

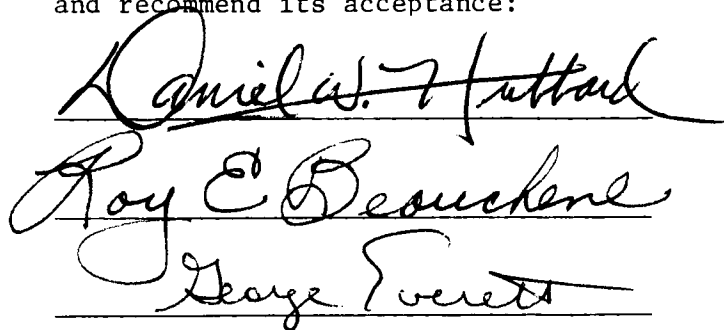
To the Graduate Council:

I am submitting herewith a dissertation written by Prisca Mugwira entitled "An Assessment of Maternal Nutrition in a District in Zimbabwe and a Proposal for Creating Nutrition Awareness." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Home Economics.



Lura M. Odland, Major Professor

We have read this dissertation
and recommend its acceptance:



Accepted for the Council:



Vice Chancellor
Graduate Studies and Research

AN ASSESSMENT OF MATERNAL NUTRITION IN A DISTRICT IN
ZIMBABWE AND A PROPOSAL FOR CREATING NUTRITION
AWARENESS

A Dissertation
Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Prisca Mugwira

June 1982

3060836

ACKNOWLEDGMENTS

The completion of this manuscript is a tribute to the hard work and unselfish cooperation of many people. The author would like to express sincere thanks to the following people and institutions:

To Dr. Lura M. Odland, who served as my major professor and provided competent and continuing guidance in the planning and completion of this study, and for her patience and encouragement throughout this study, and for her wealth of knowledge in areas of nutrition and public policy, together with her outstanding teaching ability, and her professionalism which have won her the respect of both students and faculty, and for stimulating professional development with colleagues in this and African countries.

To Dr. George Everett, who served as my advisor in the communication area of this study and also served as a committee member and provided assistance throughout the course of the study and showed a continuing interest in my academic progress, giving his many helpful comments in preparing and improving this manuscript.

To Dr. Daniel Hubbard, who has served as a committee member and has been a much appreciated source of encouragement and understanding during this study.

To Dr. Roy Beauchene, who has served as a committee member and has shown interest in this study, for his helpful suggestions for improving the manuscript.

Deepest appreciation is expressed to the African-American Institute, in particular Charlotte McPhearson, Program Director,

for sponsoring my study here at The University of Tennessee, Knoxville.

Thanks to Dr. Bharat Singh and the Department of Food Science and Technology at Alabama A. & M. University for allowing me the use of their facilities to do the food analyses.

Special thanks go to all the pregnant women who volunteered to participate in this study and to Miss Louise Allaart, the former Chief Dietitian in the Ministry of Health, for her cooperation in the collection of the data; and to the team of experts who evaluated the messages and to the graduate students and faculty members who critiqued the model.

To the many friends who believed in me and encouraged me, many thanks are offered.

The author wishes to extend profound gratitude to her family for sharing her dream. Most heart-felt thanks to my children, Tapiwa, Tafadzwa, and Anesu for their support, understanding, sacrifices, faith, inspiration and a great deal more.

ABSTRACT

In order to establish the existence of malnutrition in pregnant women in a district in Zimbabwe, an analysis of the staple food products, mealie meal (Lite-Wite) and sadza made from this meal was completed. In addition, a dietary survey of 50 women and body weight measurements of 21 of the 50 women were carried out.

For the meal and sadza, calories, protein, fat, calcium, iron, vitamin A, thiamin, riboflavin, niacin, and ascorbic acid level were estimated using methods established by the American Association of Cereal Chemists. The analyses of essential amino acids (valine, phenylalanine, threonine, methionine, lysine, leucine, isoleucine) involved use of the Amino Acid Analyzer--119B. Tryptophan was analyzed using the methods developed by Spies and Chambers. The dietary calculations were based on food composition tables for local foods as compiled by the Ministry of Health, Zimbabwe.

The food analysis data indicated low content of protein, fat, iron, vitamin A, thiamin, riboflavin, niacin and ascorbic acid in both mealie meal and sadza. Dietary intake estimations indicated that the protein intake approximated FAO recommended allowances; however, the protein source, maize, was low in lysine and tryptophan. Total daily caloric intake was low, as was calcium, vitamin A, niacin and ascorbic acid. The body weight measurements indicated that only 2 of 21 pregnant women achieved the recommended weight gain of 11 Kg. Women who had low total weight gain during pregnancy tended to have infants with low birth weight.

After establishing the fact that malnutrition existed in pregnant women in this district, a communication program aimed at creating nutrition awareness in this group of people was developed. The communication program required a thorough description of the existing communication system in Zimbabwe, sample nutrition messages that may flow in such a system were developed, and a communication model with a plan of action was proposed. The nutrition messages consisted of press releases, fact sheets, brochures, and posters. These messages were sent to experts in the fields of international nutrition and communication for evaluation. Comments of 12 evaluators were then incorporated into the reconstruction of these messages.

A nutrition communication model with a plan of action was developed. The model consisted of three phases: opinion leaders, the target population, and feedback. The model was then critiqued by graduate students and faculty members in the Communication discipline. Comments of the participants were used to improve the model's usefulness.

The messages and the model were found to have potential in creating nutrition awareness in this population. The model was viewed as having potential use in nutrition education not only in this particular district, but the whole country, as well as other countries. Each situation, however, must be examined and adjustment made to suit local characteristics.

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CHAPTER I

INTRODUCTION

Nutrition, according to the National Research Council (1), is fundamental to life, performance, and well-being. The Food and Agriculture Organization (FAO) of the United Nations states that nutrition influences and reflects the economic and social development of a country (2).

The single most important health problem in a majority of developing countries continues to be malnutrition. But present Ministries of Health, like colonial medical departments before them, tend to regard nutrition as being of lesser priority, if considered as a priority at all (3).

When an infectious disease such as cholera occurs, which is responsible for only a fraction of the number of people that die each year due primarily to malnutrition related diseases such as kwashiorkor or marasmus, an all-out control campaign is launched. The lack of response to mortality and morbidity associated with malnutrition may in large part be due to the fact that these diseases primarily involve young children. This is usually viewed as "normal" for this age group in developing countries such as Zimbabwe. Malnutrition, if reported at all, is greatly under-reported in disease and mortality statistics, especially in young children (4).

Mothers are often unaware of the need for a well-balanced diet for themselves when pregnant or lactating. Awareness and knowledge

are also lacking in the selection of foods that small children need to be able to grow and develop to their fullest potential. It is common among parents to feel that the same diet they grew up on is good enough for their offspring.

The traditional African diet is basically adequate. However, it should be modified to allow the provision of special nutrient requirements for pregnant and lactating women and infants. Generally, the problem is not what foods are eaten, but rather how much of each food is eaten and how it is distributed within the family.

Research on the functional assessment of nutritional status has frequently been focused on physiological performances and on morbidity and mortality indices. However, social and economic factors must also be considered (1, 5). According to Joy and Payne (6), nutrition planning should encompass food supply, distribution, income, and the environment. They also suggest that an effective approach to reduce malnutrition should start with the identification of the problem and the specific group of the population at risk. It is suggested that such an analysis be accompanied by the analysis of other forms of deprivation (7).

According to the National Research Council (1), it is not enough to know that low energy intake will limit growth and decrease physical activity. It is crucial also to know the extent to which energy intake restrictions will affect learning and behavior of the population as well as community development.

Recent studies have subscribed to the belief that nutrition has a critical impact on national development. According to Berg (8),

a nutrition program cannot be effective without national government commitment. This can be facilitated by effective communication between the national policy planners and the nutrition advocates. The communication established at this point enhances the communication that is required in the diffusion of nutrition information to the masses, when the program is actually implemented.

Objectives

A plan is needed to improve nutrition awareness and knowledge within the population of Zimbabwe, especially pregnant and lactating women. This could be achieved in large part through nutrition education programs with particular attention to the communication component.

A critical starting point for any effective nutrition program is the appraisal of the extent of the problem and the nature of the population to be dealt with. The purpose of this study is to take a close look at maternal food intake and the nutritive value of the staple diet and to offer strategies for the improvement of nutrition in Zimbabwe.

The specific objectives of this study are:

1. To identify the problem of current maternal nutritional status, analyzing the staple food and maternal daily food intake.
2. To propose a possible solution to the problem with the organization of a public program to create awareness of the importance of general, maternal, and infant nutrition.

3. To offer, by developing a nutrition education message and communication model, a plan for acceptance of the proposed solution by the target audiences.

CHAPTER II

REVIEW OF LITERATURE

In recent years there have been many volumes of information written about the magnitude and implications of malnutrition in developing countries. This has created a sense of urgency to attack the problem. Yet as one looks at the plans of many developing countries, nutrition is not mentioned. If nutrition is mentioned, its relative priority, measured by allocation of resources, is almost nonexistent (7).

This worries a small but increasing number of national and international nutrition and health experts, and a rich dialogue has emerged among those sharing these concerns. Issues are now more precisely defined, new justifications are being examined, and new conceptual approaches are unfolding (8)

Through whatever route the concern for adequate nutrition is approached, there seem to be specific basic requirements that must be considered and satisfied as far as possible. These should include a survey of available foods to meet nutritional needs and nutritional status assessment of the whole population in various geographical areas of the country and in particular for the most vulnerable population groups (9). Another basic requirement is to ensure availability of resources to obtain sufficient food to meet the basic nutritional requirements of the people (10). Further is the need to provide effective educational processes for the population to attain

improvement of nutritional high risk groups through such educational processes.

History of Zimbabwe

At the beginning of the 19th century, present-day Zimbabwe was largely occupied by Shona-speaking cultivators and herders. These people tilled the land and received sustenance from it. Later in the century, the Shonas were joined by the Nguni- and Zulu-speaking Africans (Ndebeles) who were gradually being pushed northward from the Cape by the Europeans. There were recognizable areas of cooperation between the Shonas and the Ndebeles (11).

This stability was broken from 1880 onward by British colonial expansion. The local expression of this force was Cecil John Rhodes, a poor man who wanted to exploit Africa. Rhodes first made his fortune in the Kimberly diamond fields, then entered Zimbabwe in 1890 (11). Colonial rule was enforced by the British military against the Shonas and Ndebeles, the two main ethnic groups in Zimbabwe. The Shonas speak Shona and the Ndebeles speak Ndebele. Rhodes eventually prevailed and white domination of the Africans of Zimbabwe began.

The country was ruled for some time by Rhodes' British South Africa Company until it achieved responsible government in 1923. A few years after achieving self-government status, Rhodesia's whites, with the British government's approval, sought ways and means of entrenching themselves and enacted laws to perpetuate white supremacy (12). The most significant of these was the Land Apportionment Act

of 1930. This legislation removed the rights of the Africans to purchase land or occupy land outside specific African areas. It also enforced territorial segregation between blacks and whites. According to successive white governments, blacks were supposed to have benefitted from this law. But actually what happened was that Africans were removed from areas of brown productive soil into areas covered with less productive sandy soil and far away from railways and major roads, making it extremely difficult for the Africans to conduct trade and other commercial activities (13).

From the beginning, Rhodesia constantly sought greater freedom from Britain. In 1953, the British were persuaded to form a federation between Southern Rhodesia and the territories of Northern Rhodesia and Nyasaland (now Zambia and Malawi) by whites in the three territories, who hoped for the creating of a dominion along the same lines as South Africa. The Africans in the northern two territories increased their political rights to the extent that they achieved majority rule by 1962, and this resulted in the dissolution of the federation.

Meanwhile the Europeans in Southern Rhodesia grew alarmed by the nationalist spirit developing among the Africans in their own country, so there was an attempt to stifle political expression. This course did not deter the determined African people. The attitude of the ruling Europeans simply intensified the desire for self-rule by the Africans.

In 1961, Prime Minister Ian Smith held a referendum to gain the electorate's support for independence under the 1961 constitution.

Britain responded by affirming the desirability of independence, but demanded that a universal referendum be held to make sure that the Africans agreed. Smith's government refused and unilaterally declared independence on November 11, 1965 (13).

This move strengthened the determination of the present leaders of Zimbabwe to wage "chimurenga" for the liberation of Zimbabwe. The war for liberation ensued for 15 years. Zimbabwe won official independence on April 18, 1980.

Background Characteristics

Zimbabwe has an area of 150,699 square miles. It is land locked and it borders with Zambia to the north, Mozambique to the east, South Africa to the south, and Botswana to the west. The country consists of five provinces, Mashonaland, Manicaland, Matebeleland, Victoria, and Midlands. The principal cities and towns are Salisbury (capital), Bulawayo, Gwelo, Umtali, Que Que, Gatooma, Wankie, Sinoia, Fort Victoria, Marandellas, Shabani, and Redcliff (13).

Zimbabwe lies astride the high plateau between the Zambezi and Limpopo rivers. It consists of three relief regions; land over 4,000 feet altitude is highveld, land between 3,000-4,000 feet is middleveld, and land below 3,000 feet forms the lowveld. Rainfall is largely restricted to the period of November-March. The highveld and middleveld are relatively fertile (13).

The principal crops of Zimbabwe are wheat, maize, millet, sorghum, sugar cane, potatoes, dry beans, oranges, groundnut, cotton, tea, and tobacco. The major livestock products are beef and veal,

mutton and lamb, goat meat, pork, poultry, other meat (game), cow's milk, butter, cheese, and eggs (13).

The population of Zimbabwe is diverse. In 1981 it was estimated to consist of 7,140,000 Africans, 214,000 Europeans, and 35,000 Asians and Coloureds (people of mixed blood)(13).

The economy of Zimbabwe remains largely dominated by Europeans in terms of administrative and managerial expertise, entrepreneurial abilities, and skilled and even semi-skilled workers.

Health factors. According to Berg (8) and Tickney (14), effective nutritional planning requires the identification of the target population and their nutritional needs. The development of a nutrition intervention program, particularly for vulnerable groups, should be considered a high priority. However, when examining a series of policy issues relating to whether malnutrition is a high priority item among Ministries of Health in developing countries, Berg concluded that a convincing case for the urgency for nutrition consideration by governments has not been made. Researchers feel that until a sufficiently strong case has been presented, the impact of the extensive research of the scientific community will not reach beyond the periphery of the malnutrition problem (1, 7, 8).

The significance of malnutrition is frequently measured in the very basic terms of its effects on mortality rates and on morbidity rates and the physical and social development of people who survive.

The cycle of malnutrition, infection, and eventual death are so common in developing countries that the mortality of infants and

children (especially those under 5 years old) may serve as a nutritional status index of the population as a whole along with maternal death rates and stillbirths (15). Infant and child mortality, maternal death rates, and stillbirths recorded for Africans in Zimbabwe are extremely high compared to those for the other areas (16, 17).

In Zimbabwe, the African population constitutes 96.0% of the total population. Fifty percent of the African population is said to be under the age of 15 and 20% is under the age of 5 (14).

Of all the deaths recorded in Zimbabwe each year, about half are children, and half the deaths of children are said to be due to malnutrition (18). This is a common characteristic in most developing countries, where malnutrition has been found to be the primary or secondary cause of death for more than half of the children who die (19). In a study by Axton (20) on admissions at Harare Hospital in Salisbury, malnutrition was found to be the first, second, and/or third diagnosis in a third of the children admitted.

According to Riley (18), malnutrition prevalence varied from area to area. Malnutrition among children of workers on European farms and plantations was found to be worse than among those in rural areas (18). In another study by Clarke (21), in Macheke District, it was estimated that as many as 90% of the children were suffering from malnutrition. In a report by the Provincial Health Officer for Matebeleland (22, 23), it was estimated that in some areas, infant mortality rates were as high as 300 per 1,000. This widespread malnutrition was evidenced by a survey carried out in the

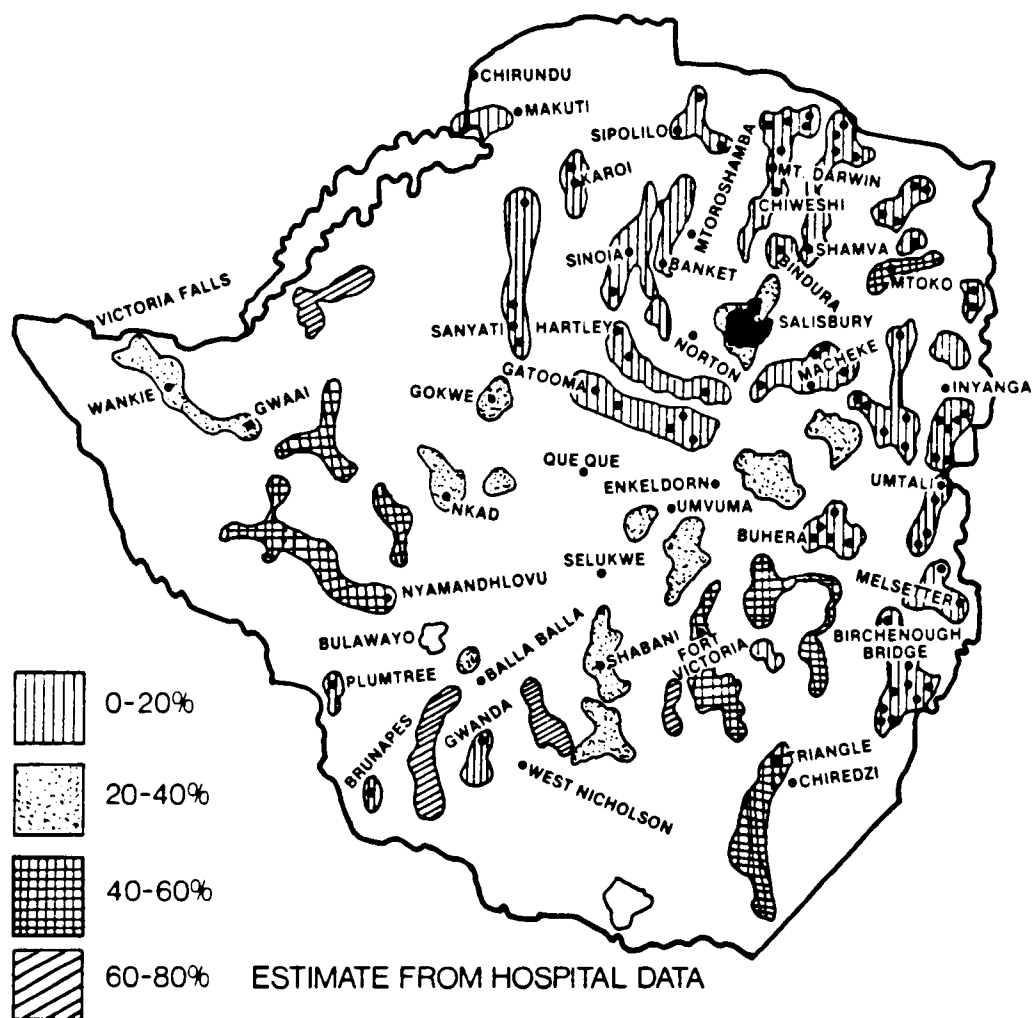
Ministry of Health in late 1980 (24). The study showed (Figure 1) that the most affected areas were in the western and southern regions of the country along with some urban areas.

Nutrition related deaths for those few African women who were hospitalized at the time in Zimbabwe in 1978, from both avitaminosis and other nutrient deficiencies, amounted to 226. In 1979, the total rose to 336. This was a 33% increase from 1978 to 1979. Anemias were responsible for 31 deaths in 1978 and 42 deaths in 1979 in African females, which was a 26% increase (16, 17).

Aside from birth injury and difficult labor, anoxic and hypoxic conditions, brain damage, and perinatal morbidity and mortality, the major killers of infants in Zimbabwe are diseases related to the nutritional status of the mother during and after pregnancy. If the mother's diet were satisfactory, the infant mortality and morbidity would decrease. According to data compiled by the Ministry of Health, of all the people who died in Zimbabwe in 1978 from pneumonia 51% were infants; enteritis and other diarrheal diseases, 48% infants; tetanus, 95% infants; and measles, 20% infants (16, 17). Therefore, emphasis on this high risk group is critical.

