<td>Response to Statement 12a: &quot;Nursing Can Aid in Establishing a Woman's Milk Supply.&quot;</td>
<td>66</td>
</tr>
<tr>
<td>15.</td>
<td>Response to Question 1: &quot;Is Your Baby a Girl or Boy?&quot;</td>
<td>69</td>
</tr>
<tr>
<td>16.</td>
<td>Response to Question 3: &quot;Did You Attend Any Prenatal Classes?&quot;</td>
<td>70</td>
</tr>
<tr>
<td>17.</td>
<td>Response to Question 19: &quot;Do You Consume Alcoholic Beverages?&quot;</td>
<td>71</td>
</tr>
<tr>
<td>18.</td>
<td>Response to Question 7a (for Women Who Had More Than One Child): &quot;Did You Breast Feed Any of Your Other Children?&quot;</td>
<td>72</td>
</tr>
<tr>
<td>Table</td>
<td>Page</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>19. Response to Question 13a: &quot;Did Your Mother Breast Feed Any of Her Children?&quot;</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>20. Response to Question 18: &quot;Do You Smoke Cigarettes?&quot;</td>
<td>75</td>
<td></td>
</tr>
</tbody>
</table>
The Incidence and Duration of Breast Feeding Among Women in the Greater Metropolitan Area of Portland, Oregon

INTRODUCTION

Since the early 1900's, considerable research has been conducted on the importance of breast feeding infants. The nutritional advantages (Gerrard, 1974; Gyorgy, 1971; Jarvenpaa, Raiha, Rassin, and Gaul, 1982; Jelliffe and Jelliffe, 1978), the immunological advantages (Chandra, 1978; Cruz, Carlson, Garcia, Gebre-Medhin, Hovfander, Urrutia, and Hanson, 1982; Gerrard, 1974; Pittard, 1979), the psychological advantages (Guthrie and Guthrie, 1966; Herbert, Sluckin, and Sluckin, 1982; Klaus and Kennell, 1976; Newton, 1971, 1976), and the economic advantages (Goldfarb and Tibbetts, 1980; Lamm, Delaney, and Dwyer, 1977; Worthington-Roberts, 1981) of breast feeding are well-documented.

Many investigators have noted that accurate information and a strong support system are key factors in helping women breast feed successfully (Kemberling, 1979; Ladas, 1970; Lawrence, 1981; Sedgwick, 1921; Tibbetts and Cadwell, 1981; Winikoff and Baer, 1980). In 1919, Sedgwick established the Breast Feeding Investigation Bureau of the Department of Pediatrics at the University of Minnesota to study certain principles that increased the incidence and the duration of breast feeding (Sedgwick, 1921). Infant mortality and morbidity decreased considerably in Minnesota during the year of Sedgwick's research. He believed that this was a direct result of the Bureau's promotion and active support of breast feeding. In 1921, Reiss, a strong advocate of breast feeding, discussed the
importance of health professionals in encouraging women to breast feed. He affirmed that the obstetrician was in a key position to provide information on the advantages of breast feeding and to offer support to new mothers as they learned the technique and art of breast feeding. Ladas, in 1970, also emphasized the importance of providing accurate and pertinent information about breast feeding to pregnant women to enable them to make an informed decision on infant feeding practices. In 1978, the Committee on Nutrition of the American Academy of Pediatrics published a joint statement with the Nutrition Committee of the Canadian Paediatric Society (American Academy of Pediatrics, 1979) encouraging breast feeding for full-term infants. They also recommended that "breast milk should be practically the only source of nutrients for the first four to six months for most infants." In April 1982, the Councils of the Society for Pediatric Research (SPR) and the American Pediatric Society (APS), and the American Academy of Pediatrics jointly issued strong statements encouraging breast feeding. They included:

1. "A major effort must be undertaken to provide information to expectant mothers regarding the use of breast feeding as an effective natural form of infant nutrition, especially for normal fullterm infants for the first few months of life"; and

2. "Breast feeding should be encouraged in the hospital setting shortly after the birth of the baby" ("Promotion of Breast Feeding," 1982).

In May 1982, strong support was again expressed by the American Academy of Pediatrics, encouraging breast feeding.
Documentation of the increased incidence and duration of breast feeding since the early 1970's is supported in the literature. A national longitudinal study conducted from 1955 to 1980 by Martinez and Nalezienski (1981) illustrates that the incidence of breast feeding has increased from 24.7 percent in 1971 to 55.3 percent in 1980 and that the duration of breast feeding for five and six months has increased from 5.5 percent in 1971 to 24.9 percent in 1980. The literature also indicates a need for women to be given more information on the advantages of breast feeding and the establishment of stronger support systems by health care workers, since the majority of mothers who initiate breast feeding in the hospital stop within two to six weeks (James, 1981; Tibbitts and Cadwell, 1981; Winikoff and Baer, 1980).

**Goals and Objectives**

The goal of this study is to ascertain the incidence and duration of breast feeding among women who delivered healthy infants during the month of September 1982, in the greater metropolitan area of Portland, Oregon. This goal will be achieved by meeting the following objectives:

1. To determine the percentage of women who are breast feeding only, formula feeding only, or partially breast and formula feeding from birth to six months.

2. To determine if the formula-fed-only babies were breast fed at birth and, if so, the length of time they were nursed.
3. To determine if pregnant women are receiving information about the advantages of breast feeding and, if so, from whom.

4. To determine the support system(s) available and utilized by mothers who wish to breast feed their babies.

5. To determine if the social factors age, education, income, or race have an influence on the incidence and duration of breast feeding.

6. To identify the relationship between the incidence of breast feeding and the amount of information given, and the relationship between the duration of breast feeding and the support system(s) established.

Hypotheses

The specific hypotheses tested were:

1. Women who breast feed their babies, who feed their babies formula, and who do both are all equally likely to have received information on the advantages of breast feeding, during pregnancy.

2. Women who breast feed for less than six months and those who breast feed longer are equally likely to have an established support system.

3. Women who breast feed their babies, who feed their babies formula, and who do both do not differ from each other demographically.
REVIEW OF LITERATURE

Historical Trends of Breast Feeding

For over a century, the medical profession has been concerned about infant feeding practices. Between 1880-1890, with the increasing use of artificial feeding for infants, the first and primary concern of health care workers was the production and use of milk safe and free from harmful bacteria (Davis, 1937). At the turn of the century, health care workers knew that cow's milk used to feed infants was the main cause of infant mortality due to increased incidences of diarrhea and dysentery (Richardson, 1950); it was also general knowledge among physicians that "dirty milk" was the rule rather than the exception and that "breast-fed babies in New York tenements had better chances for life and health than their bottle-fed contemporaries on Fifth Avenue" (Richardson, 1950). During 1900 to 1915, with the advances of microbiology, the main concern of the medical profession shifted from the production of safe milk to the production of milk with an easily digestible soft curd similar to the curd of breast milk (Davis, 1937). Even though there was a ponderous amount of information on the advancement of artificial feeding in the literature during this period, the medical profession was still strongly in support of breast feeding rather than bottle feeding (Reiss, 1921). Because physicians were concerned about advertising practices of infant formula companies, the American Medical Association formed the Committee on Infant Feeding and Infant Foods.
in 1925. This committee made the following statement regarding its concern with infant formulas.

There should be an increased propaganda among physicians and in lay journals to increase knowledge about breast feeding. Such propaganda will include the dangers of artificial feeding of infants, particularly when carried on without the supervision of medical men. (Committee on Infant Feeding and Infant Foods, 1925).

By the 1930's, when artificial feedings for infants were generally assumed to be safe and easily digestible, the main concern of health care workers was in meeting the nutrient needs of infants for proteins, fats, carbohydrates, vitamins, and minerals (Davis, 1937). In 1932, when the popular trend was for mothers and some medical professionals to choose bottle feeding, the American Medical Association (which was still very cautious about advertising and artificial feeding practices for infants) proclaimed through their Committee on Foods:

The feeding of an infant by routine feeding formulas and instructions distributed by food manufacturers, or according to directions, printed material, or advice of any person other than the attending physician who can personally observe the condition of the baby, may seriously endanger the health of the infant.

Sedgwick (1921) reported the organization of a local study in Minneapolis to increase the incidence and duration of breast feeding. He formed the Breast Feeding Investigation Bureau of the Department of Pediatrics of the University of Minnesota, which provided information on breast feeding and offered support to the mother of every baby born in Minneapolis during the year 1919. When a baby was born, someone from the bureau would contact the mother and give her information on breast feeding. Thereafter, the mother was contacted on a monthly
basis. She was mailed a letter which encouraged her to continue breast feeding and was asked to return an enclosed postcard after answering questions on her experiences of breast feeding. If a mother was having difficulty with breast feeding, or did not return a card, she was contacted by telephone or in person by someone from the bureau. When necessary, a nurse would visit the mother on a daily basis until the difficulty was resolved. With this kind of support, Sedgwick showed that the incidence of breast feeding was 96 percent after two months and 72 percent by the end of nine months.

An unexpected outcome of Sedgwick's (1921) study was the decreased rate of infant mortality during the year of his study. Reiss (1921) was concerned with the high morbidity and mortality rate of artificially fed babies compared to breast fed babies. He, therefore, emphasized the importance of the obstetrician in encouraging women to breast feed their infants. Grulee, Sanford, and Herron (1934) published a study on how feeding practices affected the morbidity and mortality of over 20,000 infants from birth to nine months during the years 1924 to 1929 inclusive. These results showed without question that breast fed babies did much better against infection than did artificially fed babies. The results were as follows: of the 20,061 infants in the study, 48.5 percent were breast fed; 43.0 percent were partially breast fed; and 8.5 percent were totally artificially fed. The morbidity rate for totally breast fed infants was 37.4 percent; for the partially breast fed infants, 53.8 percent; and for the totally artificially fed infants, 63.6 percent. The mortality rate was 1.1 percent for the sample.
Of the infants who died, 6.7 percent were breast fed; 27.2 percent were partially breast fed; and 66.1 were artificially fed.

Due to the advances of medical science, the infant mortality rate was reduced from 82.3 per 1,000 live births in 1921 to 45.3 per 1,000 live births in 1941 (Trainham and Montgomery, 1946). According to the March 1983 Monthly Vital Statistics Report, the infant mortality rate for 1982 was 11.2 per 1,000 live births. In the early 1900's, the discoveries of science helped to improve obstetric and infant health care practices, thereby decreasing infant mortality and morbidity rates. Through these scientific discoveries, manufacturers were very successful in creating easily digestible, nutritious baby formulas. Discovering the need for improved sanitary conditions in hospitals for infants resulted in the formation of infant nurseries (Trainham and Montgomery, 1946). As a result of improved infant formulas and the establishment of infant nurseries, breast feeding and rooming-in were not actively encouraged (Jackson, 1946; Simsarian and McLendon, 1942; Trainham and Montgomery, 1946). Not only was breast feeding not actively encouraged, some physicians were willing to abandon breast feeding altogether (Richardson, 1950). This was in sharp contrast to the views on breast feeding held by the majority of physicians 50, or even 25, years earlier.

INCIDENCE OF BREAST FEEDING

Although there was a great amount of information written in the literature on the incidences and trends of breast feeding, it was primarily based on personal opinions and data from local studies
(Meyer, 1958; Robertson, 1961; Salber, Stitt, and Babbott, 1958). It was not until 1948, after Bain (1948) conducted her study, that the first nationwide scientific statistical survey on the incidences of breast feeding was published in the United States. Bain collected data from hospitals on the extent of breast feeding, breast and bottle feeding, and bottle feeding, from 1946 through 1947. Seventy-two percent of 3,500 hospitals responded, covering equally all regions, states (except Nevada), urban and rural areas, and sizes of hospitals. The conclusions from her study were:

1. Approximately one-third of the infants were bottle fed when discharged from the hospital, while two-thirds were breast fed or breast and bottle fed.

2. The lowest percentage of breast fed infants occurred in medium-sized hospitals, as compared to small or large hospitals.

3. There was a higher incidence of breast feeding in rural areas than in urban areas.

4. There were some major regional differences: In the Northeast, 23 percent of the infants discharged from the hospital were breast fed, 16 percent were breast and bottle fed, and 61 percent were bottle fed. In the Southeast, 55 percent of the babies were breast fed, 27 percent were breast and bottle fed, and 18 percent were bottle fed. In the Pacific Northwest, 31 percent were breast fed, 29 percent were breast and bottle fed, and 40 percent were bottle fed (Bain, 1948).
Jackson, Wilkin, and Auerbach (1956) published a statistical report on the incidence and duration of breast feeding in New Haven, Connecticut. The primary purpose of this study was "to review the incidence of breast feeding during a 10-year period, 1942 to 1951 inclusive, at the Grace-New Haven Community Hospital (University Service)." They found that the incidence of breast feeding had decreased from 81.9 percent in 1942 to 48.9 percent in 1946. There was a slight rise in 1947, stabilizing thereafter. The second purpose of this study was to "compare the duration of breast feeding of mothers who had their babies in a hospital rooming-in arrangement with that of mothers whose infants were taken care of in the nursery." The duration of breast feeding was determined from 1947 through 1949. They found a statistical difference between rooming-in and nursery mothers; i.e., the rooming-in mothers nursed at least a month longer than the nursery mothers. Jackson et al. (1956) speculated that the longer duration of breast feeding among rooming-in mothers may be due to constant presence of the baby, and the support and encouragement of the hospital staff in helping the mother learn to care for her new baby.