According to the Ministry of Health data collected in 1978 and 1979 (16, 17), the number of stillbirths registered for these two years showed a drastic increase from 1,671 to 2,040. These figures reflect only those who were hospitalized at the time of the census.

Infant mortality rates, particularly for Africans, have been found to be varied from region to region. The infant mortality rates



Note: Dots represent areas from which the data was collected.

Source: Zimbabwe Herald, December 8, 1980.

Figure 1. The Prevalence of Malnutrition in Children in Zimbabwe.

for Africans ranged from 120-300 per 1,000 in the 2 years. This range is said to be characteristic of developing countries. European infant mortality rates were 15 per 1,000 for 1978 and 14 per 1,000 in 1979. There were no figures available for Coloureds (16, 17).

In those children who survive malnutrition, altered behavior has been noted. In 1976, Cravioto and Delicardie (25) in Mexico reported that children who were malnourished early in life exhibited signs of slow learning and short attention span compared to their counterparts.

Maternal death rates for Africans in Zimbabwe have been reported to be much higher than those for other races combined (16, 17) due to the uneven distribution of wealth, lack of food and inadequate hygiene facilities (4). This was further supported by Wenlock's (5) study in Zambia, reporting that inadequate food intake apparently resulted in low milk production, hence a shorter lactation period for the infant.

Ministry of Health data in 1978 indicate that toxemia of pregnancy and puerperium represented 13% of maternal deaths and in 1979 it represented 27%, which was a 33% increase. Hemorrhage of pregnancy and childbirth in 1978 represented 18% of maternal deaths, and in 1979 it went up to 30%, an 11% increase. Other complications of pregnancy and childbirth were 49% of total maternal deaths in 1978 and 60% in 1979--an increase of 21% (16, 17).

To drastically reduce the number of infants who die or suffer from the above mentioned diseases and to decrease the number of

maternal deaths and stillbirths in Zimbabwe, there is an urgent need to improve maternal and infant nutrition from conception through early childhood.

The estimated nutrient content of frequently consumed foods in Zimbabwe indicates an inadequate daily nutrient intake. Sadza, the staple food, made from a variety of grains but mainly corn, provides a limited amount of protein, calcium, iron, vitamin A, thiamin, and riboflavin. Niacin and ascorbic acid are essentially not available in the traditional diet, although tryptophan contributes some niacin equivalent values. Sadza is prepared by water, and mealie meal from corn, millet, rapoko, and/or sorghum is added until the mixture reaches a consistency which may be consumed out of hand. Millet, rapoko, and sorghum are usually not available all year because they are not grown on a large scale (23).

The relishes that accompany the staple food (sadza) are usually prepared using dried or fresh green leafy vegetable, a little fat, tomato, onions, and sometimes peanut butter. The vegetables used in relish are rape, mufushwa (dried bean leaves), pumpkin leaves, and/or okra. These fresh vegetables are available seasonally (about 4 months of the year) and are generally good sources of some of the vitamins and minerals (23).

Meat, poultry, and meat products are generally very good sources of most nutrients except for vitamin C. Compared to the other foods, eggs were a slightly better source of vitamin C. However, because a man's wealth is equated with the number of cattle he owns, beef is

not used as part of the diet except on special occasions. Chicken is eaten, but again it is usually available only when special guests have arrived for a visit. Taboos have been a part of the heritage of the people and eggs are a cultural taboo, therefore they are not widely consumed. Milk is consumed as sour milk, but again it is a seasonal food due to insufficient grazing grass all year long, and grazing land is limited. The cows generally produce adequate milk during the summer season when there is ample grass (23).

Other foods such as rice, sweet potatoes, pawpaws, oranges, mangoes, guava, and Irish potatoes are part of the diet, but their availability may be seasonal unless there is adequate processing or adequate storage equipment and facilities. Palm oil, bread, margarine, butter, and vegetable oil are available, however, money has to be on hand for their purchase. Peanuts, peanut butter, and cowpeas are available but they frequently are used as a purchasing medium or a cash crop (23, 24).

Economic factors. The alleviation of malnutrition in Zimbabwe requires not only technical production consideration and comprehensive nutrition education but also there must be a more detailed study of the socioeconomic factors related to continuing the production, distribution, and consumption of foods. Presently, there is no mechanism for regularly incorporating nutritional considerations into the planning of food supplies as well as for socioeconomic constraints analysis (24).

According to Tickner (14), the important consideration in viewing dietary requirements is not so much to establish significant statistics

but to establish priorities for high risk sections of the population which are inadequately fed, and what methods of direct or indirect support can be undertaken to alleviate those deficiencies. Other considerations include employment generation, increased incomes, food supplementation, stimulation of nutritional awareness and knowledge, and improvement of the productive capacities and/or the distribution systems in those areas (8, 25).

As a justification for a program of improved nutrition, one would give first place to the direct contribution of nutrition to national welfare through an enhanced quality of life, including physical and mental well-being (26). This is one of the fundamental objectives of economic development for Zimbabwe.

According to Mellow (26), lack of income, not ineptness in allocating income, is the primary cause of malnutrition among the poor. For this reason, he postulates that the poor must be given increased participation in economic growth. Increasing the knowledge of the effects malnutrition exerts on human welfare will strengthen the conviction that the costs of delay in providing employment and income to the poor will be very high in terms of malnutrition and, consequently, physical and mental retardation (27). The same sentiment was echoed by Clarke (22) and Tickner (14), who feel that there is a need to change the approach to economic growth so as to provide full employment to the people if one is to effectively deal with the country's nutritional problems.

Recently, the concept of capital has been extended to human resources. Development of the new theory was prompted by the discovery

that increases in national output have been large compared to increases in land, man hours, and physical reproducible capital (28). Investment in human capital is probably the major explanation for the difference.

Attempts are being considered to measure economic returns to health investments by starting with the cost of preventing a death compared to the worker's future income had he lived (29). The investment in human capital--health, food, clothing, housing, education, and other expenditures necessary to enable a person to develop his particular skills--is measured against his loss through death prior to retirement age (30, 31, 32). These costs can also be measured against debility, where death is not a factor.

Similar comparisons were made on the benefits to be gained from expenditures on nutrition (33). The return of an absent worker to the active labor force helps to lengthen his working life span and to overcome debility that reduces his productive capacity. In an individual, improved health also enables effective in-service training and clearly raises the flow of earnings above what it would have been in absence of the improved well-being (34).

According to Schultz (31) and Mushkin (32), once a person's well-being is stabilized, nutrition costs become a maintenance expenditure where increments of nutrition no longer lead to increased productivity. An improvement in nutrition to the level of stabilized well-being, therefore, can help to improve or maintain the productivity level of the labor force.

It is better to prevent malnutrition than to cure it. The elimination of kwashiorkor, for instance, frees beds and other medical

resources for the treatment of other sick individuals who are otherwise unable to gain entry into the hospital (33). Adequate nutrition enables the medical system to increase the state of well-being and restore the productivity of all those people on the line who would not be able to replace malnutrition patients in the system (29).

Productivity losses due to debility are reduced in a substantial portion of the labor force when a nutrition program is developed, implemented, and carried out. Malnutrition has been shown to decrease the economic growth of the country when the working years of the labor force (due to debility and death) are reduced (35).

Another way malnutrition can cost economic growth of a nation is in the number of days a laborer takes off because of sickness and/or death of a child, wife, or other relative due to malnutrition. This also results in decreased productivity and eventually in increased operative costs (36).

Other things being equal, researchers postulate that a lengthening of the working life reduces the country's dependency ratio (26, 33). Nutrition programs provide a number of economic benefits in addition to direct productive benefits (37). These benefits include the lowering of the incidence of communicable diseases among the adequately nourished. The increased income of well-nourished workers has been reported to improve the living standards of their dependents, thereby raising both their current consumption and their future productivity (38). Housewives whose activities are not measured in a market economy should, when better nourished, improve performance

on a number of functions, not least of which is the quality of care of their children (39).

According to Tickner (14), the poor spend a larger percentage of wages on food than do those in the higher income bracket although increased income may or may not equate with increased food for the family (40).

Tickner (14) noted that although a greater proportion of the population in Zimbabwe is engaged in employment for wages than in many other African countries, the proportion of those employed for wages has been dropping over the past 20 years.

The investment benefit of a health program including nutrition extends from reduction in mortality and morbidity to a general enhancement of vitality (41). Low levels of health reduce the nation's effective labor supply. To reduce high mortality and morbidity rates requires training of the people who are expected to be professionals in the field of nutrition who will be responsible for the development and implementation of intervention programs (42).

However, it is crucial to remember that benefits of nutrition programs do not all occur instantly. Some social benefits of lowering infant mortality come years later, while others are immediate, such as increases in adult labor force and productivity (9).

It is difficult to value all benefits in terms of money. This is inappropriate because it underestimates or neglects possible benefits (15). There must be an understanding of the incentives and disincentives that a program alternative brings into existence. It is not adequate to describe a nutritional need and a solution and be

aware of neither the beneficiary behavior nor the supportive bureaucratic effort that the solution requires (34).

Social factors. Nutrition, whether its work is in the laboratory or in the field, is an area of ultimate and direct concern to human welfare. Nutrition education aims to transform knowledge into eating practices that will improve health and well-being of the masses. However, it is critical to understand the Zimbabwe society if such a program is to be effective (43).

According to Giffit et al. (40), an intimate relationship exists between peoples' life styles and the foods they choose to eat. Food behavior cannot be isolated, for purposes of understanding, from behavior in all other areas of human existence. Every society possesses a culture, a set of customs, and traditions that designate appropriate or required ways of acting, thinking, and feeling. Culture, therefore, is considered man's way of life. Its function, according to Giffit and coworkers (40), is to assure survival by providing tested techniques for coping with the needs of the people who compose the society.

As it has been demonstrated by Cepede (44, 45), some customs that society establishes for a people are detrimental to physical as well as mental development of the people in that society. According to the African custom, the status attached to the consumption of certain foods, especially meat, means it is kept for the head of the family, while those needing it most (pregnant and lactating women and

infants--the most vulnerable groups) go without. Therefore, as Cepede (45) puts it, malnutrition is not only an economic phenomenon but a cultural one as well.

In suburban populations of African cities and towns, it has been noted that families who have moved from rural areas are ceasing to eat legumes and millet long before their purchasing power is high enough to allow consumptions of meat in amounts necessary to supply adequate protein (45, 14), which might otherwise have been derived from combinations of legumes and millet.

Due to substitution for certain foodstuffs of the so-called "European foods" (pies, sweets) as a status symbol, malnutrition is increasing among families in the urban areas. In small infants the reconstitution of baby formulas with unsanitary water and departure from the traditional and natural infant feeding mode--breast feeding --have been responsible for the high infant mortality and morbidity rates in Africa and other developing countries (3, 39).

The effects of malnutrition vary, depending on the nature of the factor that caused the disease--the age of the individual at onset, severity of the lack of the nutrients, the season, and the physiological state of the individual (46, 47, 48, 27). According to research, manifestations of malnutrition include growth retardation, loss of the body's ability to repair tissues, tissue breakdown, impaired cell synthesis and maturation, abnormal metabolic processes, and, ultimately, death (49, 50). All these abnormal occurrences caused by malnutrition are said to have a direct or indirect influence on the survival of the society (44, 40).

The interaction of the effects produced by the societal factors and the individual is what ultimately results in malnutrition. These may arise from causes ranging from insufficient investment in sanitary modifications of the environment to the persistence of traditional concepts of health and disease. These prescientific conceptions include incorrect ideas on the role of food in the production of disease. Therefore, within the limits set by the purchasing power of the family, the pattern of distribution of available food within the family is reduced (14). The final result is a reduction in the type and amount of food that the person is allowed to consume.

Taking a different look at the effect of malnutrition on the society, Bengoa (33) said it may begin from a lack of financial reserves which result in pressure for early school dropout to increase the purchasing power of the family. It is postulated that the reason why school dropout rates increase the problem of malnutrition is that the lack of education restricts opportunities for advancement. This in turn interferes with technological development and the persistence of primitive conceptions of health and disease. Early school dropout has also been shown to result in the conferral by society of adulthood status and role to persons at an earlier age than would be the case had they continued with schooling. This situation is said to lead to an increased chance of marrying at a young age and to an equally uneducated spouse. This, therefore, results in the maintenance of the cycle of a large family, inadequate child care, low income, illness, and malnutrition (51, 8).

The malnourished individual may make an adjustment in the body process as a means of adapting to inadequate intake (52). For instance, an individual may expend less energy as the individual attempts to conserve energy necessary for internal processes (53). This adjustment may result in a more slowly paced work, less muscular exertion, diminished opportunities for activity, low body weight, and poor health (33). All of this can result in an individual's loss of employment and exclusion from society (54, 50). The apathy and indifference, according to Scrimshaw and Gordon (55), are common characteristics among people in the low-income levels of the population in developing countries. Research has confirmed that this is a result of the adjustment to a way of life consistent with the inadequate energy and nutrient supplies available (56).

In Zimbabwe, average wages (Z\$49.00 per month) for Africans are very low when compared to those of the other races in Zimbabwe. The average family size for Africans is estimated to be 5.8 people (21). The average wage is not adequate to support such a family even in a developing country like Zimbabwe where the standard of living is relatively low.

As part of a larger study, Clarke (21) reported that for agricultural workers and their families, the inadequacy of their diets was associated with widespread malnutrition of these workers and their families. In a study done in 1976 (18), a medical specialist described the food rations given to the farm workers as wholly inadequate, and a majority of the children of farm workers were suffering from malnutrition.

Political factors. The Manifesto published by the government after independence in April 1980 states that the government is dedicated to the elimination of hunger. It stated that provision of adequate amounts of food constitutes a basic human right for every man, woman, and child in Zimbabwe (57, 58).

It is only during the past decade that the problem of malnutrition has been given attention in Zimbabwe by others than health professionals. This new focus has been provided mainly by outside organizations. The facts about the economic conditions producing wide-spread malnutrition were brought to the surface, particularly in the struggle for liberation. Studies of a very limited extent have indicated that Zimbabwe, where the staple food is mainly maize, was facing a protein crisis, particularly in young children (3, 14, 18, 20).

It is fair to say that a major concern of the government and the people of Zimbabwe is to provide enough calories for all. According to Tickner (14), this means increased food production and proper distribution. For adequate nutrition, this means food planning with nutrition considerations in that plan. Therefore, attention should be given to improving the variety, selection, and quality of such food as can be made available and may even mean modification of genetic characteristics of food--as in the production of high lysine maize.

It is obvious that Zimbabwe cannot change overnight the political conditions that its people have lived under for the past 90 years.

The development of an agriculturally based economy is of necessity a relatively slow process. It involves transformation of the traditional sector through carefully managed innovations and its integration into the national development policies (59). This in turn implies the establishment of all the necessary physical and socio-economic infrastructure, land reform, and a marketing system which encompasses both internal and external needs (14). There is also a need to build better roads and transportation services to facilitate the movement of people and good and to establish an adequate education and communication system (60). These conditions would increase earnings, thereby improving the standard of living of the people.

Zimbabwe exports minerals, tobacco, and corn, and these constitute 70-80% of the total exports. It is these exports that bring the foreign exchange needed to finance the country's total development program (14).

To redesign the basic structure that is required to accommodate the needs of the people will take time to organize, perhaps through the remainder of this century. In the meantime, a plan to improve the nutritional level of the masses must be initiated immediately. New inputs organized through the "package" type approach to small land holders, such as those attempted in Ethiopia, may enable some farmers to significantly increase yields, improve storage, and adopt marketing procedures, thus raising their incomes. A concerted effort to educate the masses, especially women, to improve their techniques in food selection, preparation, and consumption may ensure that in a small portion of the field or garden beans, groundnuts, and

other vegetables will continue to be cultivated. This would increase and improve the dietary intake of the whole family (61). It is critical to realize that only a small number of rural people can be reached and offered such assistance simultaneously. With the increase in production, the low income urban dweller will be able to purchase less expensive foodstuffs until such a time that industrial output makes it possible to pay higher wages (62).

It can be said that the malnutrition problem has its roots in the world economic situation and it is not as easily soluble as it may seem (1). It is only through the process of development and proper planning that the underfed of Zimbabwe can reach a point where they can be able to attain better nutrition.

Although there has not been varied and deep research on the problem of malnutrition in Zimbabwe, the work on research now is beginning to yield significantly qualified results to allow decisive action by policy makers. However, nutrition should receive attention commensurate with and as an integrated part of the other problems that are facing the new government (4).

Malnutrition often becomes a visible problem and when this happens, the government may look to international sources for aid and to other measures of relief from within which will not be adequate (63). Under such circumstances, policy makers may remain inert, because the nutrition problem has not been integrated in many national plans (8). Nutrition should be made a long-range productive factor and not purely a consumptive drain upon the national economy.

Rural development is of crucial importance to national political stability. This is because the rural area is and will continue to be the main source of national income for years to come.

According to George (62), in view of the food planning and policy, the adoption of a "new economic order" based on the uniform food system model which guarantees western-style standards of living for some just as surely as it does hunger for others is probably the line of least resistance most developing countries will follow. The only way to oppose it is said to be through genuine political commitment, backed by the entire national community which recognizes dependency as the enemy.

No matter how practical or clear a program may be, nothing can succeed unless people accept what is being proposed and use it in their homes. To achieve such an effect there must be effective communication between the change agent and the target population, utilizing all levels of government.

The Diffusion Process

Communication is now becoming fully recognized as a vital force in the spreading of innovations like nutrition programs. This is true particularly in developing countries. For a target audience to be expected to adopt an innovation, a communication strategy must be mapped and established before program implementation.

In the literature of communication theory, an innovation is an idea, product, or practice which is new in the experience of the potential adopter (64). In a social system, the diffusion process

is the spread of a new idea from its source of invention to its ultimate user (64, 65).

Earlier diffusion studies were centered on introduction of agricultural products. Recently, study of the process of spreading new technology (including industrial products) has taken hold in developed countries. Although very little research has been done on other innovations, such as changes in the diets of people, the process of getting a farmer in the third world countries to change the way he ploughs the land is not terribly different from changing the way he feeds his family.

Several disciplines have had a long tradition of diffusion research. In anthropology and geography, in this country, the research dates back from the early 1900s (66). Sociologists, on the other hand, trace their beginning in this area to Tarde's (1903) book on imitation behavior (67). The focus on innovation as such, instead of the generalized diffusion process, is more recent, dating back to the 1930s (64). This is represented by works of Pemberton (68, 69), Bowers (70, 71), McVoy (72), and Ryan and Gross (73). Other disciplines more recently involved in diffusion research include economics, marketing, political science, communication, education (64), and nutrition (74).

According to Brown (67), the prevailing and most completely developed area of research on the diffusion of innovations, representing an effort spanning approximately 45 years, focuses on the process by which adoption takes place. Rogers and Shoemaker (64) list the

main elements of diffusion as (1) innovation, (2) channels, (3) time, and (4) target population.

Until recently, the adoption perspective was identical to what people termed innovation diffusion (64). This concern about spreading new ideas to improve the well-being of people the world over has had the most direct input into policy and planning of development programs in many countries (industrialized as well as non-industrialized countries).

Diffusion of innovation has been viewed largely in a communication context by those in communication as well as those in other disciplines, with special attention given to the process by which a person is persuaded to adopt (64, 74). Several disciplines also emphasize situational factors in explaining differences in the adoption times from place to place (74), while others have given emphasis to site factors (74, 75).

The study of the diffusion theory has been applied to many programs in both developed and developing countries. Success has been reported in many of the programs, however, some have met with complete failure. Great strides are being made with this concept of communication.

Usually, it is assumed that adoption of an innovation is beneficial, that the primary task in bringing about adoption is to create knowledge of the innovation and its attributes. This, according to Rogers (76) and Frey (77), is the key to making a program a success or a failure. In designing the communication strategy, it was pointed out by the Protein Advisory Group (PAG) of the United

Nations (74) that the message must be easy to comprehend and relevant to the needs of the target population. The United Nations Protein Advisory Group, apparently, is the only group thus far to apply diffusion to nutrition.

The adoption process draws attention to a process which begins with a source (a change agent or agency). The main purpose of the source is to diffuse an innovation, which in this case could be a balanced diet, to the target audience (pregnant and lactating women). To do this, messages are constructed (pamphlets, for example) which must reach the intended audience through channels such as radios and newspapers (74).

To be able to convince people that what is being proposed is a solution to some of the problems they may be experiencing, communication must balance the advantages and disadvantages against each other in such a way that the former outweigh the latter in the perception of the potential adopter (78).

An innovation is said to be an idea, a practice, or an object that is perceived as new in the eyes of future adopters who are being introduced to it for the first time. Communication experts focus upon how that innovation will be perceived by potential adopters. For those experts, it is crucial to know the general characteristics of the innovation that provide a basis for evaluating the diffusability of a given innovation. These are said to be: (1) relative advantage; (2) compatibility; (3) complexity; (4) observability; and (5) trial-ability (74).

The relative advantage of a nutrition innovation may be quite clear to trained experts, yet hidden to their clients due to differences in sophistication. Therefore, appropriate symbols and messages must be found and critiqued to make sure they fit the perception of intended adopters.

Due to the imposition of varied new tastes, smells, textures, and appearances, compatibility may be difficult to deal with. Therefore, ways must be found to make innovations, particularly those associated with food, appear less strange in the eyes of those intended. Before and after pictures of persons on various diets need to be produced to demonstrate improvement over time. Formulating a balanced diet may be complex to understand because instructions may be difficult to comprehend. So, ways must be found to reduce complexity. Unavailability of food has been found to complicate trialability. Foods proposed must be easily available to those involved (74, 78).

According to Yarbrough (78) and McAnany (79), to be able to get the idea across to those for whom it is intended, a message must be externalized to become observable. This will involve message treatment and symbol selection that is creatively executed. The message must provide a motivational drive for behavioral change (80). The symbol selection should be meaningful to those potential adopters.

Diffusion theory has been used in many developing countries by international agencies belonging to PAG to create and increase nutrition knowledge and awareness. The Agency for International Development (AID) carried out a project in Bihar, India a few years after a severe famine overtook Bihar. After the famine, the AID

formulated a plan for packaging, pricing, and retailing Belahar (a nutritious bread that was used during the famine) to win continuing acceptance among those who were in nutritional need.

In this study AID found that teachers were more important change agents than children. This food was accepted after it was repackaged in a different package to remove its association to the famine.

Another study by Manof International Inc. (81) in Ecuador demonstrated the effectiveness of the mass media in nutritional education. In this study, they tried to educate specific segments of the Ecuadorian population as to the viable solutions to specific priority nutrition problems. They also set out to motivate those segments to take steps to improve their nutritional habits.

This study demonstrated that mass media can be used to change food habits and hygiene in poor communities. It also showed that such strategies can be used to educate rural mothers, farmers, and young people without the investment of large sums of money (81).

A United Nations study in India also demonstrated that the use of mass communication can be very effective. In this study, initially, the objectives were formulated. They consisted of informing the people about protein and its role in health and creating awareness as well as informing them about balanced diets. It also set out to motivate people to make sacrifices to improve their diets (74).

The second step was to develop an operational strategy. Here, they chose a single linguistic region of India. Field research was used to evaluate the effect of the mass communication campaign on the exposed public.

The crux of the message was to inform people that protein was a very important part of a healthy diet and that the right quantity and quality were vital for well-being, particularly for those still growing.

With such successful results in these projects, it is fairly reasonable to conclude that when imaginatively conceived and creatively used, mass media offer an additional effective means of imparting nutrition knowledge to vast numbers of people. Interpersonal communication can also be used to complement mass media in such campaigns.

CHAPTER III

MATERIALS AND METHODS

Food Analysis

The food items of mealie meal and sadza were chosen for analysis because they constitute the major part of the staple diet of the African population of Zimbabwe. The Lite-Wite brand (Wightman and Company (Private) Limited, Salisbury, Zimbabwe) of mealie meal is commonly used in the making of sadza throughout most of the country. The mealie meal was obtained from Zimbabwe. It is the super-refined Lite-Wite brand. This brand was chosen because it is popular due to its white appearance and it is available nationwide. Also, it represents how most of the cereal products in Zimbabwe are processed. They are usually not enriched. The appearance appeals to people as whiteness of a meal is considered to be very prestigious.

The mealie meal is basically maize meal but it is much more refined than the regular maize meal. Sadza is eaten hot in the morning for breakfast in the form of porridge and for lunch and supper. It was essential to determine the nutritive value of Lite-Wite brand mealie meal and sadza made from this meal to estimate the nutrient composition in the diet, particularly as related to maternal and infant malnutrition in Zimbabwe. After the problem was established, this led to the exploration of how nutrition awareness could be provided among this population (pregnant women). A communication

strategy was developed and this included an extensive description of the current communication network in Zimbabwe, construction of representative sample nutrition messages, and a communication model and plan of action.

The biochemical composition of mealie meal was determined using the American Association of Cereal Chemists methods (82-91).

Calories

Gross calories were determined using a bomb calorimeter. The flour was made into three 1-gram pellets (82).

Method. Initially, switches were turned on the calorimeter controller and water heater for 15 minutes. To load the bomb, the wire was threaded and the cup with the sample was placed in a holder. The wire was placed so that it could touch the sample. The bomb was placed in a clamp, and the top was screwed on tightly, then 20 atmospheres of oxygen was slowly introduced into the bomb. The bomb was placed into the bucket and the ignition wire was attached. The bucket was filled with 2,000 ml of distilled water. The thermometers were lowered and the motor and water were turned on. After 4 minutes the initial temperature reading was taken. The bomb was ignited and timed for 8 minutes before the final reading was taken.

$$\text{Calculations. } \text{Kcal/g} = \frac{\text{Water equivalent} \times \text{temperature rise}}{\text{Sample weight}}$$

Determination of water equivalent of bomb was carried out by running 0.5 g of benzoic acid through the bomb. Wire corrections were done

using the wire correction chart. Determination of acid correction was done by rinsing the inside of the bomb and capsule holder with 50 ml of distilled water and titrating with .725N NaCO₃. Water equivalent =
$$\frac{(6318 \text{ Kcal/g/w} + C_1 C_2)}{\text{Temperature rise}}$$

Where 6318 Kcal/gm = heat of bomb per gram of benzoic acid

w = weight of benzoic acid sample

C₁ = wire correction

C₂ = acid correction

Protein

Protein was determined using the Udy Dye Method. With this method proteins react with the monosulfuric azo dye, Acid Orange 12, to form an insoluble complex. The estimate of protein is based on Calorimetric measurement of unbound dye through its relationship to total nitrogen. The Udy Protein Analyzer is manufactured by Udy Analyzer Company, Boulder, Colorado (83).

Reagents. Standard Udy reagent and reference dye solutions (Acid Orange 12 dye).

Method. Due to the granular-like texture of mealie meal, the meal had to be reground to flour form. Initially, the meter needle was adjusted to 0 and the color analyzer was turned on to allow maximum time for stabilization. Reagent dye (40 ml) was dispensed into React-R tube and 800 mg of well-blended meal flour was added.

Oscillation was done in React-R-Tube for 3 minutes, then the contents were poured into a sample bottle and screw caps were attached with a filter disk insert. The cuvet was filled with reference dye and the meter needle adjusted to a 12% protein reading as indicated in the conversion table for a particular color analyzer (83).

The sample was filtered into a cuvet and percent transmission was read when the needle reading was constant. A reference point check was done before the next sample and frequently thereafter until it, too, did not require further adjustment. The meter reading was converted into percent protein using the accompanying conversion table for the particular color analyzer. The samples were done in triplicate and averaged.

Fat

Crude fat analysis was determined using the American Association of Cereal Chemists (AACC) methods (84) for crude fat in flour, bread, and baked cereal products not containing fruit.

- Reagents.
1. Ethyl alcohol--95%
 2. Hydrochloric acid solution
 3. Ethyl ether, free from residue on evaporation
 4. Ether with a boiling point below 60° F

Method. Flour (2 g) was placed in a 50 ml beaker, 2 ml of alcohol were added and stirred to moisten all particles. HCl (10 ml) was added, mixed well, and set in a beaker in a water bath held at 70-80° F and stirred at frequent intervals until the samples were

completely hydrolyzed (about 35 minutes). Then 10 ml of alcohol were added and the samples were cooled.

The mixture was then transferred to a Rohrig fat extraction apparatus. The beaker was rinsed into an extension tube with 25 ml of ether in three portions. The flask was stoppered with a cork and shaken vigorously for 1 minute. Redistilled ether (25 ml), boiling point below 60° F, was added and again shaken vigorously for 1 minute. The mixture was allowed to stand until the upper liquid was practically clear. The ether-fat solution was drawn as much as possible through a filter consisting of a pledget of cotton packed firmly enough in the stem of the funnel to allow free passage of the ether into a weighed 125 ml flask. The liquid remaining in the tube was re-extracted each time with 15 mg of ether. It was shaken well on the addition of ether. Ether solutions were again drawn off through a filter into the same flask as before, and the tip of the spigot funnel and end of the funnel stem were free from suspended water, with a few milliliters of mixture of equal volume of the two ethers. Evaporation of ether was done slowly on the steam bath. Fat was dried in an oven at 100° C to constant weight. The flask and counterpoise were removed from the oven and allowed to stand in air to constant weight. This was reported as percent fat by hydrolysis.

Calcium and Iron

The determination of calcium and iron was carried out using the AACC method of ashing (85). After hydrolysis, calcium and iron of the samples were determined by atomic absorption (86).

Method. Mealie meal (3 g) was weighed into preweighed ashing dishes. The ashing dishes were put into a muffle furnace at 400° F. The samples were incinerated until light gray ash was obtained. They were removed from the furnace and put into a desiccator and weighed soon after they had attained room temperature. Then the samples were digested and run by atomic absorption spectrophotometry.

Thiamin

The determination of thiamin was done using AACC method 86-80--Thiamin-Thiochrone method (87).

- Reagents.
1. Sodium hydroxide solution, 15%
 2. Potassium ferricyanide solution, 1%
 3. Sulfuric acid solution, 0.1N
 4. Sodium acetate solution, 2.5M
 5. Enzyme preparation. Prepared fresh daily using 2% solution of enzyme in 2.5M sodium acetate.
 6. Isobutanol
 7. Potassium chloride solution, 25%
 8. Activated Decalso. Use 50- to 80-mesh product
 9. Stock thiamin solution
 10. Standard thiamin solution
 11. Quinine sulfate solution

Method. The mealie meal was ground to pass 20-mesh screen. The milled mixture was thoroughly mixed by tumbling materials in a container. A gram of sample was weighed. The sample was placed in

100 ml volumetric flask, 50 ml of 0.1N sulfuric acid were added, and the mixture was heated in a boiling water bath for 10 minutes. The flask was cooled to 40° C and 5 ml of enzyme suspension was added. Then it was incubated for about 4 hours at 38° C. It was then cooled and diluted to 100 ml.

The digested sample extraction was mixed well and filtered through Whatman No. 41H filter paper. Purification was not required after extraction. For oxidation purposes, the eluate was mixed well by inverting three times. A portion (5 ml) of the sample was pipeted into 25 ml glass-stoppered centrifuge separate funnel. A similar 5 ml aliquot was pipeted into a second glass-stoppered centrifuge separator funnel to be used for blank. These were marked 1 and 2. To the first funnel, 3 ml alkaline ferricyanide solution were added and 3 ml of 15% sodium hydroxide solution were added. These were mixed thoroughly and gently for 30 seconds and then 15 ml of isobutanol were added to each of the funnels and shaken vigorously for 60 seconds. They were then centrifuged to separate layers. The aqueous layer was drawn off and 1 ml of 95% ethanol was added to the isobutanol layer and mixed. A portion (10 ml) of isobutanol was decanted into a cuvet for reading fluorescence of thiochrome.

Calculations. Thiamin mg/lb = $\frac{R_x - R_{xb}}{R_s - R_{sb}} \times \frac{V}{Z} \times \frac{E}{S} \times \frac{I}{S} \times 0.454$

Where R_x = fluorometer reading with unknown

R_{xb} = blank fluorometer reading with unknown

R_s = fluorometer reading with B_1 standard

Rsb = blank fluorometer reading with B₁
standard

Z = volume in ml of extraction passed
through Decalso tube

E = volume in ml of eluate collection

S = sample weight in grams

V = volume of extraction (100)

Riboflavin

The fluorometric method (AACC Method 86-70) applicable to meal was used for the determination of riboflavin (88).

- Reagents.
1. Sulfuric acid, 0.1N
 2. Sodium acetate, 2.5N
 3. Potassium permanganate, 4%, prepared fresh daily
 4. Hydrogen peroxide, 3%
 5. Riboflavin standards

Method. The meal was ground to pass a 20-mesh sieve. The ground material was mixed thoroughly. The 4 grams of mixed sample were weighed into a 100 ml volumetric flask.

For extraction purposes, 75 ml of 0.1N sulfuric acid was added and mixed and the flask immersed in boiling water bath for 30 minutes, shaking the flask every 5 minutes. It was allowed to cool at room temperature. To adjust the pH, 5 ml of 2.5M sodium acetate solution were added. It was mixed and let stand for about 1 hour and the solution was approximately pH 4.5. This was made up to volume and filtered through Whatman No. 4.

To measure, adjustment of the fluorometer was done so that sodium fluorescence solution gives suitable galvanometer deflection as directed for the instrument. Determination of fluorescence of solutions was accomplished. The readings were done with no more than 10 seconds exposure in the fluorometer.

Calculations. Riboflavin mg/lb = $\frac{B - C}{A - B} \times \frac{R}{S} \times \frac{V}{V_1} \times 0.454$

Where A = fluorometer reading of sample plus
riboflavin standard

B = fluorometer reading of sample plus
water

C = fluorometer reading after addition of
sodium hydrosulfite

R = standard riboflavin added γ/V_1 of
sample solution

V = original volume of sample solution, ml

V_1 = volume of sample solution taken for
measurement, ml

S = sample weight, g

Niacin

The niacin analysis was done using the AACC Method 86-50 (niacin and nicotinamide in cereal products). This is based on the use of 1.5% calcium hydroxide for extraction and on a reaction of cyanogen bromide with niacin at 2° C (89).

- Reagents.
1. Nicotinic acid stock solution
 2. Nicotinic acid standard solution
 3. Phosphate buffer solution
 4. Cyanogen bromide solution, 10%
 5. Sulfanilic acid, 55%

Method. Hydrolysis was determined by placing 1.5 g of Ca(OH)_2 in each of the six 250 ml Erlenmeyer flasks, then by pipet 0, 5, 10, 15, 20, and 25 ml of nicotinic acid standard were added respectively. In another 25 ml Erlenmeyer flask the sample weighed was transferred and 1.5 g of Ca(OH)_2 was added. Water (90 ml) was added to each flask, then they were shaken to mix and autoclaved for 2 hours at 15 lb pressure. The mixtures were mixed while still hot. They were then cooled to 40° C and then transferred to 100 ml volumetric flasks and diluted to volume.

Clarification was accomplished by transferring 50 ml of supernatant from each 100 ml volumetric flask to separate centrifuge tubes and placed in the bath for 15 minutes. They were centrifuged for 15 minutes and 15 ml of supernatant was pipeted from each tube into separate centrifuge tubes containing 8 g $(\text{NH}_4)_2\text{SO}_4$ and 2 ml phosphate buffer solution. These were shaken and then warmed to 55-60° C. They were centrifuged for 5 minutes and filtered through Whatman No. 12 filter paper.

To develop the color, one additional tube was added, a standard blank for each set of determinants. In each tube, a 5 ml sample solution was added and 10 ml of water were added to standard and

sample blanks. All tubes were allowed to stand for 30 minutes in a bath of ice. To samples, standards, and reagent blank, 10 ml of CNBr were added followed by 1 ml of 55% of sulfanilic acid solution. They were mixed immediately after addition of each reagent and tubes were stoppered. All tubes were replaced in the ice bath, and 1.0 ml of sulfanilic acid solution was added.

The colorimeter was set to 470nm wavelength at 100% transmittance with standard blanks, and transmittance of other tubes were read 12 minutes after addition of sulfanilic acid. Tubes were cooled uniformly and each tube was wiped dry just before it was placed in the colorimeter.

Ascorbic Acid

The procedure is based on quantitative decolorization of 2,6 dichlorophenolindophenol by ascorbic acid. The excess dye is extracted with xylene and measured in a photoelectric colorimeter. In the absence of interfering materials, the amount of ascorbic acid present in samples is proportional to the amount of dye decolorized (90).

Method. Five grams of sample was blended with equal weight of 6% metaphosphoric acid solution. Known weight of slurry was diluted with 6% metaphosphoric acid volumetrically to give a concentration of approximately 20 γ of ascorbic acid per ml.

These were mixed well and filtered through Whatman No. 12 filter paper. The solution was filtered after it was diluted. The reduction of dye with ascorbic acid was done using 5 ml sample of acid filtrate.

Extraction of dye was achieved by the addition of 10 ml of xylene, stoppered and shaken vigorously for 6-10 seconds to extract excess dye. The mixture was centrifuged briefly to separate layers. The top layer of xylene was transferred to a labeled tube and it was read in the colorimeter at 500 using pure xylene to set the instrument at 0 on absorbance scale.

Calculations. Ascorbic acid γ per g = $\frac{R \times 2 \text{ Vt}}{W}$

Where R = reading of concentration (γ /ml) on standard curve corresponding to difference in absorbance of total dye minus absorbance of sample

Vt = volume in ml of dilution in extraction

W = weight in grams of slurry taken in extraction

Vitamin A

The determination of vitamin A was done using AACC Method 86-03 (91). Vitamin A reacts with chloroform saturated with antimony trichloride (Carr-Price Reagent) resulting in a transient blue-colored compound. Intensity of color is proportional to vitamin A content. Maximum intensity is at 620nm. Because vitamin A is extremely sensitive to light, to prevent destruction during sampling and analysis amber glassware was used. Vitamin A is also subject to oxidation, therefore all steps in the procedure were carried out to minimize exposure to air.

- Reagents.
1. Alcohol, 3A, 95%
 2. Potassium hydroxide, A grade, 50%

3. Ether, anhydrous, free of peroxides
4. Ether, 30-60° C boiling point
5. Sodium sulfate, anhydrous, granular
6. Antimony, trichloride, A grade
7. Carr-Price reagent
8. Chloroform (Merek spectrophotometric grade)
9. USP Reference standard vitamin A containing
30 mg/g
10. Acetic anhydride, A grade

Method. Standardization was accomplished by weighing approximately 0.1 g USP reference grade vitamin A standard into 100 ml amber volumetric flask. It was dissolved in isopropanol and diluted to volume and mixed well. The solution was then pipeted into 50 ml volumetric flasks--2, 4, 6, and 8 ml--and made to volume with chloroform. A measure of 2 ml of each diluted standard was pipeted into colorimeter tubes and color was developed. The curve was plotted percent transmittance vs units/2 ml vitamin A.

Determination was done by initially weighing 25 g of the sample into 500 ml low actinic Erlenmeyer flask. Water (150 ml) was added and swirled to mix, then vigorously shaken to break down all lumps and to disperse flour. Alcohol (150 ml) was added and swirled, then 30 ml of KOH was added and the mixture swirled to mix. The sample was then digested in a water bath at 70° F for 30 minutes and cooled to room temperature and transferred to a 1 liter amber separator funnel with a small amount of water and alcohol. The flask was rinsed

with 100 ml of ether and the rinsings transferred into a separator funnel and then shaken vigorously several times. Phases were allowed to separate and the lower water phase was transferred into a second separatory funnel. Ether (100 ml) was added to the aqueous phase and shaken vigorously for 1 minute and the phases were allowed to separate and the water phase was removed with a beaker. The ether phase was pooled and extracted a third time. All ether extracts were combined and washed until neutral to phenolphthalein. This was then transferred into a 250 ml low actinic volumetric flask and diluted to volume with pet. ether and mixed well. A portion was transferred to a glass-stoppered mixing cylinder and several grams of anhydrous sodium sulfate were added and the solution was shaken and allowed to settle. Ten ml aliquots of dry extract were pipeted into two colorimeter tubes and evaporated to dryness with a stream of nitrogen. Immediately, 2 ml of chloroform were added. The tube was placed in colorimeter previously set at 100% transmittance. Rapidly, 10 ml of Carr-Price Reagent were added and percent transmittance was read at 620nm.