The trend in the decreased incidence of breast feeding is supported by other studies. In 1958, Meyer published a study similar to that of Bain, which surveyed the types of feeding practices (breast only, breast and bottle, or bottle only) of infants when discharged from the hospital after birth. The results showed that for the continental United States, breast feeding had decreased from 65 percent in 1946 to 37 percent in 1956. In all of the geographic
regions and in each of the states, there were more newborn infants leaving the hospital nurseries with artificial feeding than there were 10 years earlier (Meyer, 1958). As was the case 10 years earlier, the Northeast had the lowest percentage of infants being breast fed (12 percent for 1956 compared to 23 percent in 1946), while the Southwest still had the highest percentage of infants being breast fed (27 percent for 1956 compared to 53 percent in 1946). Meyer's (1958) survey is important because the data suggest an inclination toward a decrease in the incidence of breast feeding among American women.

Salber et al. in their studies on the incidence (1958) and duration (1959) of breast feeding concurred with Meyer's (1958) study. Salber et al. (1958) state: "The prevalence of breast feeding in the United States is the lowest of any country in the world that reports its figures. This is especially true of the initiation of breast feeding since nowhere else do a majority of women not try to feed their babies on the breast for any period." However, they found a slight increase in interest in breast feeding among college educated women of middle and upper social classes, but not enough interest to offset the decreasing trend in breast feeding. The study by Robertson (1961) also found this decreasing trend in breast feeding. He reported the incidence of breast feeding to be at 30 percent compared to the 1958 report by Meyer of 37 percent. The apparent decline in breast feeding was attributed to a lack of professional support, a lack of accurate information, and a decrease in rooming-in practices. Researchers, therefore, concur that nationally the incidence of breast feeding decreased from the 1940's to the late 1960's or early 1970's
(Bain, 1948; Hendershot, 1980; Hirschman and Hendershot, 1979; Martinez and Nalezienski, 1979).

In the late 1960's an upward trend in breast feeding started to occur among educated middle-income white women (Guthrie and Guthrie, 1966). There have been numerous studies published since the early 1970's which demonstrated that indeed there has been a continued upward trend in the incidence of breast feeding among women in the United States (Cole, 1977; Hendershot, 1980; Hirschman and Hendershot, 1979; Martinez et al., 1981; Martinez and Dodd, 1983; Martinez and Nalezienski, 1979, 1981; Paine and Coble, 1982; Rivera, 1971; Smith, Mhango, Warren, Rochat, and Huffman, 1982). Of the above researchers, four groups published results of studies conducted on a national level: Hendershot (1980); Hirschman and Hendershot (1979); Martinez and Nalezienski (1979, 1981); and Martinez and Stahle (1982).

The study by Hirschman and Hendershot (1979) entitled "Trends in Breast Feeding Among American Mothers" is based on data collected in the 1965 National Fertility Study (NFS) and the 1973 National Survey of Family Growth (NSFG). When data from both surveys are combined, the time frame utilized for analyzing the incidence of breast feeding of American women spans 42 years from 1931 to 1973. This study demonstrates that although the incidence of breast feeding varied according to race, geographic regions, socioeconomic and cultural backgrounds, nationally there was a dramatic decrease in the proportion of women who breast fed their babies in the 1950's and 1960's. According to their results, "over 70 percent of first-born infants in the 1930's were breast fed, while less than 30 percent in
The late 1960's and early 1970's were breast fed." The women who tended to breast feed lived in the West, had 16 years or more of education, and held jobs as professionals or managers; the women who tended not to breast feed were black, had less than 12 years of education, and did not work outside of the home. Hirschman and Hendershot (1979) also noted a leveling off of the decline of breast feeding in the early 1970's, indicating a possible reversal in the trend of breast feeding.

The findings in a follow-up study published by Hendershot (1980) entitled "Trends in Breast Feeding" are based upon data collected from 1973 through 1975 from Cycle II of the 1976 National Survey of Family Growth. According to the results reported by Hendershot, the proportion of American babies breast fed increased from 25 percent in 1973 to 35 percent in 1975. These findings suggest that the downward trend in breast feeding of the 1950's and 1960's was, in fact, reversed in the early 1970's, as indicated by Hirschman and Hendershot (1979) in Cycle I of the survey. Hendershot reported that the incidence of breast feeding increased among all of the categories he considered: parity, sex of the baby, mother's race, and mother's educational level. Even so, white women were still more inclined to breast feed than were black women (33 percent compared to 15 percent), and women with more than 12 years of education were more inclined to breast feed than were women with less than 12 years of education (48 percent compared to 24 percent).

Surveys published by Martinez and Nalezinski (1979, 1981) and Martinez and Stahle (1982) also support the results of the above
mentioned studies (that there has been a national upward trend in the incidence of breast feeding since the early 1970's). For a period of 25 years, from 1955 to 1980, they conducted a national survey to determine the trend and the incidence of breast feeding. Their results showed a decrease in the incidence of breast feeding from 1955 to 1971 and a reversal of the downward trend beginning in 1971. Their findings also indicate that the incidence of breast feeding sharply increased from 1971 to 1980. According to them, the incidence of breast feeding in hospitals increased from 24.7 percent in 1971 to 55.3 percent in 1980. An important finding of their 1979 publication is "that the increased incidence of breast-feeding has not been limited to higher income, better educated mothers. The increase in breast-feeding among the lower income, less educated mothers and those attending public clinics had been comparable, and in many instances greater than in mothers from higher socioeconomic strata." This also was reaffirmed in a report published by Martinez and Nalezienski (1981) entitled "1980 Update: The Recent Trend in Breast Feeding" and in a report published by Martinez and Stahle (1982) entitled "The Recent Trend in Milk Feeding Among WIC Infants." It is important to note that although the percentage of low-income mothers who are choosing to breast feed is increasing, the relative percentage of low-income mothers who actually breast feed is still very low compared to middle- and higher-income mothers (Table 1) (Martinez and Nalezienski, 1981).
TABLE 1

Percentage of Infants Breast Fed in Hospitals as Related to Income

<table>
<thead>
<tr>
<th>Income</th>
<th>Year of Birth of Child</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1971</td>
</tr>
<tr>
<td>Less than $7,000</td>
<td>22.3</td>
</tr>
<tr>
<td>$7,000 - $14,999</td>
<td>26.7</td>
</tr>
<tr>
<td>More than $15,000</td>
<td>NA</td>
</tr>
</tbody>
</table>

DURATION OF BREAST FEEDING

Many women who initiate feeding wean their babies from the breast earlier than they had originally intended (Hall, 1978; James, 1981). According to several investigators, women usually stop breast feeding within two to six weeks postpartum (James, 1981; Tibbetts and Cadwell, 1981; Winikoff and Baer, 1980). Two of the most frequently cited reasons as to why women stop breast feeding are problems associated with the breast or nipples and an insufficient milk supply (James, 1981; Ladas, 1970; Noval, 1947; Salber et al., 1959; Sedgwick, 1921). In 1917, Sedgwick addressed these problems in an article entitled "Establishment, Maintenance and Reinstitution of Breast Feeding." He stated that repeated demands on the breast by a vigorously sucking baby is the best way for a woman to maintain a supply of breast milk sufficient to support a young infant. He further explained that if a woman had sore, inverted, or fissured nipples, manual expression was one way to stimulate the breast in order to ensure an adequate supply of milk, while at the same time allowing some relief to the nipple. As reported earlier, he published a study in 1921, which showed that when new mothers are provided with information and support, they will breast feed for long periods of time.

In 1947, Noval conducted a study entitled "Some Factors Which Influence the Duration of Breast Feeding." She found that among 462 mothers, the sharpest decrease in breast feeding occurred within the first month after the baby was born. She also found that approximately half of the women surveyed had stopped breast feeding within two and a half months after the baby was born. Salber et al.
published a study in 1959 on the duration of breast feeding. Their report determined the duration of breast feeding among 68 mothers attending a health clinic in Boston, Massachusetts, from 1950 to 1956. They reported that of the women who initiated breast feeding, the median duration was two and nine-tenths months. Statistics from two national studies (Hirschman and Hendershot, 1979; Martinez et al., 1981) reported a decrease in duration of breast feeding among women who gave birth from 1950 to the early 1970's. According to Hirschman and Hendershot (1979), 32 percent of the women who breast fed in 1950 were still nursing at three months, while in 1971, only 7.1 percent of the women who initiated breast feeding were still nursing at three months (Table 2).

A reversal in this trend, beginning in the early 1970's, was reported by Martinez et al. (1981). They published figures which clearly demonstrated that the duration of breast feeding increased from 1971 to 1980 (Table 3).

From the late 1940's to the early 1950's, age, parity, race, education, and income were some of the factors which had a major influence on the duration of breast feeding (Hirschman and Hendershot, 1979; Jackson et al., 1956; James, 1981; Martinez et al., 1981; Martinez and Stahle, 1982; Salber et al., 1959).

**Age of Mother**

Studies which were conducted before 1950 gave conflicting data as to the influence of the mother's age in relation to the duration of
# TABLE 2

Number of Months of Breast Feeding, Up to 1973

<table>
<thead>
<tr>
<th>Year of Birth of Child</th>
<th>All Durations (percent)</th>
<th>Less than 3 Months (percent)</th>
<th>3 Months or More (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971-73</td>
<td>28.7</td>
<td>21.6</td>
<td>7.1</td>
</tr>
<tr>
<td>1966-70</td>
<td>27.9</td>
<td>19.7</td>
<td>8.2</td>
</tr>
<tr>
<td>1961-65</td>
<td>37.5</td>
<td>25.2</td>
<td>12.3</td>
</tr>
<tr>
<td>1956-60</td>
<td>42.9</td>
<td>29.5</td>
<td>13.4</td>
</tr>
<tr>
<td>1951-55</td>
<td>49.8</td>
<td>31.7</td>
<td>18.1</td>
</tr>
<tr>
<td>1950 or before</td>
<td>59.9</td>
<td>27.9</td>
<td>32.0</td>
</tr>
</tbody>
</table>

### TABLE 3

Number of Months of Breast Feeding for 1971 and 1980

<table>
<thead>
<tr>
<th>Year</th>
<th>Hospital (percent)</th>
<th>2 Months (percent)</th>
<th>3-4 Months (percent)</th>
<th>5-6 Months (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>24.7</td>
<td>13.9</td>
<td>8.2</td>
<td>5.5</td>
</tr>
<tr>
<td>1980</td>
<td>55.7</td>
<td>42.3</td>
<td>33.2</td>
<td>25.9</td>
</tr>
</tbody>
</table>

breast feeding (Herlitz, 1947; Jackson et al., 1956; Noval, 1947). However, more recent studies clearly indicate that the duration of breast feeding is related to age and that older women are more likely to nurse for longer periods of time than are younger women (James, 1981; Martinez and Stahle, 1982).

Parity

Parity did not seem to be a factor in the duration of breast feeding before 1950 (Jackson et al., 1956; Noval, 1947). Recent studies (Hirschman and Hendershot, 1979; James, 1981; Martinez et al., 1981; Smith et al., 1982) have shown that women are much more inclined to breast feed their first baby than their second. However, among babies who are breast fed "second-born babies are more likely than first-born babies to be breast fed for longer duration" (Hirschman and Hendershot, 1979).

Race

In the late 1940's, the duration of breast feeding among black women was much higher than was the duration of breast feeding among white women (Jackson et al., 1956). According to this study, the mean duration of breast feeding for white women was 3.2 months, while the mean duration of breast feeding for black women was 4.6 months. This was corroborated by Hirschman and Hendershot (1979), who reported that before 1950, the percentage of black women who breast fed past three months was 45.4 percent compared to 28.0 percent among white women. However, during the 1950's and 1960's, breast feeding declined more rapidly among black women than among white women. Hirschman and Hendershot (1979) reported that by the early 1970's, the duration of
breast feeding among black women for three months or longer had decreased to 1.5 percent compared to 7.6 percent among white women.

**Education**

Before 1950, there was not much difference between the duration of breast feeding and the educational level of the mother (Hirschman and Hendershot, 1979). After 1950, however, the duration of breast feeding increased among women who had some college education (Salber et al., 1959). This is confirmed by Hirschman and Hendershot (1979), Hendershot (1980), and Martinez and Nalezienski (1981), who also report that women with some college education are more inclined to breast feed their babies for longer durations than are women without some college education.

**Income**

Before 1950, lower income women were more inclined to breast feed for longer durations than were middle or upper-middle income women (Hirschman and Hendershot, 1979). Between 1950 and 1956, women from the upper and upper-middle income classes were more inclined to breast feed for longer periods of time than were women from the working and lower income classes (Salber et al., 1959). These results are consistent with the recent reports of Andrew, Clancy, and Katy (1980), James (1981), Martinez and Nalezienski (1981), Martinez and Stahle (1982), and Martinez and Dodd (1983). Martinez and Stahle (1982) also report that although the duration of breast feeding is short among low-income women, this is gradually increasing. According to Winikoff and Baer (1980), income is the factor that correlates most significantly with successful breast feeding. This is in agreement with Rivera (1971), who, in his study, reported that 25 percent of
middle-income children are breast fed for the first month of life. This is also consistent with the findings of other investigators (Filer, 1968; Fomon, 1974; Salber et al., 1958).

**Advantages of Breast Feeding**

Even though the infant mortality rate is decreasing in the United States, and cow's milk formulas have improved so that they are easily digested, safe, and free from harmful bacteria, there are still major reasons for encouraging breast feeding.

**COLOSTRUM**

Colostrum is the first fluid secreted from a woman's breast during the first two to four days after the birth of a baby. The protein content of colostrum is very high. This high protein content correlates with its high immunoglobulin content, which is approximately 95 percent of the total protein concentration (Goldfarb and Tibbetts, 1980). Colostrum is a rich source of immunological factors, especially lactoferrin and immunoglobulin A (IgA). These help protect the neonate against various infections caused by microorganisms such as Escherichia coli (E. coli) and Shigella (Fomon, 1974; Jelliffe and Jelliffe, 1979; Lawrence, 1980).