- Calculations. 1. From the vitamin A calibration curve,
observed percent transmittance read at
620nm was converted to units of vitamin A/2 ml
aliquots
2. Vitamin A (mg/gram) =
- $$\frac{\text{units/2 ml} \times \text{dilution factor}}{\text{sample weight (g)}}$$

Amino Acid Analyses

The amino acid analyses were determined using an Amino Acid Analyzer, Model 119B, manufactured by Beckman. The Model 119B Amino Acid Analyzer is a column chromatography instrument using an ion-exchange resin and buffer elution of the amino acids. The column effluent is treated with ninhydrin, and the colored compounds formed are detected photometrically. The results are plotted using a multipoint chart recorder (92).

Method. The sample (approximately 5 mg) was transferred to hydrolysis tubes. One ml of constant-boiling 6 N HCl containing mercaptoethanol in the amount of 5 ml mercaptoethanol per 10 ml of HCl was added to each hydrolyzate tube. The tubes were then allowed to cool. The tubes were then suspended in a thermos bottle containing a mixture of ethanol and solid carbon dioxide. Using a vacuum assembly with a nitrogen purge and a cold trap in the line, evacuation and then purging with purified nitrogen three times were done, alternating with vacuum each time. The final vacuum was pulled for 3 minutes while thawing contents at room temperature. The lower portion of the tube was sealed off at the constriction. The samples were then hydrolyzed at 110° C for 22 hours in a metal beaker covered with a metal plate. Then they were cooled to room temperature. The tube was scribed with a tube cutter and cracked with a white-hot glass rod and the sealed portion broken off under a hood. The tubes were dried down by slowly evacuating the heated desiccator for 15 minutes until hydrolyzate fractions were dry. These were then dissolved in a

pH 2.2 sodium citrate diluting buffer containing internal standards. One ml of the sample was injected for analysis and this was done three times.

Tryptophan

Tryptophan was determined using the method developed by Spies and Chambers (93). The analysis was done on fat-free samples. Tryptophan was analyzed using this method because it did not destroy the amino acid.

- Reagents.
1. Sulfuric acid, 23.8 N
 2. p-Dimethylaminobenzaldehyde (DBA) solution, 30 mg/ml
 3. Sodium nitrite solution, 0.045%
 4. Tryptophan Standard Solution

Procedure. The standard curves for 20 to 200 micrograms of tryptophan were done as follows: pipeted into clean test tubes were aliquots of 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, and 1.0 ml of solution "4" in duplicates. To each test tube was added a mixture of 8 ml reagent number 1 and 1 ml of reagent number 2 above. After cooking to 25° C using distilled water, the volume of each test tube was brought to 10 ml. The mixture was then shaken properly and it was kept in the dark for an hour. To mixture, reagent number 3 was added (0.1 ml), then shaken thoroughly. It was allowed to stand in the dark for 30 minutes. Transmittancy was read at 600mu using 10 ml cuvettes. A blank solution containing DBA was used. A log of percent transmittance against micrograms of tryptophan was plotted.

To determine tryptophan in samples, 10-15 mg of fat-free sample was weighed and placed into 25 ml glass stoppered Erlenmeyer flasks. To this, 9.0 ml of sulfuric acid was added and 1.0 ml of solution number 2. They were then mixed thoroughly, cooled to 25° C, and allowed to stand in the dark for 12 hours. Then 0.1 ml of sodium nitrite solution was added and the mixture was allowed to stand for 30 minutes. Transmittancy was read at 590mu. Transmittancy was converted to weight of tryptophan from the standard curve.

The preparation of a fat-free sample was achieved by mixing about 2 grams of dry power with 5 ml methanol CHCl_3 (3:1 ratio) in a Waring blender and then the mixture was filtered. The residue was placed in a vacuum desiccator overnight to dry.

Dietary Intake Estimation

The dietary survey was undertaken for this study through the cooperation with the Chief Dietitian in the Ministry of Health. The general type of data and sample were agreed upon. Mtoko Hospital was chosen because the author had worked with the nurse-practitioner-interviewer and recorder in the maternity section of the hospital.

Fifty women 20-30 years of age from families that earned less than Z\$200.00 a year were selected according to how far along they were in their pregnancy. They were in their fourth or fifth month of pregnancy. Most women do not seek medical care before the fourth month of pregnancy. The dietary survey was conducted from June to August, 1980, winter in Zimbabwe, and it was conducted directly after the harvest and food should have been plentiful.

In determining the types of foods and the amount of foods, the nurse-nutritionist worker asked each of the 50 women what foods she had eaten all day the previous day. With her were several preweighed containers of various sizes, with various foods that they were likely to have consumed. In trying to determine the amounts of food eaten, she would pick up the various sizes of each of the foods and the pregnant woman could point out which size she had eaten. This procedure was done with all the foods. The 24-hour recalls were done a total of three times. Depending on the time of day when the foods were eaten, the data were grouped into breakfast, lunch, and supper. Foods eaten between the regular meal times were grouped as snacks.

Each of these women was given an identification number so that she could be recognized when she came for her weighing visits. The women were encouraged to come for weighing throughout their pregnancy. They were not given any incentive for participation in the program. It was not designed that each of the women was expecting a second child. The women did not come for their weighing visits on one single day, they were interviewed during regular clinic visits.

The women came to the hospital when they were four to five months pregnant, therefore, total weight gain during pregnancy had to be adjusted. To determine total weight gain, the weight of the pregnant women before pregnancy was estimated from height and weight tables. If the woman was 20 years of age, for example, and was 5 feet 4 inches tall, she was assumed to weigh 125 pounds before pregnancy. So, to determine weight gain during pregnancy, estimated weight before

pregnancy was subtracted from weight before delivery. This is the standard procedure used by the Ministry of Health of Zimbabwe and does provide some indications of weight gain although limitations are recognized (94).

Due to little differences in the types of foods and amounts of foods consumed by these individuals, all the nutrients were calculated, added, and averaged. The nutritive value of these foods was derived from food tables representing nutrient values of some local foods compiled by the Ministry of Health (23) and analysis done.

Body Weight Measurements

The 50 women from whom the dietary survey was done were weighed at the hospital. They were expected to come to check their weight every month until they delivered. However, due to the cold weather, transportation problems, and other reasons, of the 50 women only 21 managed not to miss their weighing appointments (fifth to ninth month). The body weight measurements for this study were for these 21 women.

For weighing purposes, each woman was instructed to remove her coat, sweater, and shoes before weighing. The weighing was done on a standard beam balance in pounds and were converted to kilograms.

At delivery each of the 21 women's infants was weighed and length was measured also. Those that had delivered before the thirty-seventh week of gestation were considered to be premature. Infants that weighed less than 5 pounds were considered to be premature. Any of the women who did not gain 24 pounds and above were considered to be underweight (95).

The weight gain of the pregnant women was from the time they made their first weight check visit, when they were about four or five months pregnant. Weighing continued on a monthly basis until delivery which was about four to five months later. No accounting was done on those who did not keep their weighing visits.

The Diffusion Process

It should be remembered that the goals of this study are not only to identify and assess the nutrition problem so that a solution might be proposed, but also to find ways by which the solution might be delivered to the population which needs it. This might be called the communication part of the problem, and addressing it requires these three steps:

1. Provide a complete description of the communication system which is available in Zimbabwe.
2. Develop some sample nutrition education messages.
3. Develop a communication model which provides a plan for introducing such messages in the existing system.

The communication system in Zimbabwe today was investigated by getting information from three types of sources. One group included the official sources: the Ministry of Posts and Telecommunication, the Ministry of Information and Tourism, and the Embassy of the Republic of Zimbabwe in Washington, D.C. (96, 97). A second group included reference sources: standard reference materials which describe the print media, broadcast stations, and other modes of the formal communication network (98, 99). A third group drew on

informal sources--friends, acquaintances, and Zimbabwean citizens who were able to describe informal channels (e.g., free papers distributed by merchants) which are not included in the first two types of sources.

The method for producing the nutrition education messages was developed using standard practices for public relations (100) and those established by the FAO of the United Nations (101).

The nutrition message content is of three types: nutrition in general, maternal nutrition, and infant nutrition. The messages are designed to flow in the existing channels for communication in Zimbabwe.

The following is a list of some possible types of messages that could be developed: press releases, fact sheets, posters, public service announcements for radio and television, slide presentations, brochures, films, and pamphlets.

The press releases could be used in television and radio, newspapers, and periodicals. Fact sheets can be utilized by all media and in interpersonal communication as well. Posters might be used in health facilities (clinics, hospitals, and dispensaries), roads for walking, and motor traffic billboards. They can also be distributed to shop owners, churches, and schools. Public service announcements can be used in the broadcast media. Slide presentations may be used in lectures, workshops, seminars, and in-service training. They are also suitable for presentation at church meetings as well as civic organization gatherings.

For this study, press releases, fact sheets, posters, and brochures were developed for each of the content areas. These four forms of messages were chosen because they were less expensive. Also, they were more practical in terms of the situation, intended audience, and the environment for which they were being developed.

There is a limiting factor in this part of the study in that because of the time and expense of going to Zimbabwe, collecting the data, and returning to the laboratory, it was not possible to try out the nutrition education messages and the communication model using the target population in Zimbabwe.

In the absence of any opportunity to pretest the messages on the target population, the next best method was to have representative samples of these materials evaluated by experts in the fields of international nutrition and communication (Appendix 1). Each of 12 experts was asked to evaluate the message in terms of the simplicity of message, ease of comprehension, impact, interest, and straightforwardness. This was done in a questionnaire (Appendix 2), which was mailed along with each set of messages (fact sheet, press releases, brochure, and poster). The questionnaire was formulated using guidelines outlined by Erdos (102) and by Warwick and Lininger (103).

In addition, analysis of the diffusion process involved the formulation of a communication model which describes the expected spread of the innovation, which is to create nutrition awareness and change dietary intake in the target population.

The method for developing the communication program to achieve adoption was drawn from a communication study done by Mugwira, Everett, and Odland (104).

The communication model was critiqued by graduate students and faculty members in the College of Communication at The University of Tennessee, Knoxville, and the School of Journalism at the University of Iowa. Initially, an introduction of this research and its purposes was given, then the model was distributed to the participants and a description of the model was provided. The participants were instructed to study the model carefully before discussion, looking at whether the model was descriptive, practical, simple, and complete. They were also required to look at any aspects that may have been overlooked in the construction of the model.

The critiques of the models were recorded on each individual's model. The models were then analyzed and, as feasible, were incorporated into a new reconstructed model.

CHAPTER IV

RESULTS

The results of this study are of two general types: those coming from examination of the nutrition problem and those coming from examination of the closely related communication problem. The first group of results will include the analysis of the primary staple food, the survey of maternal dietary intake, and the body weight measurements. The second group will include a description of existing channels for communication about nutrition, the evaluation of some sample nutrition messages, and the construction and critiquing of a proposed diffusion model.

Food Analysis

The nutritive value of Lite-Wite mealie meal was determined as shown in Table 1. Units per 100 g were: calories 110, protein 5.2 g, fat 0.3 g, calcium 300 mg, iron 1.0 mg, vitamin A 0.0 Retinol Equivalents (RE), thiamin 0.01 mg, riboflavin 0.03 mg, niacin 0.05 mg, and ascorbic acid, 0.0 mg.

Sadza made from Lite-Wite mealie meal was also analyzed for the same nutrients. Table 1 also shows, per 100 g, calories 116, protein 4.6 g, fat 0.1 g, calcium 292 mg, iron 0.7 mg, thiamin 0.005 mg, riboflavin 0.01 mg, and vitamin A, niacin, and ascorbic acid were not present. The process of cooking mealie meal, thus changing it into sadza, destroyed thiamin and riboflavin.

Table 1. Nutritive Value of Mealie Meal (Lite-Wite) and Sadza
(per 100 gram sample)*

Nutrient	Mealie meal	Sadza
Calories	110.0	116.0
Protein (g)	5.0	4.6
Fat (g)	0.3	1.0
Calcium (mg)	300.0	292.0
Iron (mg)	1.0	0.7
Vitamin A (RE)	0.0	0.0
Thiamin (mg)	0.01	0.005
Riboflavin (mg)	0.03	0.01
Niacin (mg)	0.0	0.0
Ascorbic acid (mg)	0.0	0.0

*Average of three samples.

Table 2 shows the essential amino acid composition of both mealie meal and sadza. In the mealie meal, average mg per gram same was : phenylalanine 4.3, valine, 3.6, threonine 1.8, methionine 8.5, leucine 8.6, isoleucine 1.8, lysine 1.5, and tryptophan 0.6. In sadza corresponding values were: phenylalanine 4.0, valine 2.9, threonine 1.2, methionine 7.3, leucine 7.1, isoleucine 1.5, lysine 1.0, and tryptophan 0.3. Essential amino acid content of sadza was lower than that of the meal.

Maternal Dietary Intake Survey

As shown in Table 3, a 24-hour recall of 50 pregnant women was done and the current maternal daily food intake was determined. The diets were calculated for calories, protein, fat, calcium, iron, vitamin A, thiamin, riboflavin, niacin, and ascorbic acid.

The breakfast meals consisted, in general, of porridge with sugar, hot tea with sugar, and a slice of bread with margarine. It provided an average of 518 calories, 6.6 g protein, 10.8 g fat, 74.8 mg calcium, 0.9 mg iron, 0.02 RE of vitamin A, 0.09 mg thiamin, 0.06 mg riboflavin, and 0.04 mg of niacin. Ascorbic acid was essentially not present.

The lunch meal consisted of sadza, okra, relish from fresh pumpkin leaves cooked in a little vegetable oil. This provided an average of 446 calories, 11.3 g protein, 17.3 g fat, 187.3 mg calcium, 8.6 mg iron, 0.02 RE of vitamin A, 0.12 mg of thiamin, 1.1 mg of riboflavin, and niacin and vitamin C were not present.

Supper was constituted of sadza, and the relish made from rape cooked with tomatoes and peanut butter was added. The nutritive value of this meal as averaged was 306 calories, 10.3 g protein, 3.0

Table 2. Essential Amino Acid Content of Mealie Meal and Sadza
(mg/g of sample)*

	Mealie meal	Sadza
Phenylalanine	4.3	4.0
Valine	3.6	2.9
Threonine	1.8	1.2
Methionine	8.5	7.3
Leucine	8.6	7.1
Isoleucine	1.8	1.5
Lysine	1.5	1.0
Tryptophan	0.6	0.3

*Average of three samples.

Table 3. Current Maternal Average Daily Food Intake, Estimated Average Daily Nutrient Intake, and Range of Daily Nutrient Intake for 50 Pregnant Women

Food item	Amount	Kcal	Prot. (g)	Fat (g)	Ca (mg)	Fe (mg)	Vit. A (RE)	B ₁ (mg)	B ₂ (mg)	Niacin (mg)	Vit. C (mg)
<u>Breakfast</u>											
Porridge	1 cup	119	2.4	0.5	2.0	0.5	0.02	0.05	0.02	0.0	0.0
Bread (white)	2 slices	124	4.0	1.4	38.0	0.4	trace	0.04	0.04	0.04	trace
Margarine	1 Tablespoon	79	0.0	8.9	0.8	0.0	-	-	-	-	-
Hot tea	2 cups	4	0.2	0.0	34.0	-	-	-	-	-	-
Sugar	6 teaspoons	192	0.0	0.0	trace	-	-	-	-	-	-
TOTAL		518	6.6	10.8	74.5	0.9	0.02	0.09	0.06	0.04	trace
<u>Lunch</u>											
Sadza	1 cup	276	7.3	2.4	7.3	3.6	0.02	0.12	1.1	0.0	0.0
Okra	1/2 cup	16	1.0	0.3	90.0	2.0	-	-	-	-	-
Pumpkin leaves (fresh)	1/2 cup	30	3.0	0.6	90.0	3.0	-	-	-	-	-
Vegetable oil	1 T	124	0.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		446	11.3	17.3	187.3	8.6	0.02	0.12	0.0	0.0	0.0
<u>Supper</u>											
Sadza	1 cup	276	7.3	2.4	7.3	3.6	0.02	0.12	1.1	0.0	0.0
Rape/tomatoes/peanut butter	1/2 cup	30	3.0	0.6	93.0	3.0	-	-	-	-	-
TOTAL		306	10.3	3.0	100.3	6.6	0.02	0.12	1.1	0.0	0.0
<u>Snack</u>											
Bread (white)	1 slice	124	2.0	2.1	57.0	0.6	trace	0.02	0.02	0.02	trace
Hot tea	2 cups	4	0.2	0.0	34.1	-	-	-	-	-	-
Sugar	2 teaspoons	64	0.0	0.0	trace	-	-	-	-	-	-
TOTAL		192	2.2	2.1	91.1	0.6	trace	0.02	0.02	0.02	trace
GRAND TOTAL		1,424	30.4	33.3	453.5	16.7	0.06	0.35	2.3	0.06	trace
RANGE											
		1,310-	25.2-	28.0-	357.0-	14.0-	0.04-	0.32-	2.0-	0.03-	0.0-
		1,786	36.1	35.1	491.2	18.7	0.08	0.37	3.5	0.08	trace

Sources: The Ministry of Health (1974) Food composition of some local foods.
Food Analysis, page 58.

g fat, 100.3 mg calcium, 6.6 mg iron, 0.02 RE vitamin A, 0.12 mg thiamin, 1.1 mg riboflavin, and niacin and ascorbic acid were absent.

The snacks were foods that were eaten between meals through the day. These consisted of hot tea with sugar and bread, providing an average of 192 calories, 2.2 g protein, 2.1 g fat, 91.1 mg calcium, 0.6 mg iron, a trace of vitamin A, 0.02 mg thiamin, 0.02 mg riboflavin, and 0.02 mg niacin to the diet. Vitamin C was not present.

The average daily total amount of nutrients supplied by this diet, for these women, came to 1,424 calories, 30.4 g protein, 33.3 g fat, 453.5 mg calcium, 16.7 mg iron, 0.06 RE vitamin A, 0.35 mg thiamin, 2.3 mg riboflavin, 0.06 mg niacin. There was virtually no vitamin C supplied by this diet.

The daily total food intake range was 1,310-1,786 for calories, 25.2-36.1 g protein, 28.0-35.1 g fat, 357.0-491.2 mg calcium, 14.0-18.7 mg iron, 0.04-0.08 RE vitamin A, 0.32-0.37 mg thiamin, 2.0-3.5 mg riboflavin, 0.03-0.08 mg niacin and 0.0-trace mg ascorbic acid.

Body Weight Measurements

Of the 50 women who had originally participated in the dietary survey, only 21 came regularly for weighing at the hospital. The average weight gained by these women was 6.7 kg. As shown in Figure 2, weight gain ranged from 11.2 kg to 6.0 kg. Only two women reached the recommended minimum weight gain of about 11.0 kg. Seven individuals gained about 9.1 kg and the remainder of the participants gained approximately 6.4 kg.