**NUTRITIONAL ADVANTAGES OF MATURE MILK**

A woman is producing mature milk by the third or fourth week after the birth of a baby (Vaughan, McKay, and Behrman, 1979).
Since the composition of the milk of a species is designed specifically for the young of that species, it follows that the nutrient content of human milk, from adequately nourished mothers, is "well adapted" for the maintenance and growth of human infants (AAP, 1978; Alfin-Slater and Jelliffe, 1977; Lawrence, 1980; Worthington-Roberts, 1981).

Major nutrient differences between human milk and cow's milk are well-documented (Table 4) (Hambraeus, 1977; Jelliffe and Jelliffe, 1978; Schneider and Worthington-Roberts, 1981). Some of the main differences are the smaller amounts of protein and minerals and the larger amounts of lactose in human milk as compared to cow's milk (Fomon, 1974). These differences are so important that the Recommended Dietary Allowance for infants, developed by the Food and Nutrition Board (FNB) of the National Research Council, are based on the nutrient analysis of human milk (FNB, 1980). Cow's milk formulas are prepared according to nutrient requirement of the infant and are modified to resemble human milk. In spite of this modification, there are significant biochemical differences when the nutritional advantages of breast milk in feeding the human infant are considered (Jelliffe and Jelliffe, 1978; Schneider and Worthington-Roberts, 1981).

Protein

The protein content of breast milk is much lower than that of cow's milk (tables 4 and 5).
# TABLE 4

**Nutrient Composition of Human and Cow's Milk**

<table>
<thead>
<tr>
<th>Constituent (per liter)</th>
<th>Human Breast Milk</th>
<th>Cow Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kcal)</td>
<td>690</td>
<td>660</td>
</tr>
<tr>
<td>Protein (gm)</td>
<td>9</td>
<td>35</td>
</tr>
<tr>
<td>Fat (gm)</td>
<td>45</td>
<td>37</td>
</tr>
<tr>
<td>Lactose (gm)</td>
<td>68</td>
<td>49</td>
</tr>
<tr>
<td>Vitamins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin A (IU)</td>
<td>1898</td>
<td>1025</td>
</tr>
<tr>
<td>Vitamin D (IU)</td>
<td>22</td>
<td>14</td>
</tr>
<tr>
<td>Vitamin E (IU)</td>
<td>2</td>
<td>0.4</td>
</tr>
<tr>
<td>Vitamin K (µg)</td>
<td>15</td>
<td>60</td>
</tr>
<tr>
<td>Riboflavin (µg)</td>
<td>160</td>
<td>440</td>
</tr>
<tr>
<td>Niacin (mg)</td>
<td>1.5</td>
<td>0.9</td>
</tr>
<tr>
<td>Pyridoxine (µg)</td>
<td>100</td>
<td>640</td>
</tr>
<tr>
<td>Folic acid (µg)</td>
<td>52</td>
<td>55</td>
</tr>
<tr>
<td>Cobalamin (µg)</td>
<td>0.3</td>
<td>4</td>
</tr>
<tr>
<td>Ascorbic acid (mg)</td>
<td>43</td>
<td>11</td>
</tr>
<tr>
<td>Minerals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>297</td>
<td>1170</td>
</tr>
<tr>
<td>Phosphorus (mg)</td>
<td>150</td>
<td>920</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>150</td>
<td>506</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>550</td>
<td>1368</td>
</tr>
<tr>
<td>Chlorine (mg)</td>
<td>385</td>
<td>1028</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>23</td>
<td>120</td>
</tr>
<tr>
<td>Sulfur (mg)</td>
<td>140</td>
<td>300</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>0.3-0.56</td>
<td>0.5</td>
</tr>
<tr>
<td>Iodine (mg)</td>
<td>30</td>
<td>47</td>
</tr>
<tr>
<td>Manganese (µg)</td>
<td>4-5.9</td>
<td>20-40</td>
</tr>
<tr>
<td>Copper (µg)</td>
<td>0.25-0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>0.5-4</td>
<td>3-5</td>
</tr>
<tr>
<td>Selenium (µg)</td>
<td>20</td>
<td>5-50</td>
</tr>
<tr>
<td>Fluoride (mg)</td>
<td>0.05</td>
<td>0.03-0.1</td>
</tr>
</tbody>
</table>

### TABLE 5
Protein and Nonprotein Nitrogen Composition in Human Milk and Cow's Milk*

<table>
<thead>
<tr>
<th></th>
<th>Human Milk</th>
<th>Cow's Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total nitrogen</strong></td>
<td>1.93</td>
<td>5.31</td>
</tr>
<tr>
<td><strong>Protein nitrogen</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Casein nitrogen</td>
<td>0.40 (2.5)</td>
<td>4.37 (27.3)</td>
</tr>
<tr>
<td>Whey protein nitrogen</td>
<td>1.03 (6.4)</td>
<td>0.93 (5.8)</td>
</tr>
<tr>
<td>α-lactalbumin</td>
<td>0.42 (2.6)</td>
<td>0.17 (1.1)</td>
</tr>
<tr>
<td>lactoferrin</td>
<td>0.27 (1.7)</td>
<td>traces</td>
</tr>
<tr>
<td>β-lactoglobulin</td>
<td>-</td>
<td>0.57 (3.6)</td>
</tr>
<tr>
<td>lysozyme</td>
<td>0.08 (0.5)</td>
<td>traces</td>
</tr>
<tr>
<td>serum albumin</td>
<td>0.08 (0.5)</td>
<td>0.07 (0.4)</td>
</tr>
<tr>
<td>Ig A</td>
<td>0.16 (1.0)</td>
<td>0.005 (0.03)</td>
</tr>
<tr>
<td>Ig G</td>
<td>0.005 (0.03)</td>
<td>0.096 (0.6)</td>
</tr>
<tr>
<td>Ig M</td>
<td>0.003 (0.02)</td>
<td>0.005 (0.03)</td>
</tr>
<tr>
<td><strong>Nonprotein nitrogen</strong></td>
<td>0.50</td>
<td>0.28</td>
</tr>
<tr>
<td>Urea nitrogen</td>
<td>0.25</td>
<td>0.13</td>
</tr>
<tr>
<td>Creatine nitrogen</td>
<td>0.037</td>
<td>0.009</td>
</tr>
<tr>
<td>Creatinine nitrogen</td>
<td>0.035</td>
<td>0.003</td>
</tr>
<tr>
<td>Uric acid nitrogen</td>
<td>0.005</td>
<td>0.008</td>
</tr>
<tr>
<td>Glucosamine</td>
<td>0.047</td>
<td>?</td>
</tr>
<tr>
<td>α-amino nitrogen</td>
<td>0.13</td>
<td>0.048</td>
</tr>
<tr>
<td>Ammonia nitrogen</td>
<td>0.002</td>
<td>0.003</td>
</tr>
<tr>
<td>Nitrogen from other components</td>
<td>?</td>
<td>0.074</td>
</tr>
</tbody>
</table>

*Values refer to gm N per liter; values within brackets refer to gm protein per liter.

There are two main types of protein in human and cow's milk. These are casein and whey protein (Fomon, 1974; Worthington-Roberts, 1981). The ratio of whey protein to casein in human milk and in cow's milk is very different: 60 percent to 40 percent in human milk and 20 percent to 80 percent in cow's milk (Table 5) (Lawrence, 1980; Worthington-Roberts, 1981).

When milk is ingested, the casein protein will precipitate into curds. Because the casein content of human milk is low, the curds are small and easily digested by the infant. On the other hand, because the casein content of cow's milk is high, the curds are large and less easily digested by the infant (Fomon, 1974; Worthington-Roberts, 1981). There is also an amino acid compositional difference between the two milks (Hambraeus, 1977; Jelliffe and Jelliffe, 1978; Lawrence, 1980). When considering the nutritional needs of newborn and premature infants, these differences are extremely important (Hambraeus, 1977). There are two significant amino acid compositional differences in the casein fraction of human milk (Hambraeus, 1977; Jelliffe and Jelliffe, 1978; Lawrence, 1980; Raiha, 1974). The first is the ratio of the sulfur-containing amino acids methionine and cysteine; the second is the low concentration of the aromatic amino acids phenyalanine and tyrosine (Hambraeus, 1977; Jarvenpaa et al., 1982).

The methionine/cysteine ratio of human milk is approximately one (Lawrence, 1980). In cow's milk, the methionine/cysteine ratio is seven times higher than that of human milk (Hambraeus, 1977; Jelliffe and Jelliffe, 1978). This low methionine/cysteine ratio in human milk
is advantageous to the newborn. The immature liver of the neonate cannot metabolize methionine to cysteine as adults can, because they have very low levels of the enzyme cystathionase; premature infants lack this enzyme (Gyorgy, 1971; Jelliffe and Jelliffe, 1978; Raiha, 1974). If the concentration of methionine becomes very high in the neonate, hypermethioninemia may develop and the central nervous system may become damaged (Worthington-Roberts, 1981).

The phenylalanine and tyrosine content of human milk is much lower than that of cow's milk (Hambraeus, 1977; Jelliffe and Jelliffe, 1978; Lawrence, 1980; Raiha, 1974). Low levels of phenylalanine and tyrosine are advantageous to premature and low birth-weight infants, because their immature livers are deficient in the enzymes necessary to metabolize either phenylalanine or tyrosine (Hambraeus, 1977; Raiha, 1974; Worthington-Roberts, 1981). If these amino acids become very high, this increases the possibility of low birth-weight and premature infants developing hyperphenylalanemia and hypertyrosinemia (Jarvenpaa et al., 1982; Raiha, 1974), in which case, the development of the central nervous system may be adversely affected (Worthington-Roberts, 1981).

Taurine, another sulfur-containing amino acid, has been found in large amounts in human milk compared to small amounts in cow's milk. Taurine has been linked with brain and eye development (Lawrence, 1980; Worthington-Roberts, 1981) and to growth and weight gain, but nothing conclusive has yet been found (Jarvenpaa et al., 1983).

As mentioned earlier, the whey content of human milk is approximately 60 percent while the whey content of cow's milk
is approximately 20 percent. Two of the major whey proteins in human milk are alpha-lactalbumin and lactoferrin (Hambraeus, 1977; Lonnerdal, Forsum, Gebre-Medhin, and Hambraeus, 1976). Alpha-lactalbumin is part of the enzyme galactosyl transferase, which is used to synthesize lactose (Worthington-Roberts, 1981). Although both cow's milk and human milk contain alpha-lactalbumin, its level in human milk is much higher than in cow's milk (Table 5). Lactoferrin inhibits the growth of certain bacteria by robbing them of their iron. It is present in high amounts in colostrum and significant amounts in mature human milk, but only in trace amounts in cow's milk (Hambraeus, 1977; Lawrence, 1980; Worthington-Roberts, 1981).

Lipids

The lipid portion of human milk provides approximately 50 percent of the calories for the infant (Jelliffe and Jelliffe, 1978; Hambraeus, 1977). When comparing human milk to cow's milk, the fat content appears to be similar (between 3.5 gm per 100 ml to 4.5 gm per 100 ml for human milk and approximately 3.7 gm per 100 ml for cow's milk) (Fomon, 1974; Lawrence, 1980). However, there are major differences in the composition of the lipid fraction of human milk and that of cow's milk (Goldfarb and Tibbetts, 1980; Jelliffe and Jelliffe, 1978; Mata, 1978; Worthington-Roberts, 1981). Human milk contains more long-chain unsaturated and polyunsaturated fatty acids than does cow's milk (Table 6) (Goldfarb and Tibbetts, 1980; Hambraeus, 1977; Jelliffe and Jelliffe, 1978; Widdowson et al., 1974). The concentration of linoleic acid is much higher in breast milk than in cow's milk (Schneider and Worthington-Roberts, 1981).
<table>
<thead>
<tr>
<th>Fatty Acid</th>
<th>Human Milk</th>
<th>Cow's Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Saturated</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C12:0 (Lauric)</td>
<td>4.8</td>
<td>3.2</td>
</tr>
<tr>
<td>C14:0 (Myristic)</td>
<td>6.2</td>
<td>11.5</td>
</tr>
<tr>
<td>C16:0 (Palmitic)</td>
<td>23.7</td>
<td>30.0</td>
</tr>
<tr>
<td>C18:0 (Stearic)</td>
<td>6.7</td>
<td>14.3</td>
</tr>
<tr>
<td><strong>Unsaturated</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C16:1 (Palmitoleic)</td>
<td>4.6</td>
<td>2.0</td>
</tr>
<tr>
<td>C18:1 (Oleic)</td>
<td>37.4</td>
<td>31.3</td>
</tr>
<tr>
<td>C18:2 (Linoleic)</td>
<td>9.0</td>
<td>1.8</td>
</tr>
<tr>
<td>C18:3 (Linolenic)</td>
<td>3.4</td>
<td>trace</td>
</tr>
</tbody>
</table>

*Values are given as gm per 100 gm fat.

This is important because linoleic acid is an essential fatty acid and is also used in the synthesis of prostaglandins (Hambraeus, 1977; Jelliffe and Jelliffe, 1978).

Within the past few years, the high cholesterol concentration of breast milk has been under investigation by many researchers. Because human milk has a higher cholesterol level than does cow's milk and especially cow's milk formulas (Friedman and Goldberg, 1975; Worthington-Roberts, 1981), there is a great deal of controversy over the advantages of consuming a high cholesterol diet early in life and its effect on the serum cholesterol level of adults (Hulbron, Aubert, Bourgeois, and Lemonnier, 1982; Jarvenpaa et al., 1982; Potter and Nestel, 1976; Reiser, 1975). Jensen, Hagerty, and McMahon (1978) summarized the cholesterol controversy with the following statement:

It has been hypothesized and possibly disproven that consumption of a diet containing relatively large amounts of cholesterol early in life would enable the adult to cope more efficiently with large amounts of cholesterol. The data on both sides of the argument are incomplete and are likely to remain so, unless suitable studies with animal models can be done. It is our opinion that the hypothesis may not be biologically sound because of the wide variation in cholesterol contents of human milk.

It is suggested that the high digestibility and absorption of the fat in human milk may be due to its lipase activity (Goldfarb and Tibbetts, 1980; Holt, Tidwell, Kirk, Cross, and Neale, 1935; Tomarelli, Meyer, Weaber, and Bernhart, 1968). There are two main lipases present in breast milk. One is a bile salt-stimulated lipase; the other is a serum-stimulated lipase which is inhibited by bile salts (Hernell and Olivecrona, 1974a, 1974b). The purpose and function of the serum-stimulated lipase is unknown (Hernell,
Researchers agree that the bile salt-stimulated lipase is the major lipase in human milk (Hall, 1975a; Hernell et al., 1977; Hernell and Olivecrona, 1974a, 1974b). Its molar concentration in the duodenum of the newborn infant is ideal for the easy hydrolysis of all three ester bonds of long-chain triglycerides in human milk (Hernell and Olivecrona, 1974b; Hernell et al., 1977; Signer, Murphy, Edikins, and Anderson, 1974). In cow's milk, there is only one main lipase, a serum-stimulated lipase (Hernell and Olivecrona, 1974a).

In addition to the activity of the bile salt-stimulated lipase, the high absorption of fat in human milk may also be due to the high proportion of palmitic acid located in the 2-position (Filer, Mattson, and Fomon, 1969; Gyorgy, 1971; Lawrence, 1980). When palmitic acid is located in the 2-position, it is less often hydrolyzed off the glycerol moiety. Instead, it is absorbed as a 2-monoglyceride. On the other hand, palmitic acid in cow's milk is usually located in the first or third positions (Filer et al., 1969; Gyorgy, 1971; Lawrence, 1980). Upon hydrolysis, the free "palmitic acid reacts with dietary calcium and magnesium to form insoluble soaps" (Filer et al., 1969). These soaps are then excreted, which results in a loss of fat, calcium, and magnesium to the infant (Filer et al., 1969; Gyorgy, 1971).

Carbohydrates

Lactose is the main carbohydrate in both human milk and cow's milk (Goldfarb and Tibbetts, 1980; Jelliffe and Jelliffe, 1978; Lawrence, 1980; Worthington-Roberts, 1981). However, the
concentration of lactose is higher in human milk than in cow's milk (Table 4). The nutrient benefit of this is that lactose is broken down to glucose and galactose at a slow steady rate in the intestines. Since glucose and galactose are easily absorbed, the slow breakdown rate of lactose ensures a steady release of these two sugars (Jelliffe and Jelliffe, 1978; Worthington-Roberts, 1981).

An important component of breast milk is the "bifidus factor," a N-containing carbohydrate which stimulates the growth of Lactobacillus bifidus (L. bifidus) (Gyorgy, 1953, 1971). Further discussion on the bifidus factor will be presented in the section on Immunological Advantages of Breast Feeding.

**Minerals**

The ash content of human milk is much lower than the ash content of cow's milk, possibly reflecting a slower rate of growth for the human infant (Table 4) (Fomon, 1974; Jelliffe, 1976; Worthington-Roberts, 1981). Many investigators report that minerals present in human milk are better absorbed and utilized by the infant than the minerals in cow's milk. Therefore, the mineral requirements for breast and formula fed infants may be different (MacDonald, Gibson, and Miles, 1982; Picciano, Calkins, Garrick, and Deering, 1981; Vaughn, Weber, and Kemberling, 1979). Of special concern to investigators is the adequacy of the trace minerals iron and zinc in human milk for the totally breast fed infant.

Although the iron content of breast milk is similar to the iron content of cow's milk (Table 4), investigators report that the bioavailability of iron in breast milk is approximately 50 percent
compared to the bioavailability of iron in cow's milk which is approximately 10 percent (Picciano et al., 1981; Picciano and Guthrie, 1976; Saarinen, Siimes, and Dallman, 1977; Schneider and Worthington-Roberts, 1981). Researchers do not know the reason(s) for the higher absorption of iron in breast milk; however, they suggest that it may be due to the low protein, low phosphorus, and high lactose content of breast milk (Schneider and Worthington-Roberts, 1981). Because of the high bioavailability of iron from breast milk and the large accumulation and storage of iron by the fetus, it is suggested that the iron content of breast milk is sufficient to meet the nutrient needs of the exclusively breast fed term baby for the first four to six months of life (AAP, 1978; Saarinen et al., 1977).

In 1978, Johnson and Evans reported on the bioavailability of zinc, using rats as the test animal. According to their study, the bioavailability of zinc was 59.2 percent from breast milk, 42 percent from cow's milk, and 26.8 to 39.5 percent from infant formulas. They suggested that human infants absorb more zinc than do rats, therefore, they concluded that the zinc content of human milk is sufficient to meet the zinc needs of young infants. Since this study is not conclusive, further research is needed in this area.

Although calcium, a major mineral, is present at much lower concentrations in breast milk than in cow's milk (Table 4), the absorbability of calcium in breast milk is much higher, approximately 51 percent, compared to cow's milk, which is approximately 17 percent (Jelliffe and Jelliffe, 1971; Schneider and Worthington-Roberts, 1981). The high absorbability of calcium of breast milk may be due to
the high calcium to phosphorus ratio (2:1), compared to the calcium to phosphorus ratio of cow's milk (1.2:1) (Worthington-Roberts, 1981). If the phosphate level is high, it will bind to calcium in the gastrointestinal tract and interfere with the amount of calcium absorbed (Vermeersch, 1981).

As mentioned earlier, human milk is well-adapted for the nutrient needs of young infants. Because the low mineral and protein content of breast milk produces a low renal solute load, the immature kidney of the newborn is able to tolerate human milk much better than cow's milk (AAP, 1978; Schneider and Worthington-Roberts, 1981; Ziegler and Fomon, 1971). When an infant consumes a diet which has a high solute load, as in cow's milk, the infant will need to consume a large amount of water to ensure proper renal excretion of this extra solute; if sufficient water is not consumed, the infant may become severely dehydrated (Anderson, Chinn, and Fisher, 1982; Schneider and Worthington-Roberts, 1981; Ziegler and Fomon, 1971).

**Vitamins**

A woman's diet can influence the vitamin composition of her breast milk. If a woman was well-nourished during pregnancy, and is well-nourished during lactation, the composition of vitamins in human milk will usually meet the nutritional needs of the infant for the first four to six months of life (Goldfarb and Tibbetts, 1980; Jelliffe, 1976; Jelliffe and Jelliffe, 1978; Worthington-Roberts, 1981). Fat-soluble vitamins vary less than water-soluble vitamins since they can be taken from the mother's stores built up during pregnancy. There are questions, however, about the adequacy of

The vitamin K content of human milk is very low. In the adult, vitamin K is produced in the intestines; however, it takes several days for the sterile gut of the newborn to produce a sufficient microbe population to produce an adequate amount of vitamin K to synthesize blood clotting factors (Lawrence, 1980; Worthington-Roberts, 1981). Therefore, the American Academy of Pediatrics (1980) recommends that at birth, all infants receive a vitamin K injection to prevent hemorrhagic disease of the newborn.

Both breast milk and cow's milk have low levels of vitamin D; however, cow's milk formulas are fortified with this vitamin. Because of the low levels of vitamin D in breast milk, there is concern about its adequacy for the exclusively breast fed baby. Earlier studies reported that the water-soluble form of vitamin D in breast milk was biologically active, and it was hypothesized then that the vitamin D level in breast milk was adequate to meet the nutrient needs of the human infant (Lakdawala and Widdowson, 1977). However, recent research shows, conclusively, that the water-soluble form of vitamin D is not biologically active in human milk (Nagubandi, Londowski, Bollman, Tietz, and Kumar, 1981; Reeve, Chesney, and DeLuca, 1982; Reeve et al., 1981). Since vitamin D levels are low in breast milk, and the water-soluble form of vitamin D is not biologically active, investigators are not clear as to the biochemical mechanism(s) that
help maintain calcium balance in the exclusively breast fed infant. One theory, as reported in a recent animal study by Pahiya and DeLuca (1981), is that prolactin (a hormone present at high levels during pregnancy and lactation) and not vitamin D is responsible for regulating calcium metabolism in the rat. The significance of this report for human infants is under investigation. However, until there is conclusive evidence on the adequacy of vitamin D in breast milk, many researchers recommend that the fully breast fed infant should be given a vitamin D supplement for optimal bone mineralization (Goldfarb and Tibbetts, 1980; Greer et al., 1981).

IMMUNOLOGICAL ADVANTAGES

Mothers are able to offer immunological protection to the fetus via the placenta, and to the newborn via breast milk (Goldfarb and Tibbetts, 1980; Lawrence, 1980; Welsh and May, 1979). Evidence by Chandra (1978) suggests that the greatest immunological protection against intestinal pathogens occurs when an infant is totally breast fed. Although there are many immunological factors in human milk that seem to protect the infant against infections, investigators are primarily concerned with those immune factors that destroy or inhibit intestinal bacteria and viruses (Mata, 1978; Worthington-Roberts, 1981).

The majority of cells, approximately 90 percent, in human milk are macrophages. The exact mechanism of the protective function of macrophages is unclear (Worthington-Roberts, 1981). What is known is that macrophages are phagocytic and contain immunoglobins,
lactoferrin, and lysozyme, which protect the newborn against gastrointestinal (GI) infections (Pittard, 1979; Worthington-Roberts, 1981).

**Immunogloblins**

The five immunoglobins have been measured in human milk: IgA, IgG, IgM, IgD, and IgE (Goldman, 1976; Lawrence, 1980). However, milk IgA, called Secretory IgA (SIgA), is the main and most active immunoglobulin of human milk (Goldman, 1976; Lawrence, 1980; Worthington-Roberts, 1981). As an antibody, SIgA functions against a number of microorganisms that may be present in human milk, e.g., polio and influenza viral agents (Pittard, 1979). Secretory IgA also functions as an antibody against microbial antigens, such as E. coli, present in the GI tract (Goldman, 1976; Pittard, 1979). Because it resists digestive enzymes and pH changes, SIgA reaches the intestinal tract intact. The exact mechanism(s) by which SIgA protects the infant from viral and bacterial pathogens is unknown (Goldman, 1976; Welsh and May, 1979; Worthington-Roberts, 1981). It is hypothesized, however, that the immunoglobulins bind to the mucosal surface at certain sites of the GI tract and prevent the invasion of pathogenic organisms by acting as an "antiseptic paint" (Williams and Gibbons, 1972; Worthington-Roberts, 1981).

**OTHER PROTECTIVE FACTORS**

**Lactoferrin and Lysozyme**

Lactoferrin is an iron-binding protein that inhibits bacterial growth by robbing bacteria of their iron (Fomon, 1974). Since
lactoferrin occurs in large amounts in breast milk, it is a major protective factor to the newborn infant (Welsh and May, 1979). In cow's milk, however, lactoferrin is present only in trace amounts (Hambraeus, 1977). Lysozyme, another antimicrobial factor in breast milk, is an enzyme that digests bacterial cell walls. The concentration of lysozyme in human milk is very high and is approximately 300 times that of cow's milk (Goldman, 1976; Pittard, 1979).

"Bifidus Factor"

The bifidus factor, a N-containing carbohydrate growth factor, helps to support the growth of L. bifidus. L. bifidus is important because it helps ensure an acid medium in the infant's intestines by breaking down lactose into lactic acid and acetic acid (Chandra, 1978; Worthington-Roberts, 1981). These products help form the acid stools of the breast fed baby. Because of this acidic intestinal environment, many bacteria such as Proteus, Clostridium, and E. coli are inhibited from growing in the intestines of the breast fed infant (AAP, 1978; Chandra, 1978; Worthington-Roberts, 1981). In 1953, Gyorgy demonstrated that the bifidus factor occurs in large amounts in human milk and only in small amounts in cow's milk. Therefore, it is only the exclusively breast fed infant who is able to take full advantage of the microbiological benefits of L. bifidus (Chandra, 1978; Jelliffe and Jelliffe, 1978; Lawrence, 1980; Worthington-Roberts, 1981).
PSYCHOLOGICAL ADVANTAGES

Psychological advantages of breast feeding are controversial and difficult to document (Herbert et al., 1982; Klaus and Kennell, 1976; Newton, 1976; Svejda, Campos, and Ende, 1980). Many women choose to breast feed their babies because of the concept of bonding, i.e., "that special relationship and closeness that accompanies nursing" (Lawrence, 1980). Various studies suggest that the very nature of breast feeding helps to ensure specific interactions between a mother and her child, which fosters bonding (Klaus and Kennell, 1976; Newton, 1971, 1976). For example, a woman who breast feeds must hold her child, touch her child, and have skin-to-skin contact with her child. These interactions can promote bonding and provide physical and emotional satisfaction to both the mother and the child (Klaus and Kennell, 1976). Since the above interactions can also apply to a child who is being bottle fed, bonding can and does occur between a mother and a child who is being bottle fed (Svejda et al., 1980). On the other hand, bonding is not fostered by a mother who bottle feeds her child without holding or touching her baby.