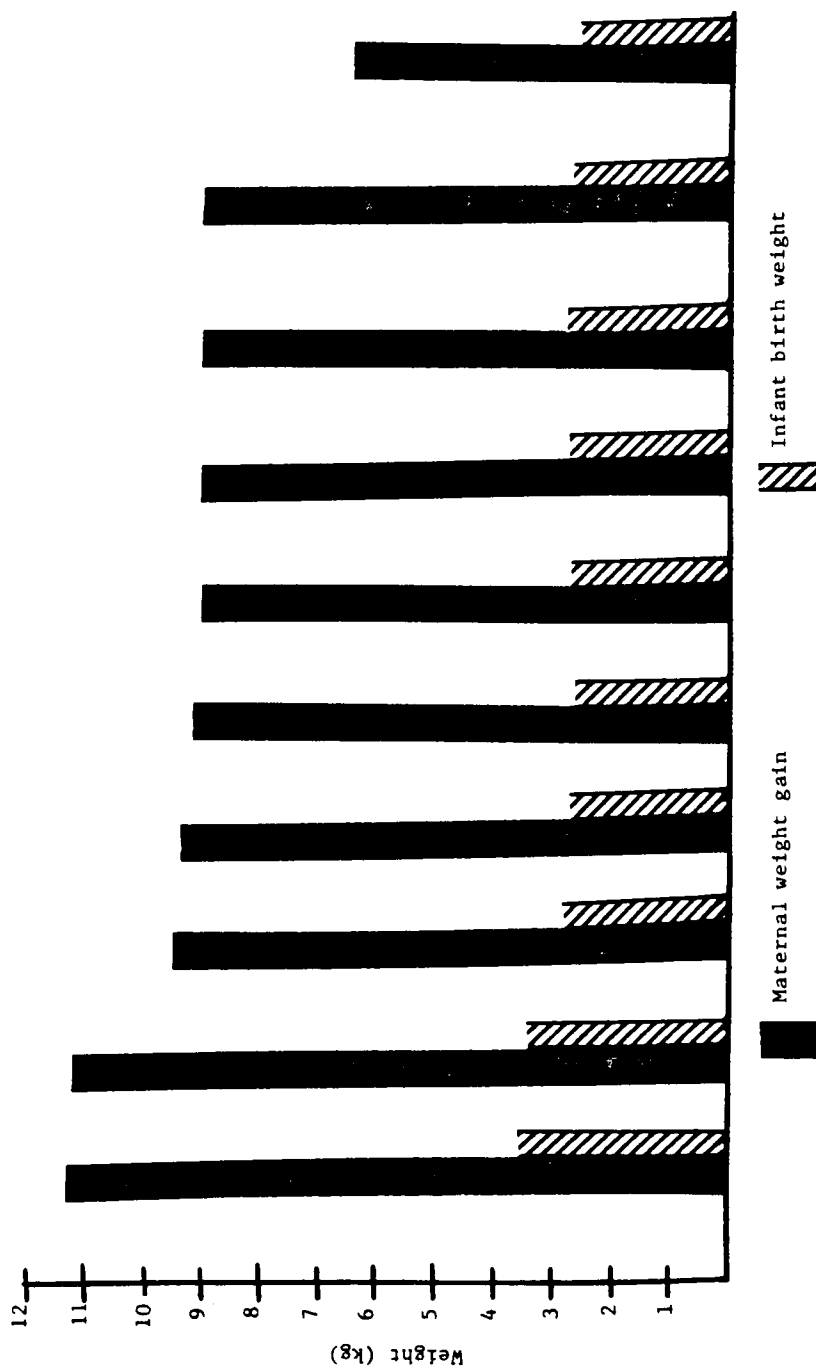


Figure 2. Total Pregnancy Weight Gain and Infant Birth Weight.

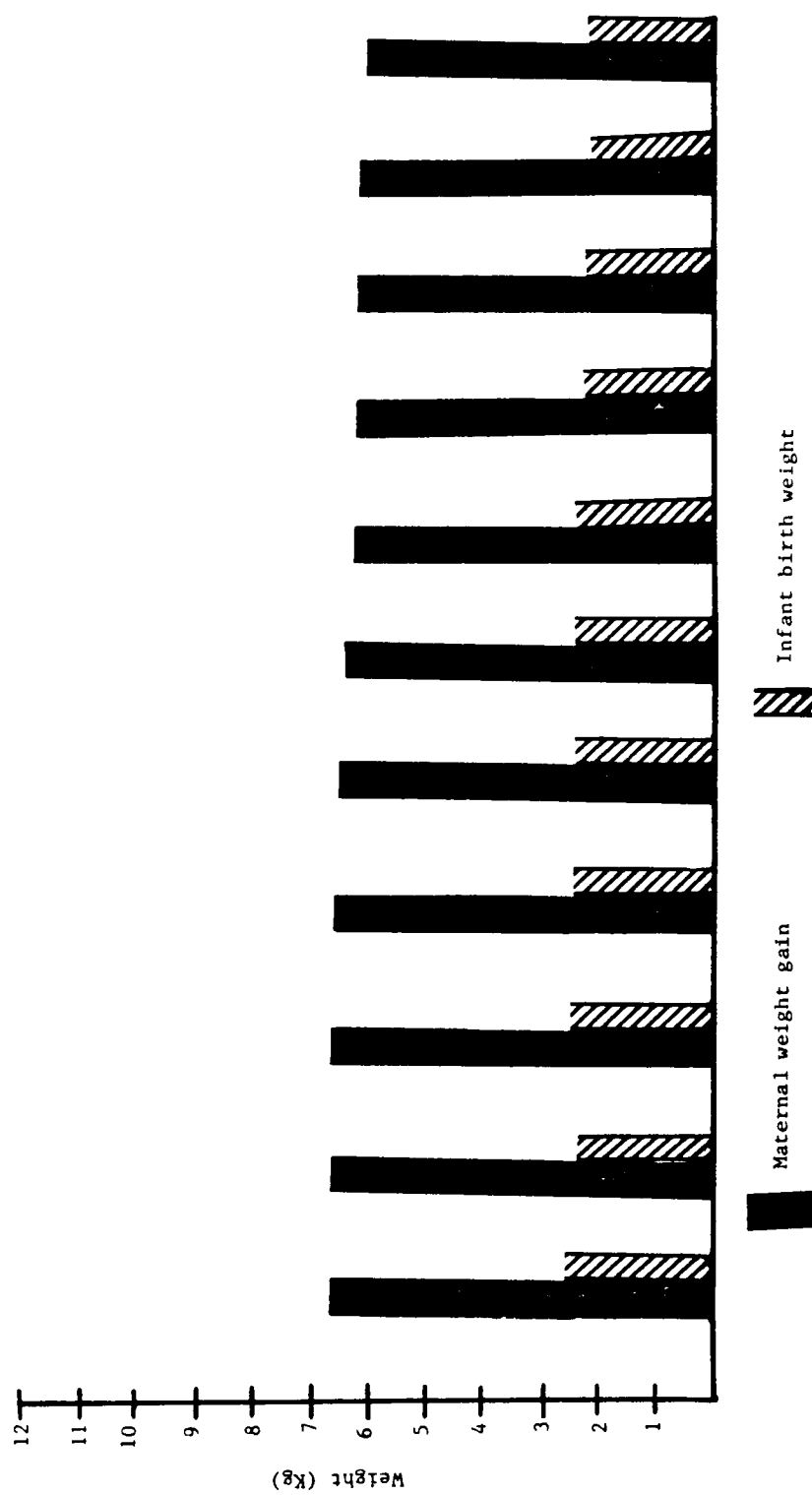


Figure 2 (Continued).

The birth weight of the infants born to these women were also determined. The average birth weight of these infants was 2.4 kg. The weight of the infants showed variation from 2.0 kg to 3.0 kg as shown in Figure 2. Eleven of the infants had weights between 2.3 kg and 3.0 kg, which would be a low normal. This is not considered to be ideal or desirable weight for a newborn infant. Nine of the infants had weights that were between 2.1 kg to 2.2 kg, which is considered to be low birth weight (115). There were no stillbirths in this group of women.

Considering the diet of pregnant women in Zimbabwe, it is no wonder that there is a high rate of infant mortality, morbidity and stillbirth. Therefore, it is essential to develop a strategy for creating awareness of the importance of a good diet during this period of life. Thus, it is appropriate now to consider the communication part of the problem.

The Diffusion Process

The existing communication networks through which nutrition messages can flow are of two kinds: mass media and interpersonal channels.

The Existing Mass Communication Network

Even though journalism in Zimbabwe has been noted for its ingenuity and its high mortality rate, there are certain aspects of it that remain favorable. It has managed to serve its clientele

since its conception in 1891, even though it has never been the mouthpiece for all the peoples of Zimbabwe (105).

Looking back through the years, it is fantastic to see the changes that have taken place in Zimbabwe. This is especially true when one looks at the present communication network. Since independence of Zimbabwe in April 1980, historic changes in communication have taken place. The system is now more people-oriented. Blacks hold virtually all editorship positions in both the print and broadcast media.

The mass communication network can be classified into three types of channels: the print media, radio and television, and others such as films, outdoor advertising, the postal system, and music.

The print media now fall under the purview of the Ministry of Information and Tourism. Radio and television are the responsibility of the Ministry of Posts and Telecommunication, as are telephones, mail, and films. Roads and outdoor advertising come under the Ministry of Transportation.

The print media, mainly the five major newspapers, are controlled by the Zimbabwe Mass Media Trust, which came into existence in January 1981. The Trust acquired a 42% share that the South Africa Argus Group had held in Zimbabwe's five major newspapers: the Herald and Sunday Mail in Salisbury, the Chronicle and Sunday News in Bulawayo, and the Umtali Post Weekly. The rest of the shares in these newspapers are held by private companies. The Herald and the Sunday Mail have an extensive circulation in Salisbury as well as outside Salisbury (105, 106).

The move to acquire these shares by the government was primarily intended to establish a chain of newspapers to serve as a mouthpiece of the Zimbabwean people as a whole and not a group of individuals (106).

The largest dailies in the country, according to 1981 statistics, are the Herald, published in Salisbury, with a circulation of 77,617; and the Chronicle, published in Bulawayo, with a circulation of 33,367 (107).

Besides these two dailies, there is a large list of 41 periodicals (107) published three times a week, weekly, semiweekly, fortnightly, monthly, quarterly, and annually. These are published by churches, trade unions, professionals, and social organizations for both men and women. Most of the periodicals are published in English. Some of them are circulated on a regional basis and not available nationally. Using fact sheets and press releases, editors of these dailies and periodicals can publish articles on nutrition and what the government is trying to do to alleviate maternal and child malnutrition.

Today there is a growing number of publications in the vernacular languages (Shona and Ndebele), many of these emanating from religious bodies. The best known are Moto and Umbowo from the Catholic and United Methodist Churches, respectively. One of the most active religious groups involved in vernacular journalism is the Jehovah's Witness denomination with its Watchtower magazine. Other denominations have newsletter-type publications that are issued monthly (107).

The church newspapers, digests, and newsletters are a major organ in reaching the rural population, even though most of the Africans

follow traditional beliefs. The non-Christians usually have one or more family members who go to church or a church school, and the information heard at church is shared with other family members. Non-Christians will listen as long as it is not related to religion. The church is a very big institution, in terms of influence at the national and local levels of government. It is estimated that 20% of the Zimbabwean population are Christians (107), but the percentage having direct contact with churches or church agencies or institutions is much higher.

Valuable contributions are being made to the vernacular press by the Department of Local Government, which produces Kambuzuma in Bulawayo, and Kuwadzana at Highfields in Salisbury. Parade, a monthly publication in English, Shona, Ndebele, and Bemba, is possibly the most successful Zimbabwean journalistic venture in the vernacular. Murimi is also a popular monthly publication (105).

The Zimbabwe government has also begun publishing a paper called "The People," formerly a propaganda paper utilized by the previous regime. Now it is produced and sold nationwide. It is an information-oriented monthly paper. It is published in Shona, Ndebele, and English (106).

As can be seen, some of the newspapers and periodicals are government-owned and some are privately owned. Some are sold and some are distributed free of charge. Some of the print media are not controlled by the three government ministries mentioned above. Others involve still other agencies; for example, any media distribution to schools will need to be cleared by the Ministry of Education.

There is also an increase in the publication of merchant papers, especially in townships, towns, and cities. These are usually distributed free of charge to the public, and are the Zimbabwean equivalent to what American journalists call "shoppers." These are weeklies and do find their way into most homes in the area where the shopping center is located. Areas reached by the merchant papers cover about 60% of rural Zimbabwe. These papers do contain a small amount of news, so they can be used to get information out to the public. Each is usually printed in whatever vernacular language is used in that particular area (108).

The women's organizations are an emerging force in terms of creating awareness of the importance of improving the family. They do publish their own newsletters as well as magazines that are geared to women's interests.

These various periodicals, like the newspapers, can also utilize fact sheets and press releases to develop stories on the problem of malnutrition in various communities or the country in general.

The radio medium began in 1932 in Zimbabwe (then Southern Rhodesia). It is operated by the Zimbabwe Broadcasting Corporation under the Ministry of Posts and Telecommunications. It has one of the most powerful medium-wave transmitters in Africa. Daily programs for national consumption are continuous from 6 to 11 p.m., and additional local evening programs were introduced with the opening in 1968 of Radio Jacaranda in Salisbury for Mashonaland, Radio Manica at Umtali for Manicaland, and Radio Matopos in Bulawayo for Matebeleland. As of 1978, one source estimated there were 250,000

radio receivers. Today it is estimated that well over 260,000 radios are tuned in on an average day. It is currently estimated that there is 1 radio for every 28 people in the country. There are 12 long/medium-wave and 10 short-wave transmitters in the country (105).

About 3 radios in 10 can tune to a non-Zimbabwe radio station. This percentage may run even higher late at night (105).

Zimbabwean radio programs consist primarily of general and commercial services, which provide news, information, and entertainment by short-wave, accessible to all parts of the country. The main broadcasting center is in Salisbury but there are also studios in Bulawayo.

The main programs (general services) also feature African Service, usually about 12 hours in a week. During this time, broadcasts are in three vernacular languages, Bemba, Shona, and Ndebele (Bemba is spoken by people originally from Zambia and Malawi who work in Zimbabwe, a very small percentage of the African population in Zimbabwe). There are African Services studios in Bulawayo and Salisbury. African Services features programs about the African culture, music, folklore, and other concerns of the community.

Another of the general services programs is the Foreign Service. Typically about 4 hours per week at this time, broadcasts are directed toward Mozambique and other neighboring countries, and are in Portuguese and English as well as the three vernacular languages.

Two of the regional commercial services--Radio Jacaranda, serving Salisbury and districts comprising Mashonaland, and Radio Matopos,

serving Bulawayo and districts of Matebeleland--broadcast light entertainment, both with medium-wave transmitters, for 6 hours daily. During the rest of the day they carry general services programs. Radio Manica serves the Umtali region with its own programs for 1 hour daily, but otherwise relays the general service programs.

The general and commercial services, the regional services, and the African services all can use public service announcements, radio forums, feature stories, and news stories on nutrition. This medium can utilize nutrition messages such as fact sheets, press releases, slide presentations and films (in the case of television), and can also interview nutritionists to get information to the people. Talk shows can be developed to incorporate the problems of nutrition in the country and what the government through the Ministry of Health is trying to do to fight this disease.

The television service began in November 1960 in Salisbury and in June 1961 in Bulawayo. Initially the medium was commercially owned and controlled by Rhodesia TeleVision, which also at the time was owner of the country's principal newspaper (105).

Presently, Zimbabwe Television Corporation operates the medium under the Ministry of Posts and Telecommunication. The main broadcasting center is in Salisbury, with a second studio in Bulawayo. It is estimated that as of 1973 there were 20 receivers per 1,000 people (107). By the end of 1979 television reached more than 80% of the Zimbabwe white population, as well as an increasing number of Africans in urban areas (106). By June 1978 there were 78,100 licenses for television sets nationwide (106).

The communication system in the urban areas is very well developed. Telephone communication is widely available, particularly in the European and Asian communities. However, an increasing number of Africans have telephones in their homes. As of June 1978 there were 206,000 telephones nationwide (106). This number also includes those in commercial use. This system is still alien in villages; therefore, a telephone campaign would not be practical because it would not reach much of the target population. However, it may be useful in reaching some of the opinion leaders.

In terms of the road system for outdoor advertising, in Zimbabwe it is estimated that by 1978 there were 83,000 kilometers of road (106). These included only the trunk roads connecting main towns and cities and not the dirt roads that connect villages, which are estimated to total five times as high (in kilometers) as the main roads. These dirt roads are fairly usable by vehicles during the dry season. They also connect villages with the local or district townships. Messages on nutrition can be put on main roads on billboards and on dirt roads in the form of smaller signs or posters.

Movies provide another means of mass communication in the country. There are about 75 indoor and outdoor cinemas nationwide, mostly in cities and towns of 10,000+ population (105). These are mainly located in the urban areas. In those areas where cinema theatres are not available, mobile 16mm units cover government circuits in all the provinces of Zimbabwe. These units, which include generators to provide their own power, can be taken to villages which have no electricity. These units can manage to reach most of

the rural population about four times a year. Film clips on nutrition can be shown before feature presentations. They can be made to illustrate nutrition messages graphically and can reach a non-reading population unaffected by other media.

The postal system in Zimbabwe is fairly efficient (108). This is particularly true in towns and cities. However, in the villages for mail delivery the villagers depend on the headmaster of the local school to go to the district post office and collect mail for the village. When collected, the mail is distributed after church services every Sunday. If the recipient is not present, a friend or a relative may take mail to him or her, and in some instances the piece of mail is lost before it reaches the intended individual.

A direct mail campaign to get nutrition information to the target population may be useful in the villages, but to a lesser extent than in the cities. Brochures, newsletters, and feature articles, for example, can be mailed to opinion leaders as well as some of the target population, especially if they live in cities and towns where mail delivery would not be as inefficient as in the rural areas.

Another mass medium that can be utilized to get information to the population is the popular music industry (108). During the liberation struggle, songs were written and sung telling of the story of why we must fight to be free. The words, in this case, can serve to tell of the problem of nutrition and why it is important that Zimbabwe as a nation must pick up arms and fight this disease. Zimbabwe has its own recording industry and such records can be

used in schools, meetings, and other appropriate gatherings. They can also be delivered over radio music programs. This could be very useful nationwide because everyone, regardless of education level, would hear the song and understand what is being said.

The people of Zimbabwe love music and singing because it is part of their culture (108). Nutrition information put into a song could provide a means of getting nutrition information across to all those in the target population regardless of literacy.

The Interpersonal Communication Network

Mass communication can be used to a certain extent, but there is a limit to what it can do. At this time interpersonal communication may be utilized to complement it. This is particularly true when dealing with opinion leaders and some individuals in the target population who view mass media as frivolous and may not believe anything they hear from the mass media. It may be useful also in reaching those who do not own radios or cannot read, which is widely true in the village population (a significant portion of the target population). The illiteracy level in the country is about 78% (109) and a ratio of one radio for every 28 people leads to the conclusion that not every household owns a radio.

Interpersonal communication in this population can be directed through churches, women's clubs, hospitals and clinics, agriculture administrators, schools, political commissars, and the village and kraal leaders.

In a church setting there are typically two church groups. For

example, in the United Methodist Church (108) there is Vabvuwi for men and Ruwandzano for women. These groups are mainly for spreading Christianity and strengthening the church and for extending a helping hand wherever needed in the community. Men and women gather (separately or together) and talk about what the church can do in the community. They also go out into the community and discuss problems of mutual interest. This is one way nutrition information can be disseminated utilizing the interpersonal communication network. Nutrition messages such as brochures and flyers can be distributed and can be explained by the church groups' members. These materials can also be used in discussions.

The health clinic is a place less frequented than the church by village people. People go there only when they are sick or when a member of the family is sick. However, it can be a place where nutrition information can be spread through the interpersonal communication approach. Hospitals and clinics are staffed with nurses and orderlies (16, 17). Besides treating illnesses, they can also discuss with the patients and their relatives the role that good eating habits can play in improving their well-being, especially during pregnancy. At the hospitals and clinics, patients stay there with their relatives for as long as three weeks. All this time can be put to some good and constructive use for the patient and for the relative attending to his/her needs.

Health workers, in some cases, are sent to the villages to teach people about sanitation. The same technique can be applied to teaching

nutrition. Health workers from clinics and hospitals who teach people about the importance of boiling water before drinking, for example, can also talk to people about the relationship between nutrition and hygiene. Film strips, slide presentations, brochures, and posters could be used by these people as instructional tools.

Agriculture extension workers, usually referred to as agriculture administrators, have been teaching the farmers and villagers how to rotate crops, use fertilizers, and maintain a healthy herd of livestock for many years (110). They are typically in touch with the community once every month, especially during the rainy season. The people are gathered together periodically for meetings on a new crop or technology. These workers are a part of the interpersonal communication network. These same meetings can incorporate information on nutrition. The demonstrators can encourage people to increase the production of certain food crops as part of improving their nutrition status. This will provide the families of these individuals with enough crops to sell and for personal consumption. In this case, brochures, flip charts, or even movies could be used to describe food production planning and its relationship to nutrition.