ECONOMIC ADVANTAGES

Worthington-Roberts (1981) states that although cost may not be an incentive to breast feed in the United States, it may be a major consideration for some families. Lamm et al. (1977) report that breast feeding can be more economical than formula feeding, depending on the foods used by the mother. Jelliffe and Jelliffe (1978), on the other hand, stress unequivocally that breast feeding is
more economical than formula feeding and that breast feeding is the cheapest way of feeding infants during the first six months of life.

MATERNAL HEALTH ADVANTAGES

There is now strong scientific evidence that prolactin, a hormone secreted during lactation, may function as a contraceptive for the mother who is exclusively breast feeding her infant (Jackson, 1977; Jelliffe, 1976; Lawrence, 1980). Because of individual variations, breast feeding should not be considered as a contraceptive on an individual basis (AAP, 1978; Worthington-Roberts, 1981). However, on a population basis, breast feeding can be considered as an effective child-spacing method (Jackson, 1977).

Oxytocin, another hormone secreted during lactation, helps the uterus return to its pre-pregnancy size if the baby is allowed to nurse soon after delivery (Lawrence, 1980; Schneider and Worthington-Roberts, 1981).

Besides hormonal advantages, there are other advantages which can benefit a woman who breast feeds. Convenience is often considered an advantage, because a mother who breast feeds is not concerned with buying and preparing formula (Schneider and Worthington-Roberts, 1981). Lactation can help a woman lose the weight she gained during her pregnancy, since it takes approximately 900 calories to produce a liter of milk (Schneider and Worthington-Roberts, 1981; Worthington-Roberts, 1981).
Contraindications to Breast Feeding

Reiss (1921) listed the following conditions of the mother as contraindications for breast feeding: (a) tuberculosis, (b) breast abscess, (c) a chronic nervous condition, and (d) acute and infectious diseases. He also advised women who were ill due to influenza, pneumonia, typhoid, and other infectious diseases to temporarily remove the baby from the breast until they have recovered.

More recently, Schneider and Worthington-Roberts (1981) listed the following conditions as contraindications for breast feeding:

(a) serious disease, such as tuberculosis;
(b) use of drugs that may harm the infant;
(c) severely inverted nipples;
(d) marked maternal disinterest in breast feeding;
(e) serious contamination of human food, air, or water with substances that may pass to the infant through mother's milk;
(f) other rare situations.

In general, if breast feeding would be a medical risk to the infant or mother, then a woman should not breast feed (Reiss, 1921; Lawrence, 1980; Worthington-Roberts and Taylor, 1981).

For situations where an infant is not being breast fed, the American Academy of Pediatrics recommends the use of an appropriate infant formula. The Committee on Nutrition of the American Academy of Pediatrics has provided guidelines for minimum and maximum requirements of nutrient levels in prepared formulas for normal healthy infants. Because infant formulas serve a need in providing adequate nutrition for infants who are not being breast fed, their importance cannot be ignored by health care professionals who encourage, support, and promote breast feeding (Ogra and Green, 1982).
Availability of Information and Support

On a national level, the increase in the incidence and duration of breast feeding is attributed to: (a) the formation and support of such lay organizations as La Leche League International and the International Childbirth Education Association (Guthrie and Guthrie, 1966; Jelliffe, 1976; Kemberling, 1979); (b) the fact that mothers now want to be more "natural" in their feeding practices (Winikoff and Baer, 1980); and (c) the support of professional organizations such as the American Academy of Pediatrics, the Canadian Paediatric Society, and the Councils of the Society for Pediatric Research and American Pediatric Society (AAP, 1982; "Promotion of Breast-feeding," 1982).

Another speculation for the current trend in the increased incidence of breast feeding is that mothers are reacting in part "against the success of modern medicine in dehumanizing the bonds between mother and child" (Wade, 1974). Although the positive benefits of modern science and technology have greatly reduced maternal and infant mortality, Kent (1981) stated that it has done so at the expense of maternal-infant bonding and breast feeding practices. In conjunction with this concept, it is not coincidental that the increase in breast feeding is coupled with an increase in assertiveness on the part of women to take an active and vocal role in their pregnancy and birth experience (Kent, 1981).

Although the incidence and duration of breast feeding is increasing among all women, breast feeding, as the only source of food for the majority of infants, is being terminated much sooner than the
four to six months recommended by the American Academy of Pediatrics (AAP, 1978; Andrew et al., 1980; Hendershot, 1980; Jelliffe and Jelliffe, 1971; Martinez and Stahle, 1982). In fact, investigators report that a large percentage of women stop breast feeding within two to six weeks postpartum (before lactation is fully established) due to lack of information and/or strong support system(s) (Kemberling, 1979; Ladas, 1970; Tibbetts and Cadwell, 1981). In other cultures, where breast feeding is part of the norm, a doula or female relative has the responsibility of supporting and working with new mothers until lactation is fully established (AAP, 1980; Jelliffe and Jelliffe; Tibbetts and Cadwell, 1981). However, according to some investigators, a large number of women in the United States are not getting either information or support encouraging them to breast feed (James, 1981; Kemberling, 1981; Tibbetts and Cadwell, 1981; Winikoff and Baer, 1980).

Researchers agree that most women who decide to breast feed do so before or during their pregnancy. Therefore, health care workers who are involved in prenatal care are in a prime position to actively promote and encourage women to breast feed, by providing them with information and support (Ladas, 1970; Sedgwick, 1921; Tibbetts and Cadwell, 1981; Winikoff and Baer, 1980). Once the baby is born, hospitals can aid in promoting breast feeding by offering and encouraging the practice of "rooming in" and by eliminating the standard practice of distributing free samples of commercial formula to every new mother (AAP, 1982). Pediatricians can foster breast feeding by seeing the baby and the mother within 48 hours after they
are discharged from the hospital, and any time thereafter as support is needed by the new mother (Kemberling, 1979). In general, when women are "given adequate instruction, emotional support, and favorable circumstances, 96% of new mothers can breast-feed successfully" (AAP, 1980).

Promotion of Breast Feeding

There is strong support in the literature among individual professionals—medical doctors, nurses, and nutritionists—and professional organizations promoting and encouraging breast feeding because of the advantages of human milk over cow's milk. As mentioned in the Introduction, the Committee on Nutrition of the American Academy of Pediatrics published a joint statement with the Nutrition Committee of the Canadian Paediatric Society (AAP, 1978) encouraging breast feeding for full-term infants. They made several recommendations on ways to increase breast feeding, since "ideally, breast milk should be practically the only source of nutrients for the first four to six months for most infants" (AAP, 1978). The American Academy of Pediatrics published a follow-up statement in 1980, entitled "Encouraging Breast Feeding," which suggested practical ways for health care workers to promote breast feeding. It wrote that:

Physicians, nurses, nursing personnel, and hospitals need to examine their practices and procedures that encourage or discourage breast-feeding. The cultural attitudes and life-styles of today's world tend to mitigate against breast-feeding. Yet the benefits of breast-feeding to the neonate and the mother are so numerous that the pediatrician must strongly encourage the practice.
In April 1982, the American Academy of Pediatrics, in conjunction with the Joint Councils of the Society for Pediatric Research and the American Pediatric Society, published nine recommendations on ways to promote breast feeding in the United States as well as throughout the world ("Promotion of Breast Feeding," 1982):

1. A major effort must be undertaken to provide information to expectant mothers regarding the use of breast feeding as an effective natural form of infant nutrition, especially for normal full term infants for the first few months of life.

2. Breast feeding should be encouraged in the hospital setting shortly after the birth of the baby. The practice of "rooming in" should be fostered worldwide to implement breast feeding under trained observers before the mother and infant are discharged from the hospital.

3. The standard nonprescription mode of in-hospital neonatal nutrition should be mother's milk unless the mother has previously decided in favor of bottle feeding.

4. ...The mass distribution of free sample packs of commercial formula to every postpartum mother should be discouraged in hospital settings. However, upon specific recommendation of a physician, formula can be made available to mothers who have elected to use formula feeding for their infants.

5. In developing countries, until adequate levels of education regarding breast feeding practices are attained in expectant parents and related medical personnel, the activities of in-hospital "milk nurses" acting on behalf of infant formula producers should be discontinued or clearly limited to mothers who have previously indicated an educated preference for formula feeding.

6. In technologically emerging nations and in individual situations in "middle class" America, where the mother may be working full time and away from the child for long hours, every effort should be made to encourage breast feeding whenever possible before a decision is made to induce cessation of lactation.
7. The use of "surrogate" nursing mothers and distribution of stored milk from available milk banks should be carefully regulated to a few selected situations and large scale use of such facilities is not recommended at this time. Even when milk from milk banks is employed, extreme caution should be exercised in preventing microbial infections or toxin ingestions in susceptible neonates from potentially infected or contaminated donor mothers.

8. The AAP and Councils of the Society for Pediatric Research and the American Pediatric Society are opposed to any ban on a global basis of advertisement of commercial milk formulas or weaning food products, unless such products can be demonstrated to be potentially hazardous to human nutrition and infant well being. At the same time, it is recommended that such promotional activities be directed at the physicians and other health care personnel, and not at the "lay public" at large.

9. Finally, the legal attitudes of most modern societies toward breast feeding must change to accommodate the needs of nursing mothers to breast feed in public facilities and places of work. Specific legislative actions may be required in many countries to implement and encourage such practices.

The following month, May 1982, the American Academy of Pediatrics again published strong statements in favor of breast feeding, in an article entitled "The Promotion of Breast Feeding" (AAP, 1982). To promote breast feeding it recommended that:

1. Pediatricians should work to improve the knowledge of health care providers about optimal infant nutrition, stressing the nutritional, immunologic, and other advantages of breast milk, and the appropriate use of breast milk substitutes.

2. Pediatricians should work to improve the knowledge of all potential expectant and current parents on optimal infant nutrition, emphasizing the positive aspects of breast-feeding and the proper choice and utilization of breast milk substitutes.
3. Within hospitals, both the administrative and the professional staff should examine in detail their procedures for perinatal care. Emphasis should be placed on encouraging those practices that are supportive of breast-feeding and discourage those that are not.

4. Pediatricians and all those with concern for healthy infants should work to improve the environmental support system for mother after the method of feeding their infants has been chosen.
METHOD

Population

The population of this study included women residing in the greater metropolitan area of Portland who gave birth to infants during the month of September 1982. This area was chosen because it is the largest urban area in the state of Oregon. The names and addresses of the women were selected according to zip code from the Multnomah County Office of Vital Statistics. Because the zip code prefix for the greater metropolitan area of Portland is 972, all women who lived in an area where the zip code started with 972 were selected. A list of 130 names was obtained after searching the 1982 birth certificate abstracts that were available for public use and information. More names were not available because, in accordance with Oregon State Law 432.19, the Office of Vital Statistics cannot make available for public information births under the following conditions:

1. Births in which the parent requests that the birth abstract not be available for public or business contact lists, or

2. If the birth certificate indicates:

   a. that a physical, mental, or social problem may exist,

   b. the father of the child is not identified or the surname of the child differs from that of the father,

   c. the fetus was stillborn,

   d. the infant died shortly after birth,

   e. the infant has a congenital malformation, or

   f. the mother has a disability or died.
Based on the 1980 Census Population, there were 9,110 resident births in Multnomah County in that year. Of these births, 6,806 were from Portland. This is an approximation of 567 births per month. Because of the limitations mentioned above, the sample for this study represents approximately 23 percent of the mothers who gave birth during the month of September 1982.

**Survey Instrument**

A modified version of the telephone survey technique as described by Dillman (1978) was the research design method used in this study. The questionnaire was developed by this investigator with the assistance of the Survey Research Center of Oregon State University. The questionnaire was designed to test the three hypotheses as mentioned in the introduction; to determine related factors which might influence a woman's decision to breast feed; and to help ascertain a woman's level of knowledge of breast feeding. In November 1982, a preliminary questionnaire with 19 questions and 6 knowledge statements was presented to:

1. approximately 20 graduate students and faculty members in the department of Foods and Nutrition at Oregon State University, and

2. four health care professionals: (a) a nurse practitioner, (b) a public health nutritionist, (c) a registered dietitian, and (d) a childbirth educator.
The written and oral suggestions which were made were then implemented in revising the questionnaire, in accordance with the purpose and design of this study.

The revised questionnaire was pretested via telephone to ten women in Corvallis, Oregon. These women had given birth to normal infants during the month of September, 1982; their names were randomly selected from birth certificate abstracts available for publication from the Benton County Office of Vital Statistics. The purpose of the pretest was to ascertain the clarity of the questions to the respondents; to identify any awkward questions which might interfere with the administration of the questionnaire; and to help the investigator further develop interviewing skills and techniques, since all of the interviewing was to be done by the author. After the pretest, the questionnaire was modified to include 25 questions and 6 knowledge statements (Appendix A).

Data Collection

After gathering the 130 names and addresses of women who gave birth during the month of September 1982, the December 1982 Portland telephone directory was used to obtain their phone numbers. There were 57 women who did not have phone numbers listed in the December 1982 telephone directory. These women, therefore, were contacted by mail. Each woman was mailed a letter (Appendix B) on December 20, 1982, describing the study and asking her to contact the investigator.
at a Portland telephone number, between December 22, 1982 and January 8, 1983, or to return an enclosed self-addressed, stamped postcard (Appendix B), with a phone number and a convenient time for the investigator to call. Four of the 57 letters were undeliverable. Twelve women called the investigator during the time period indicated.

On January 10, 1983, a follow-up letter (Appendix B) was mailed to those women who did not have listed telephone numbers and who had not responded to the first letter mailed during the Christmas holidays. This letter asked them to call the interviewer at a Portland phone number during a four-day period, from January 14 through January 17. As a result of this follow-up effort, a total of 28 women out of 57 who did not have listed phone numbers in the phone directory were included in the study.