Women's clubs are an educational force in many villages in Zimbabwe. Even though the regular club member has at least an elementary education and is thus atypical to a certain extent, these individuals are in touch with the target population, especially those in the child-bearing age. Most women, especially in the villages, are in contact with one or more members of the club daily (111). The women's clubs are an important part of the interpersonal communi-

cation network. They have lessons on child care, sewing, cooking and other aspects related to family life. Films, slide presentations, and brochures with recipes can be utilized to demonstrate the importance of proper food preparation and nutrition. These members should also be encouraged to spread this type of information to non-members in their communities.

Schools are another channel through which interpersonal communication can take place. Most parents are in touch with the schools through their children, most of whom attend these institutions for at least the few grades. Parents are at times gathered together by the headmaster to discuss a new classroom wing, expanding the school garden, or athletics (112). These meetings get fathers and mothers together and information on nutrition can be spread through such a channel. Schools also have programs for Girl and Boy Scouts. Scouting involves girls and boys ages 10-17. The scouts can go into the community and put up posters about nutrition and can distribute as well as explain brochures.

Schools also facilitate the gathering of people through sports. Posters, brochures, and flyers can be exhibited or distributed at or near sports events, to explain the importance of nutrition to the communities. School officials are part of the opinion leaders, and they can be responsible for such activities.

One of the most outstanding aspects of the liberation movement was the education of the masses about politics (113). They had to be educated so that they could understand the situation and help in fighting for Zimbabwe's freedom. This was done by political

commissars throughout the country. Now, after independence, the commissar system is still going on, though the focus has changed a bit. Political commissars are an extension of the ruling party. They are charged with the responsibility of selling the government's policies to the people. Each village is in touch with a political commissar at least once every 2 months. On such occasions, people are gathered together and the government's policies are explained. Such gatherings can feature what the government is trying to do to improve the health of the people through nutrition. Brochures, newsletters, and posters can be distributed and explained to the people by political commissars.

There are other political meetings which usually involve the leaders of a village. For example, the village headman may call for a meeting. He will send a messenger to each of the kraals in his village to tell them about the meeting, where and when. After the meeting, the kraal leaders leave for their respective communities. Each kraal leader will then meet with the elders in the kraal, and he explains what is to be done. In some cases the whole kraal gathers and they are told about a program or given information on what needs to be done. A village and a kraal have populations of about 400 and 40, respectively. (114). This gets the information out and facilitates the involvement of the whole community.

Interpersonal communication is necessary because it is a part of Zimbabwe's very traditional society. Information has been passed on from one person to another through these various channels, some of them for many generations. This has involved information on

agriculture, health, religion, and politics, and could include nutrition as well. These channels should make it possible for a nutrition education program to reach most of those not affected by the mass media channels.

Nutrition Education Messages

As the communication system exists today in Zimbabwe, it provides an almost limitless number of channels for messages to flow through. Presently, utilization of the system in terms of nutrition is non-existent.

The communication system is capable of receiving a wide variety of nutrition messages. Following is a list of some of the types of messages that can be developed: fact sheets, press releases, public service announcements, slide presentations, workshops, movies, brochures, billboard posters, leaflets, and pamphlets.

For this study, fact sheets, press releases, brochures, and posters were developed as representative samples of messages that could be used for a maternal nutrition education program. The education program was considered a three-part program which dealt with nutrition in general, maternal nutrition, and infant nutrition. A set of four messages was developed for each part.

Evaluation and analysis of sample nutrition messages by experts in the fields of international nutrition and communication brought on varied reactions. The messages were evaluated by 13 experts (see Appendix 1) throughout the United States and Africa. A set of questions was attached to each message (Appendix 2).

The fact sheet on nutrition in general consisted of the name of the program, background information about the program in general, and the objectives of the program. The fact sheet on maternal nutrition had background information on maternal nutrition and objectives of the maternal nutrition part of the total program (Maternal and Infant Nutrition). The infant nutrition fact sheet gave a detailed outline of the infant nutrition problem in Zimbabwe. Outlined also were the objectives of the infant nutrition portion of the Maternal and Infant Nutrition Program. These fact sheets could be sent to editors of daily newspapers, periodicals, and radio and television stations. Each fact sheet was attached to a list of questions that were to help the evaluators formulate their responses.

The fact sheets, in general, were found to be appropriate for editors of the print and broadcast media as a basis for news and feature stories on nutrition. The editors are well educated and will be capable of writing for people in the opinion leader category. The evaluators suggested that the wording of the fact sheets be further simplified, and that flowery language be avoided. They also suggested that more background information be added. It was also recommended that the fact sheet on nutrition in general be omitted because it was not really serving any purpose. Fact sheets were reconstructed incorporating the evaluators' comments (Appendixes 3, 4).

The press releases basically consisted of information on what the Ministry of Health is planning to do to improve the problem of

malnutrition. The press release on nutrition in general had information on the problem of malnutrition nationwide. A brief report on research that had been done on the prevalence of malnutrition had information on the maternal death rate and why it is important to improve maternal dietary intake. The press release on infant nutrition contained information on the infant mortality rate and how the Ministry of Health is committed to alleviating this problem through community services. These messages could be sent to editors of daily newspapers and periodicals and to radio and television stations. A set of questions was attached to each of the press releases to help evaluators formulate responses.

Evaluators found the press releases to be adequate. However, they recommended that the press release on nutrition in general be omitted because it was diluting the other two press releases. They found the wording of the press releases to be a bit too complicated. The changes, incorporated on these recommendations, mainly involved using simpler words in the press releases. Materials were adjusted accordingly, and the revised press releases are given in Appendixes 5 and 6.

The brochure on nutrition in general consisted of basic information on nutrition and the various foods available to people that can help in the formulation of a well-balanced diet. The brochure on maternal nutrition had information on foods that will improve maternal daily nutrient intake and the importance of breastfeeding the baby after it is born. The brochure on infant nutrition contained information about feeding the infant, a daily food guide, and a list of specific tips on feeding.

The analysis of the evaluators' comments resulted in the addition of a more dynamic cover on all the brochures (Appendixes 7, 8, 9). On the brochures on maternal and infant nutrition, information for those who may not be able to breastfeed their infants was provided as suggested by the evaluators. The content of the brochures was found to be straightforward, clear, and easy to comprehend.

The fourth set of messages were the posters. The poster on nutrition in general depicted the importance of the family as a whole to work toward good nutrition. The poster on maternal nutrition illustrated the specialness of this time and the importance of a balanced meal. The poster on infant nutrition denoted the relationship between health, happiness, and good nutrition.

According to the evaluators' comments, the original posters did not contain enough information to convey the message to the intended audience. The posters modified in keeping with the evaluators' comments (Appendixes 10, 11, 12) provided more information on types of foods and amounts of foods required daily by a pregnant woman and a child. On the poster on nutrition in general, various types of foods that could be included in a day's dietary intake for greater nutritional adequacy were depicted.

The messages were aimed at creating awareness of the importance of nutrition before, during, and after pregnancy. The messages were constructed as a follow-up to the food analysis, dietary survey, and anthropometric measurements, in recognition that it is necessary not only to identify and explain the problem and its solutions, but also to find a means of delivering this message to the people.

A Nutrition Communication Model and a Plan of Action

To be able to carry out a comprehensive program of nutrition intervention in this target population, there is a need for a communication model. A communication strategy includes not only a full description of the existing communication network and nutrition messages to be fed into the network, but also a communication model which describes a plan of action.

The communication model (Figure 3) for the nutrition education program has basically three parts:

Phase I--Directed at the opinion leaders

Phase II--Directed at the target population

Phase III--Evaluation and assistance pool

The model described in Figure 3 draws upon the model developed by Rogers and Shoemaker (65). The Rogers and Shoemaker model on diffusion of innovation offers only four functional stages. The first function is that of knowledge, or awareness of information. The second function is that of persuasion, which represents part of the behavior involved in the evaluation stage. At this point, the individual forms a favorable or an unfavorable attitude toward the new idea. The third stage is decision in which the individual engages in activities which may lead to adoption or rejection. The final stage is confirmation, which follows adoption; at this time the individual seeks reinforcement for the decision made. The new model described on the following pages combines and expands upon some of the functions in the Rogers and Shoemaker model.

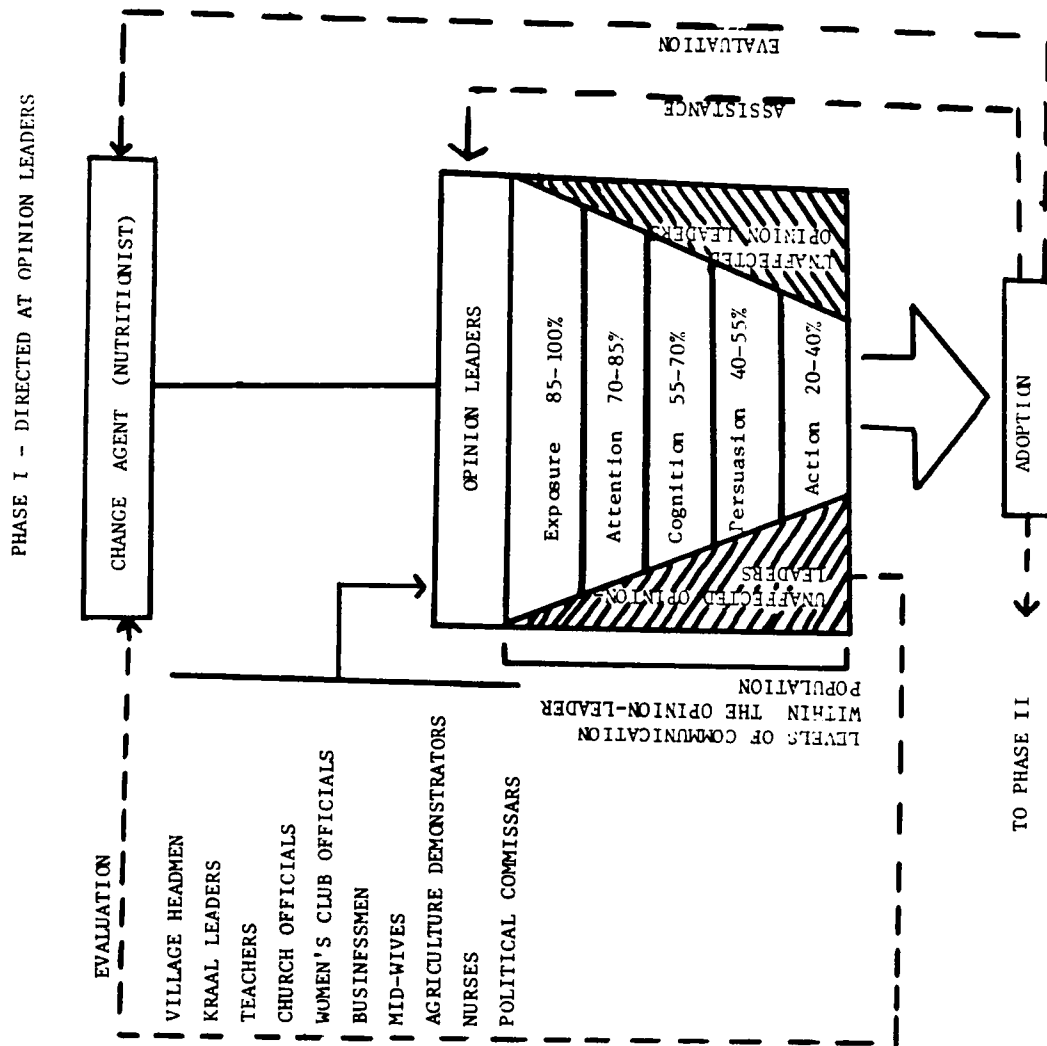


Figure 3. A Nutrition Communication Model and a Plan of Action.

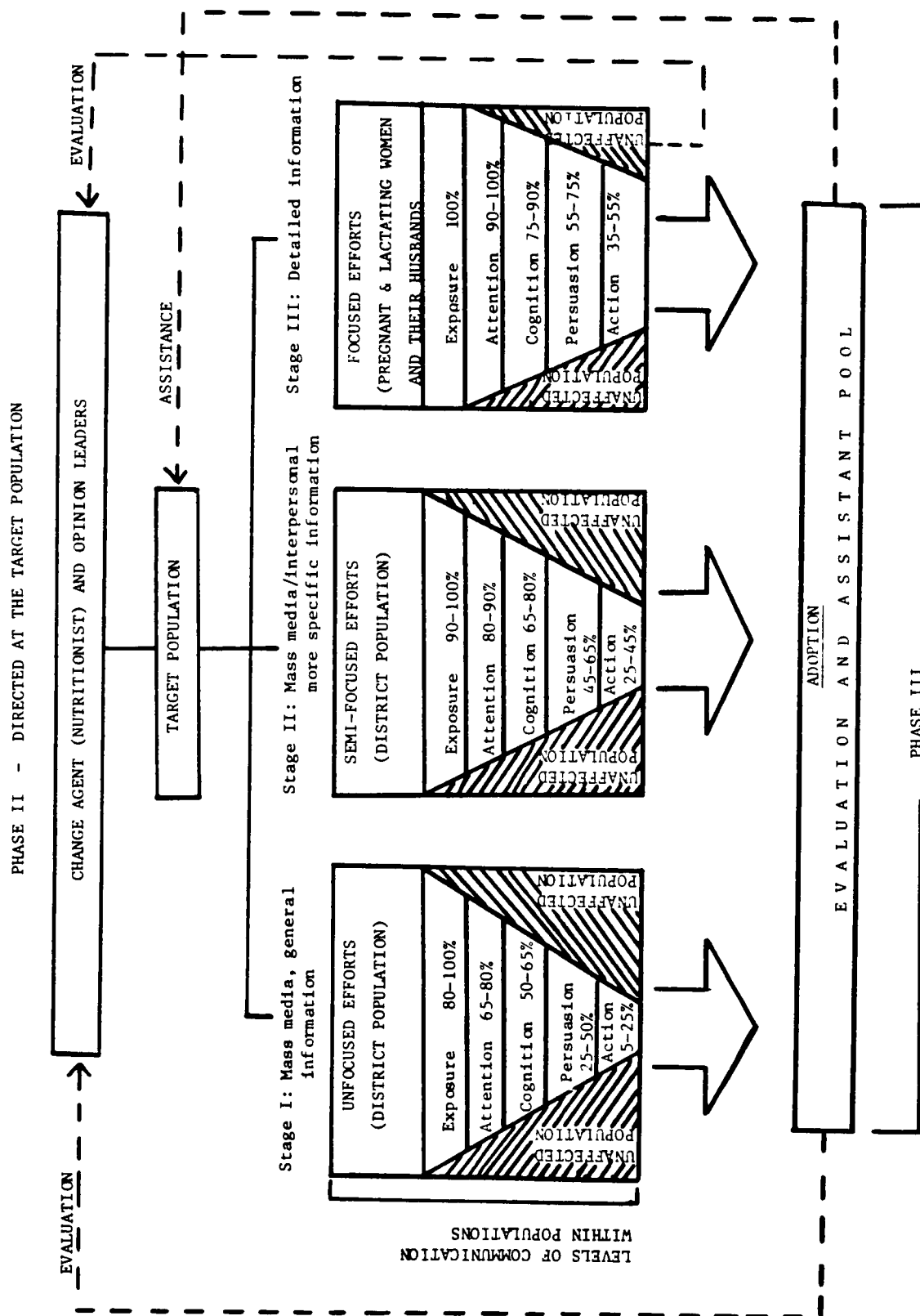


Figure 3 (Continued).

Phase I--Directed at the Opinion Leaders

Zimbabwe is a deeply traditional society. Therefore, to be able to reach the target population, it is important to approach the leaders of the community first. The change agent (nutritionist) will be an employee of the Ministry of Health, in the Division of National Nutrition Services. This individual, at the district level, will be working in cooperation with the District Health Officer and the District Commissioner. For nutrition, the change agents approach headmen of the villages, leaders of the kraal, teachers, women's club officials, church officials, businessmen, mid-wives, agriculture demonstrators, nurses and orderlies, and political commissars. This can be done with the support and encouragement of the District Commissioner. The nutritionist, with a representative of the District Commissioner (in this case the District Health Officer), will meet with the opinion leaders of each village. This will necessitate the formulation of a schedule by the nutritionist of when each village's leaders will be met.

The first meeting among the nutritionist, the representative of the District Commissioner, and the opinion leaders should mainly involve explaining the program, its objectives, and what is required of these individuals. Subsequent meetings will involve creating nutrition awareness in the opinion leaders on the importance of nutrition to the population in their respective villages, with special emphasis on pregnant and lactating women and small children. This type of communication, with this group of individuals, will involve mainly interpersonal communication.

The types of messages used to create awareness in this group will include lectures and discussions, slide presentations, film strips, brochures, and movies. In general it will be more technical and detailed than the information delivered later to the ultimate target population.

In this group of individuals, adoption will be achieved when they agree to work with the nutritionist and the health officer in their respective villages to promote nutrition education. They will also have to commit themselves to distribute some types of messages on nutrition in schools, churches, at civic meetings, in shops, and other suitable places.

It is believed that in the process of creating awareness in this population group, these individuals will go through several levels of communication effects before adoption is reached. To be able to adopt the program, they have to be exposed to nutrition information. This could be done by holding lectures and other presentations and distributing some brochures and newsletters. But exposure is meaningless unless the receivers of the communication gives it their attention. Generally, as they hear someone mention something about nutrition or see a poster to read something about it, they will be more likely to pay attention. As more information is made available to these people, eventually it leads to their making nutrition part of their knowledge--a third level, cognition, or understanding of what the government's program is all about. Persuasion takes place after cognition, when the receivers accept the government's

program as their own. Finally, this can lead to action--adoption or rejection.

The nutrition education of the opinion leaders is expected to take about 12 weeks.

In order to give the planner an idea of the number of people in each level of communication within the designated population, the percentage of those affected at each level from exposure to action is extrapolated from what little is available in the literature (65, 78). The rate of diffusion has often been found to approximate a normal distribution. Researchers have separated the diffusion curve into standard deviation units, and the characteristics of people falling into these categories have been examined. The early group of people to adopt (2.5% of the target population) are referred to as innovators. The next group (about 13.5%) are called early adopters. The early majority are said to be about 34% and the late majority are estimated to be about 34%, and the laggards--about 16%--follow much later.

In the opinion-leader population, at the end of the training or instruction period, it is believed that exposure may reach 85-100% of this population, and attention 70-85%. Those who will take nutrition as part of their knowledge (cognition) will be 55-70%, those who will be persuaded will be in the neighborhood of 40-55%, those who will decide to take action--adoption--will range between 20% and 40%. As progress is made through the various steps toward adoption, the number of those not affected by the messages or the program as a whole will rise.

It is not expected that all the opinion leaders will agree to adopt the program. Those who still reject the program will not be given up on. Those who have adopted the program will be used to encourage those who have not adopted. These early adopters will also be used as an evaluation (feedback) source for the nutritionist to determine the number of people who have agreed to adopt, what their needs are, and what changes should be made in the program. After a certain percentage (50%) of the opinion leaders have agreed to adopt, the nutritionist, with the help of the opinion leaders, will then begin work on the target population in the villages these opinion leaders are representing.

Phase II--Directed at the Target Population

The nutritionist with the help of the agreeing opinion leaders will begin to approach the target population. This phase of the communication program consists of three parts:

Stage I--Unfocused efforts

Stage II--Semi-focused efforts

Stage III--Focused efforts

As the program progresses through the stages, the messages will be longer. For example, mass media messages (radio public service announcements) used in the first stage will differ in Stage II and Stage III in terms of time on the air. In Stage II they may advance to a minute from 15 or 30 seconds. The number of public service announcements aired in 1 hour may remain the same, but the information will become more specific as the programs move from the first

stage through the other stages. The press releases and fact sheets will also become specific and gradually more advanced.

Stage I--Unfocused efforts. At this point of the campaign, a mass media approach is proposed. Utilizing the Regional Radio Service serving Salisbury and the surroundings districts, public service announcements can be run on the air during the 6 hours of regional broadcasting. Recommended would be two announcements every hour. Posters will be posted in the various villages by opinion leaders. Brochures, pamphlets, and leaflets will be distributed to all people in public places. Fact sheets and press releases will be distributed to the broadcast and print media. Radio interviews will be given by the nutritionist, health officer, and opinion leaders. This will be a shot-gun approach, basically aiming at the regional population as a whole.