An introductory letter (Appendix C) introducing the interviewer and explaining the purpose of the study was mailed to the 73 women who had their phone numbers listed in the December 1982 Portland telephone directory. The investigator conducted phone interviews from January 7, 1983 to January 20, 1983. Of the 73 phone numbers listed in the phone directory, two had been disconnected with no new number; one was changed to a North Dakota number; and two yielded no response. Of the 68 women contacted, only one refused to be interviewed. Thus, a total of 95 women out of 130 were included in this study.
Data Analysis

Completed questionnaires were coded, keypunched, and verified with the assistance of the Survey Resource Center at Oregon State University. The *Statistical Package for the Social Sciences* (SPSS), second edition (Nie, Hall, Jenkins, Steinbrenner, and Bent, 1975) was the computerized program selected for analysis of the variables. A total of 64 variables were analyzed from the questionnaire. Variables were determined according to the questions, subcomponents of the questions, and knowledge statements included in the questionnaire: 20 variables were related to the three hypotheses, 6 were related to the knowledge statements, and 38 were related to those questions asked in order to obtain information on factors which may be related to the incidence and duration of breast feeding.

The Chi Square ($x^2$) statistic at the 90-percent level was used to determine the significance of the three hypotheses selected. This statistic was also used to analyze the six knowledge statements and the variables from the other questions used in the questionnaire. Chi Square was the appropriate statistic to use to compare distribution across several categories among three subgroups: women who breast fed only, formula fed only, or both breast and formula fed.

Definition of Terms

Following are the definitions of the feeding practices for the three groups analyzed in this study: Breast Fed Only, Formula Fed Only, and Breast and Formula Fed.
**Breast Fed Only:** This term refers to those women who were only feeding their infants breast milk at the time of the interview. There were 44 women in this group.

**Formula Fed Only:** This term refers to those women who were only feeding their infants some type of prepared formula at the time of the interview. There were 36 women in this group.

**Breast and Formula Fed:** This term refers to those women who would periodically breast feed their babies but were primarily feeding their infants some type of prepared formula at the time of the interview. There were 15 women in this group.
RESULTS AND DISCUSSION

The purpose of this study was to determine the incidence and duration of breast feeding among selected women in the greater metropolitan area of Portland, in Multnomah County, Oregon. Ninety-five women out of a sample size of 130 were interviewed. This is a 73 percent response rate.

It should be noted that the mothers who participated in this study were not representative of the total population of new mothers in the city of Portland. All of the women interviewed were married at the time of their pregnancy. Therefore, single women, who constitute approximately 21.2 percent of the total population of women who had successful live births in Multnomah County, were excluded from this study (Oregon Vital Statistics, 1980).

The race or ethnic background of women in this sample was also not representative of the general population. Ninety-three percent of the women in this study were white, compared to 84 percent of the general population (Oregon Vital Statistics, 1980). This factor may be related to a higher proportion of non-white women being single (Martinez and Stahle, 1982).

In addition, mothers who were older than 25 years of age were more numerous in this study than are found, on the average, in the general population. As reported in Oregon Vital Statistics (1980), approximately 14 percent of the live births were to teenagers and 35 percent to women between the ages of 20 and 24. However, in this survey, teen births represented only 5 percent of the sample.
and women 20 to 24 years represented only 24 percent, while women between 25 and 29 years of age represented 43 percent.

Approximately 60 percent of the women interviewed had 13 years or more of formal education. It is therefore evident that well-educated mothers were more numerous in this sample than in the general population, where 23 percent of adult women have formal education beyond high school (Vital and Health Statistics, 1978). An unexpected finding was that although the educational level of these women was relatively high, 76 percent of them said that during their pregnancy, they would have found it useful or very useful to have attended a series of classes on nutrition, breast feeding, and infant feeding practices.

The average number of people in the sampled households was four, with a range from two to nine. The poverty guideline for a household of four is $9,265 (Statistical Abstract of the United States, 1981). The portion of family households below the poverty level in Portland is 14 percent (Income and Poverty Characteristics Cities and Counties of Oregon 1979, 1982). According to the data collected from this population, family household income below the poverty level was 33 percent. The median family income in Multnomah County is the third highest in Oregon--$23,438 (Annual Economic Report, 1982). It is high because of the large number of families supported by two wage earners. Therefore, the large percentage of low-income families in this study may be due to the high number of households being
supported by one wage earner, since the majority of women were not working.

In general, in this population there was a high proportion of married, white, older, educated, and middle-class women (Table 7).

These data also reveal other characteristics related to the women surveyed. Although not statistically significant, more girl babies were born than boy babies. Over 95 percent of the babies born weighed more than 5.5 pounds, were born in a hospital, and were delivered by a medical doctor. In addition, the majority of the women had attended prenatal classes and were not working. Parity between primiparous and multiparous women was fairly well divided (Table 8).

For analysis of the data, question 6 was related to Hypothesis 1, question 6a was related to Hypothesis 2, and questions 22, 23, and 24 were related to Hypothesis 3 (Appendix A).

**Hypothesis 1**

Women who breast feed their babies, who feed their babies formula, and who do both are all equally likely to have received information on the advantages of breast feeding, during pregnancy.

No overall significant difference was observed between the incidence of breast feeding and the amount of information received by pregnant women on the advantages of breast feeding. Therefore, Hypothesis 1 was not rejected for the total sample.
<table>
<thead>
<tr>
<th>Demographics of Women Interviewed</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
</tr>
<tr>
<td>Divorced</td>
<td>1</td>
</tr>
<tr>
<td>Separated</td>
<td>2</td>
</tr>
<tr>
<td>Married</td>
<td>92</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>1</td>
</tr>
<tr>
<td>Hispanic</td>
<td>3</td>
</tr>
<tr>
<td>Oriental</td>
<td>3</td>
</tr>
<tr>
<td>White</td>
<td>88</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>Under 20</td>
<td>5</td>
</tr>
<tr>
<td>20 - 24</td>
<td>23</td>
</tr>
<tr>
<td>25 - 29</td>
<td>41</td>
</tr>
<tr>
<td>30 or older</td>
<td>26</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
</tr>
<tr>
<td>Some high school</td>
<td>11</td>
</tr>
<tr>
<td>High school graduate</td>
<td>20</td>
</tr>
<tr>
<td>High school plus</td>
<td>30</td>
</tr>
<tr>
<td>Community college graduate</td>
<td>6</td>
</tr>
<tr>
<td>College graduate</td>
<td>28</td>
</tr>
<tr>
<td><strong>Income</strong></td>
<td></td>
</tr>
<tr>
<td>Below $7,000</td>
<td>17</td>
</tr>
<tr>
<td>$7,000-15,000</td>
<td>28</td>
</tr>
<tr>
<td>$15,000-25,000</td>
<td>25</td>
</tr>
<tr>
<td>Over $25,000</td>
<td>24</td>
</tr>
<tr>
<td>Not given</td>
<td>1</td>
</tr>
</tbody>
</table>
### TABLE 8

Relevant Factors Reported by Women Interviewed

<table>
<thead>
<tr>
<th>Factor</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prenatal classes</strong></td>
<td></td>
</tr>
<tr>
<td>Attended</td>
<td>54</td>
</tr>
<tr>
<td>Did not attend</td>
<td>39</td>
</tr>
<tr>
<td>Not given</td>
<td>2</td>
</tr>
<tr>
<td><strong>Employment of mother</strong></td>
<td></td>
</tr>
<tr>
<td>Full-time</td>
<td>16</td>
</tr>
<tr>
<td>Part-time</td>
<td>16</td>
</tr>
<tr>
<td>Not working</td>
<td>62</td>
</tr>
<tr>
<td>Not given</td>
<td>1</td>
</tr>
<tr>
<td><strong>Place of birth</strong></td>
<td></td>
</tr>
<tr>
<td>Hospital</td>
<td>93</td>
</tr>
<tr>
<td>Birthing center</td>
<td>2</td>
</tr>
<tr>
<td><strong>Birth attendant</strong></td>
<td></td>
</tr>
<tr>
<td>Doctor</td>
<td>92</td>
</tr>
<tr>
<td>Naturopath</td>
<td>1</td>
</tr>
<tr>
<td>Midwife</td>
<td>2</td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td></td>
</tr>
<tr>
<td>Primipara</td>
<td>49</td>
</tr>
<tr>
<td>Multipara</td>
<td>46</td>
</tr>
<tr>
<td><strong>Description of infant</strong></td>
<td></td>
</tr>
<tr>
<td>Sex of infant</td>
<td></td>
</tr>
<tr>
<td>Girl</td>
<td>49</td>
</tr>
<tr>
<td>Boy</td>
<td>44</td>
</tr>
<tr>
<td>Not given (set of twins)</td>
<td>2</td>
</tr>
<tr>
<td>Birth weight of infant</td>
<td></td>
</tr>
<tr>
<td>Under 5.5 lbs.</td>
<td>5</td>
</tr>
<tr>
<td>Over 5.5 lbs.</td>
<td>90</td>
</tr>
</tbody>
</table>

*Includes one set of twins.*
However, some differences were observed upon closer analysis of the individual components of Hypothesis 1. Three significant differences were found. The findings of this study reveal a significant association between the incidence of breast feeding and the amount of information received from (1) the mother's doctor, (2) the baby's doctor, and (3) the childbirth educator.

As seen in Table 9, a higher percentage of women who formula fed had received information about breast feeding from their doctors than had those women who breast fed. This is not consistent with other researchers who report that the more information a woman receives prenatally about breast feeding, the greater the chances are that she will breast feed (James, 1981; Kemberling, 1979; Ladas, 1970; Sedgwick, 1921; Winikoff and Baer, 1980). This unexpected finding may be due to the manner or method with which physicians provided information about breast feeding. Some physicians may lack information about breast feeding and are, therefore, more comfortable in discussing formula feedings with their patients.

The relationship between the incidence of breast feeding and the amount of information received from the baby's doctor (Table 10) is significant in that the babies' doctors seemed to urge women to both breast and formula feed. The association between the incidence of breast feeding and the amount of information received from the childbirth educator (Table 11) appears to show discouragement of formula feeding only and encouragement of a combination of breast and formula feeding.
TABLE 9

Percentage of Women Who Received and Who Did Not Receive Information on Breast Feeding from Their Doctors

<table>
<thead>
<tr>
<th></th>
<th>Breast Fed Only</th>
<th>Formula Fed only</th>
<th>Breast and Formula Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received information</td>
<td>54</td>
<td>79</td>
<td>73</td>
</tr>
<tr>
<td>Did not receive information</td>
<td>46</td>
<td>21</td>
<td>27</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 5.90; \text{ significant at 90\% level.} \]
\[ n = 90 \]
TABLE 10

Percentage of Women Who Received and Who Did Not Receive Information on Breast Feeding from Babies' Doctor

<table>
<thead>
<tr>
<th></th>
<th>Breast Fed Only</th>
<th>Formula Fed only</th>
<th>Breast and Formula Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received information</td>
<td>66</td>
<td>65</td>
<td>100</td>
</tr>
<tr>
<td>Did not receive information</td>
<td>34</td>
<td>35</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

\[ x^2 = 7.32; \text{ significant at 90\% level.} \]

\[ n = 90 \]
### TABLE 11

Percentage of Women Who Received and Who Did Not Receive Information on Breast Feeding from Childbirth Educators

<table>
<thead>
<tr>
<th></th>
<th>Breast Fed Only</th>
<th>Formula Fed only</th>
<th>Breast and Formula Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received information</td>
<td>61</td>
<td>50</td>
<td>87</td>
</tr>
<tr>
<td>Did not receive information</td>
<td>39</td>
<td>50</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

$x^2 = 5.88; \text{ significant at 90\% level.}$

$n = 90$
The results of testing the remaining three components of Hypothesis 1 were that there were no significant differences in the feeding practices of mothers who received and who did not receive information from the nursing staff at the hospital, the nurse practitioner, and friends and relatives. Perhaps these are sources of information common to all women.

**Hypothesis 2**

Women who breast feed for less than six months and those who breast feed longer are equally likely to have an established support system.

There was no observed significant difference, based on the $x^2$ statistic, between the duration of breast feeding (more than six months or less than six months) and the amount of support women received from their doctors, the nursing staff at hospitals, the babies' doctors, nurse practitioner, childbirth educators, or friends and relatives. Hypothesis 2 was not rejected for the total sample or for any of the six individual components analyzed. This is not consistent with the literature which proposes that a strong support system is a major factor in helping women breast feed successfully (James, 1981; Kemberling, 1979; Ladas, 1970; Lawrence, 1981; Winikoff and Baer, 1980). Perhaps many of the women interviewed made an early commitment to breast feeding for at least six months. Women in both groups, those who breast fed less than six months and those who breast fed more than six months, reported receiving support for breast feeding.
Hypothesis 3

Women who breast feed their babies, who feed their babies formula, and who do both do not differ from each other demographically.

Analysis of the data shows no differences in the age, education, or parity of women who feed their children differently, either in regard to the incidence or the duration of breast feeding. The null hypothesis was not rejected. However, when the duration of breast feeding was examined vis-a-vis income, a significant difference was found in the income levels of women who did and did not breast feed. (See Table 12.) The indication is that women who regularly both breast and formula fed are the least likely to be poor, while the women who formula feed only are the most likely to be poor. This is in agreement with the literature which reports that women from higher income levels are more likely to breast feed than women from lower income levels (Martinez et al., 1981; Martinez and Dodd, 1983; Martinez and Stahle, 1982).

Knowledge Statements

Of the six knowledge statements presented in question 12 of the questionnaire, 12a and 12d appear to discriminate among women who feed their babies differently. The responses to statement 12a, "frequent nursing can aid in establishing a woman's milk supply," and to statement 12d, "cow's milk is nutritionally equal to human milk for feeding young infants," are shown in tables 13 and 14 respectively. Women who were in the breast and formula fed category are significantly more knowledgable about these matters.
TABLE 12

Response to Question 24: Incidence of Breast Feeding
Related to the Social Factor Income

<table>
<thead>
<tr>
<th>Income Level</th>
<th>Breast Fed Only</th>
<th>Formula Fed Only</th>
<th>Breast and Formula Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under $7,000</td>
<td>14%</td>
<td>29%</td>
<td>7%</td>
</tr>
<tr>
<td>$7,000-15,000</td>
<td>36%</td>
<td>31%</td>
<td>7%</td>
</tr>
<tr>
<td>$15,000-25,000</td>
<td>27%</td>
<td>20%</td>
<td>39%</td>
</tr>
<tr>
<td>Over $25,000</td>
<td>23%</td>
<td>20%</td>
<td>47%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

$x^2 = 11.82$; significant at 90% level.

$n = 94$
TABLE 13
Response to Statement 12a: "Nursing Can Aid in Establishing a Woman's Milk Supply"

<table>
<thead>
<tr>
<th></th>
<th>Breast Fed Only</th>
<th>Formula Fed only</th>
<th>Breast and Formula Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>91%</td>
<td>92%</td>
<td>100%</td>
</tr>
<tr>
<td>Disagree</td>
<td>9%</td>
<td>8%</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

$x^2 = 5.63; \text{significant at 90\% level.}$
$n = 95$
TABLE 14

Response to Statement 12d: "Cow's Milk is Nutritionally Equal to Human Milk for Feeding Young Infants."

<table>
<thead>
<tr>
<th></th>
<th>Breast Fed Only</th>
<th>Formula Fed Only</th>
<th>Breast and Formula Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agree</strong></td>
<td>2%</td>
<td>14%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Disagree</strong></td>
<td>98%</td>
<td>86%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 5.73; \text{ significant at } 90\% \text{ level.} \]
\[ n = 95 \]
Additional Findings

Additional questions were asked in the questionnaire in order to obtain a more complete picture of the factors that might be related to the incidence and duration of breast feeding. Significantly large $x^2$ statistics were obtained from the responses to questions 1, 3, 7a, 13a, 18, and 19. See tables 15, 16, 17, 18, 19, and 20.

Findings concerning the sex of the baby (Table 15), the attendance of prenatal classes (Table 16), and the consumption of alcoholic beverages (Table 17) are puzzling. Results indicate that women who regularly both breast and formula feed are likely to have boy babies, attend prenatal classes, and consume alcoholic beverages. If just the breast fed only and formula fed only groups are compared, no significant differences are observed for the above three questions. Attendance at prenatal classes (Table 16) appears to encourage women to both breast and formula feed.

The significant differences found between those variables shown in Tables 18 and 19 are in accordance with the findings in the literature which state that women are more inclined to breast feed their first baby than their second baby (Hirschman and Hendershot, 1979; James, 1981; Martinez et al., 1981; Smith et al., 1982; Winikoff and Baer, 1980) and that women who were breast fed as babies are also more inclined to breast feed their own children (Winikoff and Baer, 1980).
TABLE 15

Response to Question 1: "Is Your Baby a Girl or Boy?"

<table>
<thead>
<tr>
<th></th>
<th>Breast Fed Only</th>
<th>Formula Fed Only</th>
<th>Breast and Formula Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girl</td>
<td>55%</td>
<td>50%</td>
<td>13%</td>
</tr>
<tr>
<td>Boy</td>
<td>43%</td>
<td>50%</td>
<td>87%</td>
</tr>
<tr>
<td>Not given (one set of twins)</td>
<td>2%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

\[ x^2 = 9.55; \text{ significant at 90\% level.} \]
\[ n = 95 \]
TABLE 16
Response to Question 3: "Did You Attend Any Prenatal Classes?"

<table>
<thead>
<tr>
<th></th>
<th>Breast Fed Only</th>
<th>Formula Fed only</th>
<th>Breast and Formula Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>59%</td>
<td>44%</td>
<td>93%</td>
</tr>
<tr>
<td>No</td>
<td>41%</td>
<td>56%</td>
<td>7%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

\[ x^2 = 10.46; \text{ significant at 90\% level.} \]
\[ n = 95 \]
TABLE 17

Response to Question 19: "Do You Consume Alcoholic Beverages?"

<table>
<thead>
<tr>
<th></th>
<th>Breast Fed Only</th>
<th>Formula Fed only</th>
<th>Breast and Formula Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>48%</td>
<td>58%</td>
<td>80%</td>
</tr>
<tr>
<td>No</td>
<td>52%</td>
<td>42%</td>
<td>20%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

$x^2 = 4.80$; significant at 90% level.

n = 95
### TABLE 18

Response to Question 7a (for Women Who Had More Than One Child):
"Did You Breast Feed Any of Your Other Children?"

<table>
<thead>
<tr>
<th></th>
<th>Breast Fed Only</th>
<th>Formula Fed only</th>
<th>Breast and Formula Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>96%</td>
<td>61%</td>
<td>50%</td>
</tr>
<tr>
<td>No</td>
<td>4%</td>
<td>39%</td>
<td>50%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

$x^2 = 9.55$; significant at 90% level.

$n = 46$
TABLE 19

Response to Question 13a: "Did Your Mother Breast Feed Any of Her Children?"

<table>
<thead>
<tr>
<th></th>
<th>Breast Fed Only</th>
<th>Formula Fed only</th>
<th>Breast and Formula Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>62%</td>
<td>37%</td>
<td>60%</td>
</tr>
<tr>
<td>No</td>
<td>38%</td>
<td>63%</td>
<td>40%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

\( x^2 = 5.13; \text{ significant at 90\% level.} \)
\( n = 92 \)
The analysis of the data as shown in Table 20 also indicates that there is a strong tendency for women who breast feed not to smoke.

The incidence of breast feeding in the hospital was 88 percent compared to 55 percent nationally, and the duration of breast feeding for six months or more was 44 percent compared to 27 percent nationally (Martinez and Dodd, 1983).

In this study there was a high proportion of married, white, older, educated, and middle-class women. According to the literature, marital status, race, age, education, and income have a positive correlation with the incidence and duration of breast feeding (Cole, 1977; James, 1981; Martinez and Stahle, 1982; Sjolins, Hofvander, and Hillervik, 1977; Winikoff and Baer, 1980). However, as reported earlier, income was the only significant factor in this study that was related to the incidence of breast feeding. Although it can be more economical for a woman to breast feed instead of formula feed, low-income women are more inclined to formula feed their babies (Worthington-Roberts, 1981).

The average duration of breast feeding by women who had weaned their babies at the time of this survey was 6.2 weeks. This is consistent with other investigators who report that two to six weeks is the average duration of breast feeding for women who initiate breast feeding in the hospital (James, 1981; Tibbetts and Cadwell, 1981; Winikoff and Baer, 1980). The four most cited
TABLE 20
Response to Question 18: "Do You Smoke Cigarettes?"

<table>
<thead>
<tr>
<th></th>
<th>Breast Fed Only</th>
<th>Formula Fed only</th>
<th>Breast and Formula Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>9%</td>
<td>36%</td>
<td>27%</td>
</tr>
<tr>
<td>No</td>
<td>91%</td>
<td>64%</td>
<td>73%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

\[ x^2 = 8.61; \text{ significant at 90\% level.} \]
\[ n = 95 \]
reasons given in this study for weaning were: (a) baby was not getting enough milk; (b) employment outside of the home; (c) inconvenience; and (d) (mother) wanted to lose weight. These reasons for weaning are similar to those published in earlier studies (Cole, 1977; Ladas, 1970; Salber et al., 1959; Winikoff and Baer, 1980). Many of these women reported they did not want to stop breast feeding. In many cases, if they had had accurate information and/or support, they would have continued to breast feed. For example:

1. Those women who reported that their baby was not getting enough milk had been advised by their babies' doctor to supplement breast feeding with formula. Why these women were advised to supplement their breast milk with formula is confusing since it is well-documented that the introduction of supplemental feedings may interfere with the management and maintenance of lactation (Critical Weight Loss, 1983). Inadequate milk production is often due to a poor let-down reflex and a lack of stimulation to the breast (Lawrence, 1981). Therefore, frequent feedings and nursing the baby at both breasts at each feeding will help increase the milk supply (Ladas, 1970; Lawrence, 1981; Tibbetts and Cadwell, 1981). Women who are the most successful at lactation do not supplement their breast milk with formula or introduce solids, but breast feed only for the first four to six months of life.

2. Women who reported employment outside of the home as a reason for weaning may not have known that they could have expressed their milk to help maintain milk production, and that the milk
could have been refrigerated for the infant to use the next day or discarded.

3. Women who cited inconvenience either were not motivated to breast feed or were busy with family obligations.

4. Mothers who stopped breast feeding because they wanted to lose weight clearly lacked accurate information. They may not have known that a lactating woman uses approximately 900 calories to produce a liter of milk. To help meet this need, a nursing woman uses her fat stores accumulated during pregnancy, as well as increasing the number of calories she consumes in her daily diet (Worthington-Roberts, 1981).

Among the women who did not initiate breast feeding, inconvenience and embarrassment were given as the two main reasons for not nursing.

Many women in the survey made additional statements about their experiences in feeding their babies. The most frequent were:

Breast feeding is very enjoyable.

I was not prepared for the difficulties encountered.

I wish I had had more information about breast feeding, because, initially, I had a lot of questions.

Encouragement at the beginning from my family and friends was very important.

In spite of the unexpected results of this study which indicated that the type of information and support given did not significantly influence the incidence and duration of breast feeding, the majority of women interviewed indicated that it would
have been useful or very useful for them to have attended a series
of classes on nutrition, breast feeding, and infant feeding
practices.

Currently, there are a number of prenatal classes available
to parents, which include information about nutrition, breast
feeding, and infant feeding practices. Apparently these classes
need to be more effective in promoting and encouraging breast
feeding.

According to Kemberling (1979), confidence is the single most
important factor of successful breast feeding. "If a woman thinks
she will succeed, she most likely will."

The dissemination of accurate information is a second factor
which must be taken into consideration by health care workers who
are promoting breast feeding. Health care workers should include
information on the physiology of the breast, the advantages of
breast feeding, techniques of breast feeding, and common problems
that may occur until lactation is fully established.

The third factor is support. Several investigators report
that many women need the encouragement and support of their
friends, family, health care workers, employers, and community to
successfully breast feed (Applebaum, 1975; Cunha, 1982; Hall, 1978;
Kemberling, 1979).

A program to encourage breast feeding should be designed
incorporating the three factors mentioned above.

A study that illustrates a program designed to encourage
breast feeding is currently in progress (Cunha, 1982). It was
started in 1981 by the Ministry of Health of Brazil, who organized a national program to promote breast feeding. Results will be evaluated in 1984.

To motivate and instill confidence in women who wish to breast feed, the Brazilian government is promoting a campaign encouraging breast feeding, via mass media. "Behavioral change in specified groups is known to be associated, among other things, with their repeated exposure to a persuasive message." With this in mind, radio and television commercials are being produced and aired, where famous personalities promote breast feeding by emphasizing two approaches: (a) "Every woman can! Stay with it!" and (b) "Breast feeding: the six months that are worth a lifetime!"

In addition, billboards and posters are being erected throughout the country, showing a woman breast feeding, with the statement "six month's worth a lifetime." This type of advertisement is planned to inspire confidence in women who are shy about breast feeding in public.

The Brazilian government is emphasizing that this is a community concern and "the press is beginning to be familiar with the idea" that "the mother is not in this alone." The father, family, friends, employers, community—all are responsible for women being successful at breast feeding.

In order to help increase the incidence and the duration of breast feeding in the United States, it might be helpful to follow some of the activities initiated and promoted by the Brazilian government. At the least, health care workers who provide
information on breast feeding should be knowledgeable, encouraging, supportive, and committed to promoting breast feeding by inspiring confidence in women who want a successful nursing experience.
SUMMARY AND CONCLUSION

This study determined the incidence and the duration of breast feeding in Portland, Oregon, among a sample of women who were married, predominately white, over 25 years of age, and well-educated. The reported values for the incidence of breast feeding (88 percent) and the duration of breast feeding for six months (44 percent) were relatively high. On a national level, the incidence of breast feeding is 55 percent and the duration is 27 percent. Women most inclined to breast feed their babies had higher incomes, were themselves breast fed as babies, had breast fed their other children, and did not smoke cigarettes. There was no significant association found between the duration of breast feeding and strong support system(s) among the sample of women.

An unexpected outcome of this study was that even though the incidence and duration of breast feeding was relatively high, the majority of women stated that they would have found it useful or very useful to have attended a series of classes, during their pregnancy, on nutrition, breast feeding, and infant feeding practices. In accordance with the recommendation of the American Academy of Pediatrics to provide information to pregnant women on the advantages of breast feeding, it is recommended that an effective educational program be designed to encourage breast feeding among pregnant women.
BIBLIOGRAPHY


APPENDICES
APPENDIX A

Questionnaire

INTRODUCTION

"Hello, I'm Joyce Marshall calling from Oregon State University.
Is this the __________________________ residence?

(IF NO. The number I was calling is ______ and for _____________________________.
If wrong number, terminate with: I am sorry to have bothered you.

IF YES. Ask: May I please speak to _____________________________.
If not at home, ask when she will return and call back.
When the new mother is on the phone, reintroduce myself and continue with:

I am doing a study on infant feeding practices in the Portland area.
Your name was selected from a list of new mothers at the County Office of Vital Statistics. Last week a letter was mailed to you explaining the purpose of this study. Did you receive it?