It is believed that even though this will be a broad approach, some of the population will go through all five levels of communication effects. Exposure is what is needed first, and as they encounter more messages on nutrition through the various channels, they may pay attention. This will then lead to cognition and, as they take nutrition as part of their knowledge, persuasion may be achieved which can lead to action or adoption. (Adoption means changing the diet to eat more nutrients, or deciding to breastfeed instead of using formula, for example.)

In the levels of communication effects in the district population, at some point in the campaign exposure should reach 80-100% of this

population, and attention should be achieved by 65-80% of them. Those who will take nutrition into cognition will range between 50-65%. Those who will be persuaded will be about 25-50% and those taking action-adoption at this stage will be about 5-25%. As the model progresses towards adoption, the number of people not affected by this stage of the campaign will increase.

Stage II--Semi-focused efforts. While the unfocused efforts of Stage I continue to have impact, the campaign will still aim at the district population but the messages will begin to be more specific. The opinion leaders and the nutritionist will begin to identify those who are pregnant and breastfeeding. They will approach these individuals and their spouses and explain the advantages of the program in more specific terms. The subsequent meetings will include lectures and discussions on nutrition. In these sessions, brochures, flip charts, slides, film strips, and movies will be used as teaching tools. At the same time all of this is going on, public service announcements, press releases, and fact sheets will continue to be utilized through various channels.

At this stage, the target population will receive nutrition information that will be a bit more sophisticated but still basic and simple for easy comprehension. Message design and symbols will be developed to accommodate an audience with little or no education.

It is assumed here that some of the audience will go through the same five levels of communication effects as described in Stage I. The mass media campaign during the unfocused efforts of Stage I

will have previously exposed most of this group to various nutrition messages, and the number of those exposed will increase as Stage II reaches some of those not exposed to mass media. The lectures and discussion sessions will encourage attention. The initial message will focus on nutrition for the family, then gradually become specific and more detailed. At this stage, it is anticipated that nutrition becomes part of their knowledge (cognition) fairly easily. After cognition has been achieved, persuasion, leading to action--adoption--can result.

Adoption will mean that the participants are using the knowledge they have acquired to modify their current food habits. These same people will also be utilized in the interpersonal communication process, which will be carried out on those who still have not decided to adopt for one reason or another. These individuals will also be used as a feedback mechanism to determine the effectiveness of the program as a whole.

At the end of the 6 weeks slated for this stage of the nutrition program, it is hoped that exposure will have reached 90-100% and attention 80-90% of the target population. The cognition level of the communication will have reached 65-80% and the persuasion level will reach 45-65%. The action effect--adoption--will reach 25-45%. It is hoped that because this stage follows the unfocused efforts, the people will be familiar with the program and nutrition information and the task of convincing them to adopt may not be as difficult.

Other types of channels to be utilized in Stage II will include periodicals published by women's clubs, churches, political groups

and other organizations. As the messages get more advanced and specific, this will lead to the third stage of this phase.

Stage III--Focused efforts. This section will involve both those who have decided to adopt and those who have rejected the program. To those who have adopted this will be mainly for reinforcement purposes. It is aimed at increasing and improving their knowledge. For those who rejected the program this will be continued education for them. The messages will still include lectures and discussions, radio forums, radio public service announcements, press releases, fact sheets, slides, film strips, movies, brochures, and demonstrations. However, at this level the messages will be more specific and advanced and there will be more use of interpersonal communication.

In the third stage of the nutrition education process, these levels of communication effects in the target population are expected: exposure will have reached 100%, meaning that all the target population will have been exposed to one or more nutrition messages by this time. Attention will have reached 90-100%. Taking nutrition into cognition will have reached 75-90%, for by now most of the population will understand the nutrition program. Persuasion will have been achieved among 55-75% of the participants, and taking action--adoption--will have been reached by 35-55% of the people. These levels are higher than before because these individuals will have gone through Stages I and II of the nutrition education; the number of the people not reached or affected by the program from Stage I to Stage III will decrease.

It is perceived that not all of these participants will decide to adopt. Those who do not adopt will be assisted by some of those who have adopted to understand the essentiality of the program and the importance of good nutrition.

Phase III--Evaluation and Assistance Pool

This phase is mainly for evaluation purposes. It is critical to be able to monitor the effectiveness of the program over the target population. It also helps in assessing effectiveness of the nutrition messages, personnel, and other available resources. Those who have adopted the program in Phase II will be used to assist those who have not adopted to understand better and as an evaluation tool to determine the number of people who have or have not adopted and why.

A citizen's group will be formed consisting of opinion leaders and those in the target population who have adopted. These individuals will help the nutritionists to determine the needs and concerns of the target population and to identify changes in the program and the messages as well as resources that will further improve effectiveness of the program as a whole. This group will be encouraged to meet occasionally and informally with the target population as new recruits join the program to share and solicit ideas on how the program can best help the community.

For evaluation purposes the model was critiqued by two classes of graduate students, one in the College of Communication at The University of Tennessee, Knoxville and one in the School of Journalism

at the University of Iowa. Faculty members in those academic units of the two institutions also critiqued the model.

On evaluation, the model was found to be applicable, simple, adaptable, and trialable. The evaluators suggested that for evaluation purposes, the unaffected people in the opinion leaders, district population, and target population would be a better feedback tool than those who have taken action through adoption. They felt that one would find out more about the weaknesses of the program from those who did not take action through adoption. The model was adjusted in keeping with comments from the evaluators.

CHAPTER V

DISCUSSION

The best provision for well-being in any period of life is to arrive at that point in a sound nutritional and physical state. The well-nourished mother can nourish her fetus well; therefore, the best assurance for a healthy infant is a mother who is healthy and well-nourished throughout her entire life as well as during pregnancy.

This is because a well-born infant is sturdier throughout infancy than the baby poorly born (110). The sturdy infant has stores to counteract infection and disease and to give impetus to growth in the preschool years. The preschool child who is in excellent health will have stores to be drawn upon during the rapid growth period.

The fetal and neonatal death rates plus the number of incurably damaged infants are indications of total human resource waste with proportions far too high in Zimbabwe.

Food Analysis

The nutritive value of sadza was found to be low as was mealie meal (Lite-Wite) from which it was made. The results showed slightly less thiamin and riboflavin in sadza than in mealie meal. The process of making sadza takes approximately 10 minutes and those nutrients sensitive to heat may be affected.

Studies have shown that maize is not a good source of many essential nutrients (109) but if a diet which consists of maize products as the main staple food is supplemented with other foods such as dried beans, it can provide the necessary nutrients required for growth and well-being. Also in long range planning, enrichment mechanisms can be considered for some staple foods low in nutrients.

Maternal Nutrition

The diet and average intake of the Zimbabwean pregnant women in this study fell short in several nutrients. Total daily caloric intake was only slightly more than half of the FAO caloric recommendations for pregnancy (2). Mean protein intake was 33 grams daily, which at first glance is quite good; but this protein is mainly from maize, which is very low in tryptophan and lysine. Calcium, iron, vitamin A, niacin, and ascorbic acid contents were also very low.

The essential amino acid content for mealie meal and sadza was low when compared with standards for milk or eggs.

Such a diet, for the pregnant woman, has been associated with complications of pregnancy (4, 115) and delivery, high stillbirth rates (16, 17), prematurity (116, 117), low birth weight (16, 17, 112, 115), and high morbidity and mortality rates (16, 17, 46, 47, 48) in the developing countries.

Clearly, the high loss of life and health among Zimbabwean women and infants is a problem which may be related to inadequate nutrition.

The inadequate maternal dietary intake of pregnant women in Zimbabwe is attributed in part to traditional customs. For example, the largest share of the prepared food and the occasional pieces of meat are given to or saved for the head of the household (usually the husband). The children eat the next biggest share of food. The mother is the last to eat and she eats the little that is left. The most vulnerable individuals (pregnant and lactating women and small children) in the family usually do not receive an adequate share (45, 109).

This trend can be changed by allowing more food for the family or a wider variety of food served at each meal. It is a fact that Zimbabwe is an exporter of many food items to other countries (14). The unfortunate thing about this is that food items are being produced to a large extent for cash purposes, with little left for personal consumption. Increased family production of such food crops should be encouraged to accommodate both internal consumption and exports (8). The food crops grown in Zimbabwe that can serve as supplements to the staple diet are groundnuts, soybeans, cowpeas, groundpeas, lentils, and certain types of fruits and vegetables (23). For the purposes of improving the diet, available also are a variety of wild animals, insects, and fruits that can be utilized (23, 109). The trend of consuming "European food" must be discouraged, because the foods most frequently selected are extremely expensive and their nutritive value may not be commensurate with their cost. This is particularly true in the urban areas.

Seasonal variation has been shown to be a problem. Some food items are very plentiful during certain seasons, but a lack of knowledge of appropriate preserving and storage procedures decreases the availability of these foods throughout the year. There is a need to explore suitable ways and means for preserving such food items.

The increase in food production, improvement of food distribution, and marketing cannot take place without government involvement (7, 8, 14, 15). The government in its economic development plans should emphasize food planning as a priority. This is essential, because to effect change in food production, distribution, and marketing requires complete government commitment (3, 8, 63). This can eventually lead to food security for the country as a whole.

Body Weight

Experiments in animals have shown that severe caloric or protein malnutrition in the mother delays fetal growth and the relative size of several organs (24). These effects may be irreversible in organs in which the nutritional insult has affected the rate of growth (25, 46, 47, 48, 49).

Weight gain during pregnancy is strongly correlated with birth weight in both developed and developing countries (118). The data collected on the pregnant women in this study indicated low weight gain. When the data on weight gain was compared with the infants' birth weight, those women who had gained less weight tended to have infants who had low birth weight. This is similar to findings

reported by Lechtig and coworkers (116) in which they found an association between maternal weight gain and infant birth weight. They also found that average weight increased progressively as maternal dietary intake increased. Therefore, supplementation of the Zimbabwean pregnant woman's diet may improve weight gain (3, 4, 117, 119).

Birth weight of infants born to these women reflected a relationship between maternal dietary intake, weight gain, and infant birth weight. This supports findings by Brassel and Winick (117).

Low birth weight is well established as an antecedent of excess mortality rates in infants, mental retardation, and other neurological disorders, according to Bergner and Susser (115). The lower the birth weight, the greater the perinatal death rate.

The annual report from the office of the Secretary of Health reveals a high number of African children who die from nutrition-related diseases and other types of diseases that have been found to be associated with malnutrition--for example, measles and pneumonia.

In order to reduce maternal and infant morbidity and mortality rates in Zimbabwe, it is crucial to create nutrition awareness in pregnant and lactating women. This can be achieved by developing a strategy for nutrition education for this target population which has a major communication component.

Supplementing the diet of pregnant women as in the Women, Infant and Children (WIC) supplementary food program in the United States

(120) may be effective in reducing evidence of maternal nutrition, low birth weight and prematurity. A program supplementing food for pregnant and lactating women and children found to have an inadequate nutritional status may be considered in long range planning for Zimbabwe.

In order to reduce the high incidence of maternal and infant morbidity and mortality, stillbirths, prematurity, and other anomalies, there is a need to create nutrition awareness in the family. The mother plays a central role because traditionally she is the one delegated the responsibility of child care and food production and preparation (45, 80, 109). Wenlock (5) and Cravioto (121) found that if mothers in developing countries (Zambia and Mexico, respectively) were instructed on the importance of good nutrition for their children, food intake of the child and health improved leading to the improvement of the nutritional status of the family as a whole.

The Diffusion Process

Creating nutrition awareness in any population requires an analysis of the communication network in existence in that area, preparation of nutrition messages, and a communication model with a plan of action.

The description of the communication network in Zimbabwe provides a varied list of the types of media available. Mass media consist of the broadcast media, print media (dailies and periodicals), and others (mail, movies, road advertisements, and telephones). Some of these are government controlled and others are not (105, 107).

Zimbabwe has one of the most powerful short-wave radio transmitters in Africa (106). This can be used to broadcast news, entertainment, and other information. The radio system has the capacity to broadcast regionally. This will facilitate reaching the country region by region.

There is an unlimited capacity to use the mass media in Zimbabwe, which may be complemented by interpersonal communication. Because of the tradition of close village and family ties, interpersonal communication can be utilized effectively and efficiently.

A nutrition communication model which describes a plan of action and which facilitate the flow of nutrition messages was developed. Basically, the model shows the two-step flow utilized in the diffusion of innovation described by Rogers (64). This seems to fit well with the tradition of Zimbabweans, which dictates that in order to discuss anything, the elders in the community must be informed first and then, with their support, the remainder of the community.

Even though the model is designed at the district level, it can be modified to include the whole country. It has the potential also for use in other countries or in other fields. However, it will need to be further examined to suit each individual situation.

Communication processes as noted by Yarbrough (78) are central to nutrition education. For the most part, nutrition education efforts have fallen short of expectations. Undoubtedly there are various reasons to explain such failure. Yarbrough (78) discusses central reasons for failure.

First, the expectations are often unrealistic. Communications research and theory offer a perspective for realistically evaluating the expectations. It has been established that changing behavior is a difficult and slow process that requires many messages over a long period of time (122).

A second reason for failure in nutrition education programs is that there are certain features of nutrition and food behavior which make nutrition education particularly challenging. Food is part of a person's lifestyle and, therefore, has many meanings.

A third factor cited as a reason for failure is that there are no knowledge factors which exert important influences on the effects of a program. Many nutritionists have been found to have failed to integrate that knowledge into program planning (123).

Even though the success of many nutrition intervention programs has been relatively low, what is being proposed here has more optimistic connotations. Many of the nutrition programs have been developed and carried out by nutritionists who have a weak background in communication. Knowledge on how to communicate, types of media available, and utilization of such media to the fullest extent is critical in the creation of nutrition awareness programs.

Another factor that makes the proposed program worthwhile is that when one looks at the various areas such as Guatemala, Ecuador, and India (124), the environments under which the nutrition programs were implemented are very different from those in Zimbabwe. Zimbabwe is a new nation, one which has not experienced instability in

government. The people, at present, trust their leaders and what they are trying to do for them.

True, Zimbabwe is a developing country with a high level of illiteracy, poverty, and disease; however, these people are aware of what their needs are. They are capable of changing even though the society is very traditional in many ways. They do not mistrust new ideas of things in general. They tend to embrace new ideas fairly well and easily.

Even though the Zimbabwean communication system (mass media, in particular) was basically designed to serve the Europeans, the Africans have also managed to utilize it for their benefit. Mass media, for example, was used effectively during the liberation struggle. This same skill can be applied to teach nutrition.

It is true that food is a part of a person's lifestyle and has many meanings. One of the problems contributing to failure of many nutrition education programs has been the introduction of foods that are not familiar to that society. This, of course, will cause problems which can lead to total rejection of the program. What is being proposed as supplements to the current maternal diet are foods that are familiar and grown by these individuals.

Many nutrition intervention programs have been directed by people not familiar with the culture, language, and customs of the target population. This puts a strain on communication between the change agent and the intended audience. What is being proposed here is to utilize the whole community. The use of opinion leaders and

individuals in the same community--not strangers--to explain the program and the materials can result in the successful introduction of a nutrition awareness plan.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Findings of this study can be summarized as follows:

1. The staple food items in the Zimbabwe diet (mealie meal and sadza) are deficient in essential nutrients such as protein, fat, calcium, iron, vitamin A, thiamin, riboflavin, niacin, and ascorbic acid.

2. In the daily dietary intake estimation, obtained from data from interviews with pregnant women, the nutrients calcium, fat, vitamin A, niacin, and ascorbic acid were low by FAO standards. Protein levels met FAO recommendations for pregnancy; however, the main source of protein was maize, which was deficient in tryptophan and lysine, two essential amino acids very important to growth and development.

3. Maternal weight gain data indicated a deficiency in the total weight gain achieved by more than half the women in the study. About half of the infants had low birth weight. Women who had low total weight gain tended to have infants with low birth weights.

4. There is a great need in Zimbabwe to create nutrition awareness through a nutrition education program.

5. In order to develop a nutrition education program to create this awareness, a communication strategy was formulated which included a description of the communication network in Zimbabwe, the development of sample nutrition messages, and the formulation of a nutrition communication model.

A diet that provides such an inadequate daily nutrient intake can be supplemented with various other foods that are grown locally. Therefore it is critical to promote the use of these foods to supplement the current diet of this special group in the population.

A nutrition education program that emphasizes changing the current diet by supplementation with native foodstuffs is essential to solving this problem. Such a campaign should be led by the government through its policy of freedom from hunger and increased food production. Communication will play a vital role in the implementation of such a program.

A comprehensive and well developed communication system exists in Zimbabwe in both mass media and interpersonal communication. These channels can be utilized as vehicles in carrying out nutrition education messages.

A communication model is offered in some detail which describes how the communication network can be used. Sample messages were developed to show how specific messages could be used in a nutrition education program and how the program could be implemented at specific points in specific channels.

Nutrition communication is in its infancy in the field of nutrition. Rapid advances in a short time or within one experiment cannot be expected. It must be recognized that as much must be learned about the variables that determine the effectiveness of nutrition communication as is learned about variables that affect human requirements for specific nutrients.

It is not easy to change the inherent characteristics of food behavior, but by understanding their influences on adoption of a changed behavior, we can minimize the potential negative effects they can have on nutrition education programs. The field of communication, especially in the area of diffusion theory, offers important theoretical prospects for nutrition education.

Given the government's stand on improving the health of the people (125), a nutrition education program would be appropriate. Having just become independent, the people of Zimbabwe are ready to embrace new ideas and concepts with new enthusiasm.

Along with independence, a totally new government is setting policies aimed at improving the lives of the people. At the same time, people are expecting to change their lives. This whole new atmosphere in the country provides a great opportunity for a new direction.

Conditions for attacking the problem of malnutrition nationwide have never been more favorable than right now. The need for a nutrition education program has been demonstrated. A communication network is in place and ample channels are available to develop and implement such a plan.

Currently there is no general plan designed to alleviate malnutrition in pregnant women in Zimbabwe. Therefore, it is urgent that some plan be implemented. In this study, the research required for problem identification has been done and an extensive communication strategy has been developed; implementation, evaluation and integration of fundings into successive programs remains.

The first struggle in Zimbabwe was for majority rule, and this has been attained; however, the country is embarking on another struggle for a high quality of life, which embodies good health based on good nutrition. The first struggle was won, paid for in lives lost, mostly adults. In this second struggle, this new nation cannot afford to pay with more lives lost, this time mostly children, because they are the future of Zimbabwe.

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APPENDIXES

APPENDIX 1

EVALUATORS OF NUTRITION MESSAGES

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Manof International, Inc., New York, New York.

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Dr. Charlotte Roderuck, Department of Nutrition, Iowa State University.

Dr. Diva Sanjur, Department of Nutrition Sciences, Cornell University.

Dr. Neff Smart, Department of Journalism, The University of Utah.

APPENDIX 2

NUTRITION MESSAGES QUESTIONNAIRE

Attached are nutrition messages designed to create awareness of the importance of eating a well-rounded diet during pregnancy. The target population is a group of pregnant women living in a rural district in Zimbabwe. A diet survey and anthropometric measurements have been done on these women and the nutritive value of their staple food determined. The data indicate an inadequate daily nutrient intake of these women, and low nutritive value of the staple food.

In order to be able to improve nutrient intake of such an audience, nutrition education is critical. The following message is part of a proposed nutrition education program.

It would be appreciated if you would evaluate this message for effectiveness in modifying food consumption of pregnant women in Zimbabwe. The following questions may be helpful in formulating your responses.

1. Do you feel the message is straightforward and clear for the pregnant women in Zimbabwe to easily grasp the intended meaning?
2. Do you feel the message would provoke interest on the part of pregnant women in Zimbabwe?
3. Do you think the message will encourage pregnant women in Zimbabwe to seek more information?
4. Would the message have the force to leave an imprint on the minds of pregnant women in Zimbabwe:
5. To what extent do you think the message will affect behavior of pregnant women in Zimbabwe who hold strongly to tradition?

NOTE: Please add further comments as you may wish on the other side of this sheet.

APPENDIX 3

FACT SHEET ON NUTRITION PROBLEMS OF PREGNANT WOMEN

Background: About 55% of the population of Zimbabwe are women, half of whom are in the child-bearing age. Communicable diseases and diseases related to lack of proper food have been found to be common among these individuals. Poor nourishment in pregnant and breast-feeding women is recognized as one of the biggest health problems in Zimbabwe.