IF NO. Say: I'm sorry yours didn't reach you. It was a brief letter that I sent so you would know that I would be calling you.

IF YES. Continue with:

It should take just a few minutes of your time to answer the questions for my survey. But before starting them, I want to mention that the questions are voluntary and the answers are confidential. The results will be based on the entire sample, and not for any one person. If I ask you a question you don't want to answer, just let me know. OKAY?

IF CALLBACK IS REQUIRED, INDICATE TIME AND DATE. FOR COMPLETED INTERVIEWS, ENTER "R’s" TELEPHONE NUMBER AND DATE OF INTERVIEW.

TIME__________________  DATE__________________
TIME__________________  DATE__________________
TIME__________________  DATE__________________
TIME__________________  DATE__________________
RESPONDENT'S TELEPHONE NUMBER__________________
DATE OF COMPLETED INTERVIEW__________________

(TURN PAGE AND BEGIN INTERVIEW)
**QUESTIONNAIRE**

1. **Is your baby a girl or boy?**
   - Girl: 1
   - Boy: 2
   - DK/NA: 9

2. **What did your baby weigh when he/she was born?**
   - Under 5 1/2 pounds: 1
   - Over 5 1/2 pounds: 2
   - DK/NA: 9

3. **Did you attend any prenatal classes, or not?**
   - Yes: 1
   - No: 2
   - DK/NA: 9

4. **Was your baby born in a hospital, alternative birthing center, at home, or another location?**
   - Hospital: 1
   - Alternative Birthing Center: 2
   - Home: 3
   - Other (Specify): 4
   - DK/NA: 9

5. **Was your baby delivered by a:**
   - Doctor: 1
   - Natropath: 2
   - Midwife: 3
   - Other (Specify): 4
   - DK/NA: 9
6. I'm now going to read to you a list of people who are health care workers and others who might offer you information about taking care of your baby. As I name each one, please tell me whether or not they gave you information about breast feeding.

<table>
<thead>
<tr>
<th>The first one is</th>
<th>Gave Information</th>
<th>Gave Support</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>a. your doctor, natropath, or midwife</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>b. the nursing staff at the hospital</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>c. your baby's doctor or pediatrician</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>d. nurse practitioner</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>e. childbirth educator</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>f. friends or relatives</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>g. any other organization or groups</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

6a. For "YES" to any of the above ask: Generally, did the (__________) give you encouragement to breast feed, or not?

7. How many other children, if any, do you have?

<table>
<thead>
<tr>
<th>Number</th>
<th>(IF &quot;0&quot; GO TO Q 8)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7a. Did you breast feed any of these children, or not?

<table>
<thead>
<tr>
<th></th>
<th>(GO TO Q 7b)</th>
<th>(GO TO Q 8)</th>
<th>DK/NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7b. Would you please tell me about how many weeks you breast fed each of your other children?

<table>
<thead>
<tr>
<th>Child one</th>
<th>Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child two</td>
<td>Weeks</td>
</tr>
<tr>
<td>Child three</td>
<td>Weeks</td>
</tr>
</tbody>
</table>

8. Some mothers choose to breast feed their babies while others do not, at the present time are you breast feeding only, formula feeding only, or partially breast and formula feeding your baby?

|Breast only (GO TO Q 9) | 1 |
|Formula only (GO TO Q 10) | 2 |
|Both (GO TO Q 11) | 3 |
|DK/NA | 9 |
## IF BREAST FED ONLY

**9. Are you planning to breast feed more than six months or less than six months?**

<table>
<thead>
<tr>
<th>Option</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than six months</td>
<td>1</td>
</tr>
<tr>
<td>Less than six months</td>
<td>2</td>
</tr>
<tr>
<td>DK/NA</td>
<td>9</td>
</tr>
</tbody>
</table>

**9a. Generally, do you feel that you are getting any support for breast feeding from your family, or not?**

<table>
<thead>
<tr>
<th>Option</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
</tr>
<tr>
<td>DK/NA</td>
<td>9</td>
</tr>
</tbody>
</table>

**9b. Have you been employed full-time, employed part-time, or unemployed since your baby was born?**

<table>
<thead>
<tr>
<th>Option</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed full-time (GO TO Q 9c)</td>
<td>1</td>
</tr>
<tr>
<td>Employed part-time (GO TO Q 9c)</td>
<td>2</td>
</tr>
<tr>
<td>Unemployed (GO TO Q 9d)</td>
<td>3</td>
</tr>
<tr>
<td>DK/NA</td>
<td>9</td>
</tr>
</tbody>
</table>

**9c. Generally, do you feel you are getting support for breast feeding from your employer, or not?**

<table>
<thead>
<tr>
<th>Option</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
</tr>
<tr>
<td>DK/NA</td>
<td>9</td>
</tr>
</tbody>
</table>

(NOW GO TO Q 12)

**9d. Do you have any plans to be employed full-time or part-time in the next six to nine months?**

<table>
<thead>
<tr>
<th>Option</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, full-time</td>
<td>1</td>
</tr>
<tr>
<td>Yes, part-time</td>
<td>2</td>
</tr>
<tr>
<td>NO</td>
<td>3</td>
</tr>
<tr>
<td>DK/NA</td>
<td>9</td>
</tr>
</tbody>
</table>

(NOW GO TO Q 12)
IF FORMULA FED ONLY

10. After your baby was born, did you breast feed at all, or was he/she put on formula?

   Formula (GO TO Q 10a) . . . . . .1
   Breast (GO TO Q 10b) . . . . . .2
   DK/NA (GO TO Q 10d) . . . . . .9

10a. Briefly, what were your reasons for not breast feeding?

   (NOW GO TO Q 10d)

10b. How long did you breast feed?

   Time__________________________

10c. Would you please tell me the main reason(s) you decided to stop breast feeding?

   10d. Have you been employed full-time, employed part-time, or unemployed since your baby was born?

      Employed full-time (GO TO Q 12) ..1
      Employed part-time (GO TO Q 12) ..2
      Unemployed (GO TO Q 10e) . . .3
      DK/NA (GO TO Q 12) . . . . . . .9

10e. Do you have any plans to be employed full-time or part-time in the next six to nine months?

      Yes, full-time . . . . . . . . .1
      Yes, part-time . . . . . . . .2
      No . . . . . . . . . . . . . . . .3
      DK/NA . . . . . . . . . . . . .9
      (NOW GO TO Q 12)
11. At what age was your baby when you started giving him/her formula feedings?

   Age ________________________________

11a. Are the formula feedings in addition to each feeding, or are they in place of breast feedings?

   In addition ................. 1
   In place of ................. 2
   Both ....................... 3
   DK/NA .................... 9

11b. How many months do you plan to breast feed?

   Months __________________________

11c. Generally, do you feel that you are getting any support for breast feeding from your family, or not?

   Yes ......................... 1
   No ......................... 2
   DK/NA .................... 9

11d. Have you been employed full-time, employed part-time, or unemployed since your baby was born?

   Employed full-time (GO TO Q 11e) .... 1
   Employed part-time (GO TO Q 11e) .... 2
   Unemployed (GO TO Q 11f) ............ 3
   DK/NA .................... 9

11e. Generally, do you feel you are getting support for breast feeding from your employer, or not?

   Yes ......................... 1
   No ......................... 2
   DK/NA .................... 9

11f. Do you have any plans to be employed full-time or part-time in the next six to nine months?

   Yes, full-time ............... 1
   Yes, part-time ............... 2
   No ......................... 3
   DK/NA .................... 9
12. I have here some statements that have been made recently about breast feeding. As I read them will you please tell me, quickly, if you agree or disagree with each one.

The first one is . . . Agree Disagree DK/NA

a. Frequent nursing can aid in establishing a woman's milk supply. . . . . 1 2 9

b. It can take 2-6 weeks for a new mother and baby to build a successful nursing relationship . . . . . 1 2 9

c. Cracked or sore nipples can be helped by keeping them dry and/or exposed to air. . . . . . . 1 2 9

d. Cow's milk is nutritionally equal to human milk for feeding young infants . . . . . . 1 2 9

e. Breast milk offers temporary immunity against certain diseases, whereas cow's milk does not. . . . . . . 1 2 9

f. An infant does not need additional foods, other than breast milk for the first 4-6 months of life . . . . . . 1 2 9
13. From what you know or have heard, have any of the following people breast fed any of their children . . . . . . .

The first one is . . .

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>DK/NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. your mother</td>
<td>1</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>b. your sister(s)</td>
<td>1</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>c. other relatives</td>
<td>1</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>d. friends</td>
<td>1</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>

14. Were you breast fed as a baby, or not?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>DK/NA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>

15. Was your baby's father breast fed, or not?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>DK/NA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>

16. I now have some questions that relate to health and diet that I would like to ask you. . . . .

In general, do you try to eat according to any special guidelines other than the basic four food groups?

<table>
<thead>
<tr>
<th></th>
<th>Yes (Specify______)</th>
<th>No</th>
<th>DK/NA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>

17. How useful would it have been to you during your pregnancy if you would have attended a series of classes on nutrition, breast feeding, and infant feeding practices?

<table>
<thead>
<tr>
<th></th>
<th>Very useful</th>
<th>Useful</th>
<th>Not useful</th>
<th>DK/NA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>9</td>
</tr>
</tbody>
</table>

18. Do you smoke cigarettes, or not?

<table>
<thead>
<tr>
<th></th>
<th>Yes (GO TO Q 18a)</th>
<th>No (GO TO Q 19)</th>
<th>DK/NA (GO TO Q 19)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>

18a. Did you smoke during your pregnancy?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>DK/NA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>
19. Do you consume alcoholic beverages, or not?
   Yes ........................................ 1
   No ........................................ 2
   DK/NA .................................... 9

20. I now have a few more general questions to ask you. . . .
   How many people including yourself live in your household?
   Number ____________________________

21. Are you now:
   Married ................................... 1
   Divorced ................................... 2
   Separated .................................. 3
   Single ..................................... 4
   Refused .................................... 9

22. What is the highest level of education you have completed?
   Some H.S. 11 years or less ............ 1
   High School grad. or equiv. .......... 2
   More than 12 years .................... 3
   Community College grad ............. 4
   College or University grad .......... 5
   Refused .................................... 9

23. Are you:
   Under 20 .................................. 1
   20 - 24 .................................... 2
   25 - 29 .................................... 3
   Over 30 ................................... 4
   Refused .................................... 9

24. Thinking about last year, 1982, was your total household income before taxes:
   Under 7,000 ............................... 1
   7,000 - 15,000 ............................. 2
   15,001 - 25,000 .......................... 3
   Over 25,000 ............................... 4
   Refused .......................... .......... 9
25. What is your racial or ethnic background?

Black .................. 1
Hispanic .................. 2
Oriental .................. 3
American Indian .............. 4
White ....................... 5
Other (Specify________________) .... 6
Refused ...................... 9

26. Is there anything else you would like to say about your experience in feeding your new baby?

(THANK YOU)
I am a graduate student at Oregon State University in the Department of Foods and Nutrition. Currently, I am doing a study on infant feeding practices in the Portland area. Your name was selected from a list of new mothers at the Office of Vital Statistics. Since I also am a mother with a young child, I have a personal interest in this subject.

Within the next two weeks, I would like to talk to you, by phone, to ask you a few questions about feeding your baby. However, even though I have your name and address, I was not able to locate a phone number for you in the Portland phone directory. If you would be willing to participate in this study, would you please fill out the enclosed, self-addressed, stamped postcard and place it in the mail, or call me in Portland at 254-3530.

Your help in this study is very important. The results will provide valuable information to health care workers. This information will help them in their efforts to meet the nutritional needs of young infants.

All the information you give is strictly confidential. If you have any questions, please call me.

Sincerely,

Joyce Marsnal
Graduate Student in Foods and Nutrition
Oregon State University
Corvallis, OR 97331

JM:kc
Enclosure
Joyce Marshall
Department of Foods and Nutrition
Oregon State University
Corvallis, OR 97331

Name ___________________________
Phone number ____________________
Convenient time to call:
_______________ a.m.
_______________ p.m.
Last month a letter was mailed to you asking you to participate in a study on infant feeding practices. Your name was selected from a list of new mothers at the Office of Vital Statistics.

Because the letter was mailed during the holiday season, it may have been set aside or misplaced with the excitement of Christmas.

I am writing again because your help in this study is very important. The information you can provide will help health care workers in their efforts to meet the nutritional needs of young infants.

Please call me in Portland at 281-3135. I will be available during the following days and hours:

- Friday, January 14th from 10 a.m. to 8:30 p.m.
- Saturday, January 15th from 10 a.m. to 8:30 p.m.
- Sunday, January 16th from 2:00 p.m. to 8:30 p.m.
- Monday, January 17th from 10:00 a.m. to 5:00 p.m.

Your cooperation is greatly appreciated.

Sincerely,

Joyce Marshall
Graduate Student in Foods and Nutrition
I am a graduate student at Oregon State University in the department of foods and nutrition. Currently, I am doing a study on infant feeding practices in the Portland area. Your name was selected from a list of new mothers at the Office of Vital Statistics. Since I also am a mother with a young child, I have a personal interest in this subject.

Within a few days, I will be calling you from Corvallis to ask your help in this study. The telephone interview should take just a few minutes. If I call when you are busy, please let me know and I will call back later.

Your help in this study is very important. The results will provide valuable information to health care workers. This information will help them in their effort to meet the nutritional needs of young infants.

All the information you give is strictly confidential. If you have any questions, please don't hesitate to ask when I call.

Sincerely,

Joyce Marshall
Graduate Student in Foods and Nutrition
Oregon State University
Corvallis, OR 97331