- One out of six pregnant women died in childbirth in 1979
- Most deaths of pregnant women are related to poor nutrition
- Women relying on sadza are getting no vitamin A, ascorbic acid or niacin
- Pregnant women eating poor diets are two times as likely to lose their babies
- Lack of proper food in pregnant and breastfeeding women causes problems like toxemia and inadequate milk production
- Lack of growth of the unborn child, low birth weight, prematurity, miscarriages, and stillbirths are associated with lack of proper food during pregnancy
- Infants born to mothers poorly nourished have a higher rate of nutrition-related diseases

Foods which can solve the problems are available. The situation is not hopeless; it's a matter of changing habits. For further information, please contact the Provincial Health Officer or Maternal and Infant Nutrition, Division of National Nutrition Services, The Ministry of Health, P. O. Box 8204, Salisbury, Zimbabwe.

APPENDIX 4

FACT SHEET ON CHILD NUTRITION PROBLEMS

Background: The disease patterns and lack of proper food in Zimbabwe are characteristic of developing countries. The burden of disease in developing countries falls very heavily on the very young. Up to half of them, if born alive, die before their fifth birthday. Twenty percent of the population of Zimbabwe is under the age of 15 and almost half that percentage are below the age of 5. These children may also account for over 50% of the total deaths in Zimbabwe each year. The mortality rate of children 1 to 4 years of age is up to 40 times higher than in developed countries.

- Poor nutrition is one of the biggest health problems among children in Zimbabwe
- 120-300 out of 1,000 live births die during their first year of life
- Half of these deaths are nutrition-related
- The problem is even worse in children 1 to 5 years of age
- Malnutrition is related to behavioral and learning disorders in children
- Poor nutrition is related to lack of growth and low vitality
- Breastfeeding is nature's way of nourishing a baby
- Nutritionally adequate foods are available

The problem is not so far gone that nothing can be done about it; the way children are fed and what they are fed must be changed. For further information, please contact your Provincial Health Officer or Maternal and Infant Nutrition, Division of National Nutrition Services, The Ministry of Health, P. O. Box 8204, Salisbury, Zimbabwe.

APPENDIX 5

PRESS RELEASE

Nutrition for the Mother

Pregnant and breastfeeding women are a very important group in the program for a healthier Zimbabwe, announced the Ministry of Health recently. However, there are serious problems in this group: in 1978 1 in every 7 pregnant women died due to nutrition-related disease, and in 1979, this number increased to 1 out of every 6.

It is important for a pregnant women to eat a balanced diet, and to eat enough of it. This is true because during pregnancy, the nutrient requirements are at their highest.

Poor nutrition also seems to be a primary cause of miscarriages, stillbirths, infant deaths, and even brain damage in newborn babies.

Deaths of pregnant women due to avitaminosis (disease resulting from a lack of one or more vitamins) increased by one third from 1978 to 1979. Anemia (a condition in which blood is deficient of red blood cells) was responsible for a one fourth increase in pregnant women's deaths from 1978 to 1979.

Data collected from a study of pregnant women in one district of Zimbabwe indicated a very low nutrient intake. Of the 21 women measured for weight gain during pregnancy, only 2 achieved the desirable gain of 24 lbs. Seven women gained an average of 20 lbs. and 12--over half--achieved an average of only 14 lbs.

(more)

Mother Nutrition - page 2

The weight gain of the pregnant women matched up with the birth weight of the babies born to these women. What the mother eats before, during and after pregnancy is related to low birth weight, stillbirths, miscarriages, premature deliveries and complications of pregnancy. The unborn child has also been found in some cases to have brain damage due to the mother's inadequate nutrient intake.

The largest number of deaths in the newborn period occur among the infants born to the most poorly nourished mothers.

The traditional diet which consists mainly of sadza is relatively adequate. It needs changing so that it can include foods that will improve the quality and increase the amount of nutrients that are lacking and are necessary for promoting health and growth. For example, the Zimbabwean pregnant woman's diet consists of about 4% fat, 11% protein (from maize), 85% carbohydrate and less than 1% of the vitamin A needed, and no vitamin C and niacin.

During pregnancy, nutrient needs are at their highest because of the physiological changes taking place in the individual. This is why a larger amount of high quality essential nutrients must be supplied through the foods eaten by the mother-to-be. It is also important because adequate nutrition during pregnancy helps to lay down the fat that will be required for milk production during the breastfeeding period.

The current diet of pregnant women can be supplemented with various foods cultivated throughout the country. Mothers and mothers-

(more)

Mother Nutrition - page 3

to-be can be taught how to select and prepare a well-balanced meal for themselves as well as for the whole family.

Part of the nutrition problem is the manner in which some of the staple food (maize) is processed into meal. Many of the naturally available nutrients may be stripped during processing and are not added back. This type of milling produces a meal that is super refined and white in color. Unfortunately this appeals to a lot of people because "white meal" is equated with the best.

In the fact of such thinking, it is difficult to counter the impression left by such products. This type of influence is especially undesirable to young children who are very impressionable.

If you need more information on nutrition for the mother or have questions, please contact your Provincial Health Officer. You can also write for a free copy of "A Baby? ? ? . . . These Foods Are For You."

#

APPENDIX 6

PRESS RELEASE

Nutrition for the Child

The key to making Zimbabwe's children healthier and reducing the widespread disease and death among children is to change the way children are fed.

In an Economic Policy Statement by the government of the Republic of Zimbabwe, it was stated that preventive measures such as health education in hygiene and malnutrition and maternal and child care programs will be expanded.

Malnutrition has been found to be a primary or secondary cause of illness in 3 out of every 10 African children who are hospitalized. But this is estimated to be only a tenth of the child population affected. Most of the children who die throughout the country probably die because of malnutrition. This is particularly true in the villages and tent-city urban areas.

As it stands presently, the African child death rate ranges from 120 to 300 deaths per 1,000 live births. This means that if 1,000 children are born, up to 300 will die within their first year of life. Malnutrition and malnutrition-related diseases are the major causes.

One of the major tasks ahead for the Ministry of Health is to reduce child malnutrition through community services. This can be done by teaching good diets to the population--particularly women,

(more)

Child Nutrition - page 2

because they have the responsibility of buying, growing and preparing food for children.

Breastfeeding is important to children through the first year of life. Breast milk is the most complete food, and it is the only food the child needs for the first 6 months.

In those special cases where the mother is unable to breastfeed, then other methods of feeding--formula feeding, for example--can be used. However, the formula must be prepared correctly.

As the child grows older, breast milk can be supplemented with table foods that the rest of the family eats. These foods can be strained, mashed or ground so the child can eat them. As the child's food is prepared, it is important that all operations be carried out in a clean manner. Food that is not clean can be dangerous to a child.

If you have any questions about this program or if you want more information about child feeding, please contact your Provincial Health Officer. You can also write to the Ministry of Health, P. O. Box 9204, Salisbury, Zimbabwe, for a free copy of "Food for Your Baby . . . The First Year, a Guide for Parents."

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Put Nutrition To Work For You And Your Family



Maternal and Infant Nutrition
Division of National Nutrition Services
The Ministry of Health
Salisbury, Zimbabwe

WHAT IS NUTRITION?

Nutrition is the study of the environment and of human behavior as it relates to nutrition. In other words, it is the sum total of all the processes that take place in the body to break down foods into their various components (nutrients) for growth, repair, and maintenance of all the systems that contribute to health.

WHAT ARE NUTRIENTS?

The nutrients that the body needs for growth, repair and maintenance are proteins, calories, fat, vitamins and minerals.

WHERE DO YOU FIND THESE NUTRIENTS?

Nutrients are found in the food that you eat. Some foods contain more of certain nutrients than others. Therefore, it is essential, when planning a meal, to include those foods that are rich sources of those nutrients that are limiting in the current diet.

Foods that will help provide adequate necessary nutrients for a healthy and happy family are as follows:

PROTEIN FOODS

Meat (pork, beef, chicken,
wild animals)
Fish, dried beans, cowpeas
Ground peas, lentils
Eggs, milk (fresh cow or goat)
Milk products (cheese, dried milk)
Ground nuts, peanut butter
Locusts, termites

BREADS AND CEREALS

Porridge, oatmeal
cake, bread (whole wheat)
Sadza, scones

FRUITS AND VEGETABLES

Oranges and orange juice, mangoes
Wild fruits, lemons, grapefruit
Paw paws, guavas, watermelons
granedillas, figs, peaches, goose-
berries,

VEGETABLES

Spinach, cabbage
Turnip greens, rape
Chomolia, fresh pumpkin leaves
Fresh bean leaves, mufushwa
Okra, peas, carrots
Sweet potatoes, Irish potatoes
Madumbes

FATS AND OILS

Butter
Margarine
Cooking oil

WHAT WILL HAPPEN IF NUTRIENTS ARE INADEQUATE?

- * Loss of vitality
- * Lack of growth
- * Less resistance to disease

A Baby ?????



These Foods Are For You

Maternal and Infant Nutrition
Division of National Nutrition Services
The Ministry of Health
Salisbury, Zimbabwe

FOOD FOR A DAY

What you eat during pregnancy is very important since you are nourishing both your own body and that of your unborn baby. Some nutrients are stored in the body, so your diet in the past has some effect on your present health status.

One of the best things you can do for your baby is to eat a balanced diet before, during and after pregnancy.

Failure to eat a well balanced diet may lead to low birth weight, problems during pregnancy, prematurity, still-births, and complications after the baby is born. It will also contribute to low milk production during the breast feeding period.

Some tips to help you plan a balanced diet each day are:

1. Choose 3 or 4 servings of milk or milk products

Whole fresh cow milk
Whole fresh goat milk
Sour milk
Dried skimmed milk



II. Choose 2 -3 servings
of protein foods

Meat (beef, goat,
pork)

Wild game (rabbits)

Fish

Poultry (chicken, duck,
wild birds, guinea fowl)

Dried beans

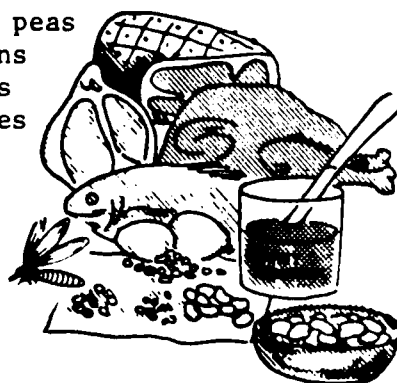
Cowpeas, ground peas

Lentils, soybeans

Groundnuts, eggs

locusts, termites

caterpillars



III. Choose 4 servings of
grain or cereal products

Bread (whole wheat)

Buns (whole wheat)

White bread (if enriched)

Sadza (from maize, rapoko,
and millet)

Porridge

Rice

Oatmeal

Scones

Cassava

Cake

Madumbe

Baobab



IV. Choose 4 servings of
fruits and vegetables

A. Vegetables

Rape, spinach
Fresh bean leaves
Dried bean leaves
Fresh pumpkin leaves
Chomolia, cabbage
Peas, carrots
Green beans
Sweet potatoes



Irish potatoes
Pumpkins
Turnip greens
Collards, onions
Cucumbers, okra
Green mealies
Tomatoes
Mushrooms



B. Fruits - 1 or More Servings

Oranges, grapefruit
Lemons, bananas
Mangoes, pawpaws
Guavas, peaches
Avocadoes
Gooseberries
Granadillars
Water melons
Sour plums
Some wild fruits
(figs, matamba,
mbumi)



HOW TO FEED YOUR BABY

The most natural way to feed your baby is by breast milk. Why?

- * Breast milk has the correct balance of nutrients
- * Breast milk is always fresh and warm
- * Breast milk costs less
- * Breast feeding benefits the baby because it is a special time for you and your baby - a closer relationship
- * It provides baby with protection against disease
- * Breast fed babies have fewer allergies
- * Breast milk helps baby's jaws and teeth to develop
- * Breast fed babies are less likely to have constipation
- * For you the mother, weight gained during pregnancy is easily lost when you breast feed

Food For Your Baby . . .



. . . The First Year

A GUIDE FOR PARENTS

Maternal and Infant Nutrition
Division of National Nutrition Services
The Ministry of Health
Salisbury, Zimbabwe

BREAST MILK

During the first year of life the growth rate of a baby is at its greatest and the right kind of food is very important. For some time after birth, the only food of the newborn is breast milk. For the rest of the year, breast milk remains a major source of nutrients throughout the first year of life.

For the first four months of life, breast milk should be the only form of food for the infant. After about four months, a wider variety of foods will be needed along with breast milk.

There are no hard and fast rules as to the exact day or week when your baby will be ready for solid foods. You need to look for certain signs as the baby grows and develops, like crying after a short period after feeding. Every baby is different and develops at a different rate. All babies are not ready for solid foods at the same age. There is no advantage to starting solid foods until baby is ready. If in doubt ask your nurse or nutritionist at the hospital or clinic.

DAILY FOOD GUIDE

FOOD	NUMBER OF SERVINGS	SIZE OF SERVING
		6-12 MONTHS OF AGE
MILK:		
Fresh cow or goat milk (boiled)		
Powdered milk mixed with equal parts of boiled water	2-4	4-0z. Child's cup
FOODS RICH IN PROTEIN:		
Fish, eggs		
Ground meat		
Chicken (ground)		
Cowpeas (mashed)	2	2-3 Tablespoons
Groundpeas (mashed)		
Peanut butter		
Dried beans (mashed)		
Lentils (mashed)		
VEGETABLES AND FRUITS:		
A.Vitamin A rich foods		
Fresh pumpkin leaves (cooked)		
Fresh bean leaves (cooked)		
Dried bean leaves Cooked)	1	1-2 Tablespoons
Spinach (cooked)		
Rape (cooked)		
Other dark green leafy vegetables (cooked)		
Yellow sweet potatoes		
Carrots, Okra		
Yellow pumpkins		
Pawpaws		

FOOD	NUMBER OF SERVINGS	SIZE OF SERVING
		6-12 MONTHS OF AGE
B. Vitamin C rich foods		
Guavas		
Oranges, orange juice		
Mashed tomatoes		
Tomatoe juice	1	5 Tablespoons
Cabbage		
Mashed Irish potatoes		
C. Other Fruits and Vegetables		
Wild Fruits -	1-3	1-2 Tablespoons
Strained madumbes		
Strained mbumi and matamba		
BREAD AND CEREALS:		
(Whole grain)		
Porridge from maize or millet		
Oatmeal		
Sadza from maize, millet and rapoko	4	1-2 Tablespoons cooked cereals
Bread		½ a slice
Rice		
FATS AND OILS:		To be used in limited amounts

SPECIAL TIPS

- * Start with the mild flavored cereals (rice), meats (chicken), and vegetables (carrots).
- * Always begin a new food by giving your baby small amounts of food, then gradually increase. Do not force the baby to eat.

- * Juice should be fed from a cup. Most babies can drink from a cup between 5-7 months of age. Strain the juice or food if necessary.
- * Use real fruit juice, not fruit ades, high sugar drinks or tea.
- * Baby does not need salt, sugar or other seasonings added to food.
- * Serve a variety of foods each day after each has been introduced to the baby. Plan a well-balanced diet for your baby.
- * If the new food disagrees with the baby, stop feeding that food immediately.
- * Eating time should be a pleasant time for you and your baby.
- * It is extremely important to make your baby's food using CLEAN utensils and ingredients.

BALANCED MEALS HELP MAKE A HAPPY AND HEALTHY FAMILY



BODY-BUILDING FOODS

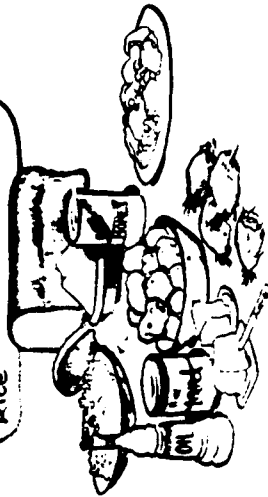
Whole Fresh Milk
Skimmed Fresh Milk
Sour Milk
Full Cream Milk
Termites
Locusts
Dry Beans
Groundpeas
Groundnuts
Lentils
Beef and Pork
Chicken
Fish
Wild Game
Peanut Butter

Maternal and Infant Nutrition
Dietary - Minimum essential nutrients
for the Maternal Health



ENERGY-GIVING FOODS

Lard
Oil
Butter
Margarine
Suet
Whole Wheat Bread
Rice
Dry Cereals
Porridge
Sugar
Honey
Sweet
Potatoes
Irish
Spices
Machinde



FOODS TO GUARD AGAINST DISEASE

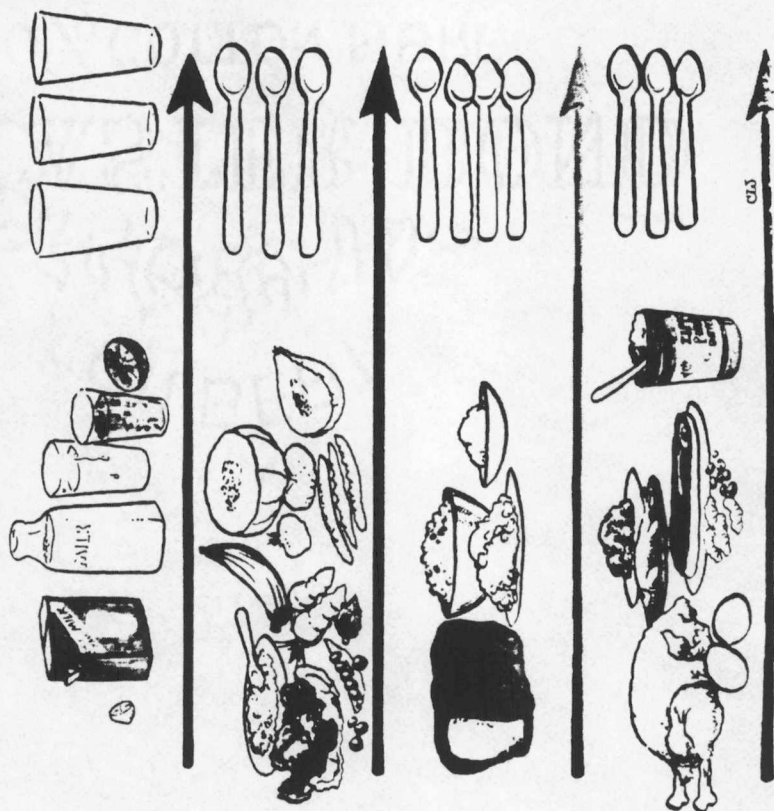
Tomatoes
Green Beans
Peas
Cabbage
Carrots
Pumpkins
Pumpkin Leaves
Fresh Bean Leaves
Rape, Okra
Mustard Greens
Spinach
Chenopodium
Mushrooms
Mint
Parsnips
Onions
Lemons
Grapefruit
Avocadoes
Peaches
Guava
Pawpaw
Coconut
Orange

For a Balanced meal include one food from each group



NATIONAL INFANT
NUTRITION
DIVISION OF NATIONAL NUTRITION SERVICES
— THE MINISTRY OF HEALTH

SERVE FOODS FROM EACH GROUP EACH MEAL:



BALANCED MEALS
MAKE A HEALTHY AND HAPPY
CHILD!

VITA

Prisca Nemapare-Sithole Mugwira was born in Salisbury, Zimbabwe on January 27, 1944. She attended Hartzel Secondary School where she obtained her high school diploma. After spending her early years in Salisbury, she moved to Dar-es-Salaam, Tanzania when she was awarded a scholarship by the African-American Institute to attend Dar-es-Salaam Technical College. She moved to East Lansing, Michigan where she started her undergraduate studies at Michigan State University. She then moved to Huntsville, Alabama where she entered Alabama A. & M. University and she received her Bachelor of Science degree in June 1973 and a Master of Science degree in June 1975. She entered The University of Tennessee, Knoxville in January 1979 to pursue a doctoral degree.

Ms. Mugwira worked as a research assistant at Alabama A. & M. University in the Department of Food Science. Her primary responsibility was food product development. She later worked at an instructor in the Division of Home Economics at the same institution with a major emphasis on teaching.

During her studies at The University of Tennessee, Knoxville, she was on scholarship from the African-American Institute.