A REVIEW OF LITERATURE ON THE CONSUMPTION
OF VEGETABLES IN AMERICA

APPROVED:

[Signatures]

Major Professor

Minor Professor

Director of the Department of Education

Dean of the Graduate Division
A REVIEW OF LITERATURE ON THE CONSUMPTION
OF VEGETABLES IN AMERICA

THESIS

Presented to the Graduate Council of the North
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By

Martha Ware, B. S.

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CHAPTER I

INTRODUCTION

The Problem and Its Purpose

Many spotlights have been turned to focus attention throughout the nation on health and its prerequisite, adequate nutrition, since Pearl Harbor, December 7, 1941. Health problems today are increasingly significant because through unhappy experiences Americans have found that it is more necessary to be physically fit in wartime than in a time when the day's problems are normal. Results of physical examinations of selectees for our armed forces have caused much concern, and have led many to consider the need for more healthy men and more adequate nutrition throughout the rank and file of America. Simultaneously many recent investigations have been related to the problem of foods and their contribution to maximum health.

Evidences of the nutritional need for vegetables in the diet of both young and old are revealed by a scientific study of food contribution to body needs. This problem is discussed in Chapter II of the present study, but is mentioned here as an approach to the problem of this research, which is a review of thirty-two investigations.
made from 1917 to 1944 relative to vegetables in the diet of the American people.

Motivation of the Study

Interest in the problem of vegetables in the diet was engendered through several years' experience as a teacher in the city schools of Dallas, Texas. Since children are allowed only a short period for lunch, most of them eat in the school cafeterias.

Teachers are requested to help in the supervision of their own particular groups, and it was during this informal supervision that the writer noted the scanty servings of vegetables eaten by many of the children and the total abstinence of others. Conferences with the individuals who persistently ate no vegetables revealed that they did not eat vegetables because they did not like them -- many of them did not eat them at home, they said.

Class discussions revealed that vegetables were not the favorite food of a majority of the children. Those who included this class of food in their diet each day usually did so because parents or teachers insisted or because the children had learned in their health work that vegetables "are good for us."

Since several years of experience did not indicate any change in the children's attitude toward the consumption of
vegetables, the writer decided to make an investigation of the problem among people outside of her classroom. Such was the beginning of this research on vegetables in the diet of the American people.

Background of the Present Research

A study of the diets of Texas school children in 1927 through 1929 indicated that they did not meet the accepted standards in the consumption of leafy vegetables.¹ A cross-section dietary study in 1935-1936 showed that the diets of about one-fourth of the families in the United States were classified as good, a little over one-third as fair, and the remainder as poor.² In 1942 the amount of vegetables consumed by Texas school children was almost double the amount consumed in 1927-1929, yet adequacy still was not attained.³

Increased purchasing power has helped to raise the dietary level of many families by enabling them to buy the protective foods more frequently and in more abundant quantities. Improved diets for many people, even in wartime, have come about as a result of victory gardens, canning of vegetables, and conservation of food values through increased


³Whitacre, op. cit., Introduction.
knowledge of preparation and cooking. Many of these war-
time achievements would have been impossible had research
not been quietly building up a reserve of nutritional facts,
which quickly were put to work when the emergency developed.
Our wartime food program is a demonstration on a vast scale
of the importance of research in human nutrition and the
nutritive values of food.

The problem of teaching children to eat vegetables
presents two different aspects: first, the development of
right food tastes and habits in a child with whom one may
begin at the beginning -- birth; and second, the re-education
of the child who has not had the right start, but who
has formed dislikes and prejudices which must be overcome
before new tastes can be developed.

The first method is the logical and the comparatively
simple plan. A child is born without definite food habits,
or at least without definite food tastes; consequently his
training in the consumption of vegetables is fairly easy,
if the one who is doing the training is well-trained her-
self. It must be remembered that the complexity of factors
influencing appetite is evident. There is apparently no
innate mechanism upon which children depend for choosing
foods. The natural stimulation to eat, which is afforded
by hunger, is easily thwarted by nutritional, physiological,
and psychological situations.
Unfortunately, the majority of children and a great many adults belong to the class who need re-education. The public school teachers have to deal largely with this group. We who have the task feel that we would like to do our part to start the next generation of children in the right way of eating, but our task for a long time is to salvage those who have not had the right beginning.

Sources and Treatment of Data

Information for this research was obtained from various sources, both local and professional. For data on vegetables consumed in Texas, the writer investigated several theses written in the departments of home economics in the two colleges of Denton, the North Texas State Teachers College and the Texas State College for Women. For fundamental principles of nutrition, textbooks and reference materials were read; and for extensive and professional research, scientific and food magazines were consulted. Among the latter sources, the Journal of Nutrition, the Journal of Home Economics, and the Journal of the American Dietetic Association were used most consistently and frequently. In addition, data were obtained from various bulletins from the Department of Agriculture, Washington, and from pamphlets published by agricultural experiment stations and by nutrition committees.
When the necessary data were collected, the following chapters were compiled: Chapter I, Introduction, including a statement of the problem and its purposes, motivation and background of the problem, and a discussion of the sources and treatment of data; Chapter II, The Contribution of Vegetables to Health, emphasizing scientific data on the contribution of vegetables, including laboratory experiments; Chapter III, A Review of Thirty Investigations of Vegetables in the Diet, including data on children of preschool age and those in elementary school, junior high school, senior high school, and college and non-school adults; and Chapter IV, containing the summary and conclusions.
CHAPTER II

THE CONTRIBUTION OF VEGETABLES TO HEALTH

Introduction

Vegetables can be included in the menu in such a way that they will satisfy hunger, gratify the esthetic sense, satisfy the body needs, and promote digestion and other bodily functions. Vegetables' wide variety in kind, color, texture, and flavor, as well as their content of nutrients, makes them a seemingly essential class of foods. They are valuable not only because of their ability to lend variety in kind and preparation, but also because of important minerals they supply for vitamin content, for bulk or roughage, for alkaline-producing qualities, and for energy supplied by starchy classifications.

Vegetables should be cooked in such a way that they preserve their attractiveness of shape, color, texture, and flavor as well as their nutrients. Cooking softens their cellulose and cooks the starch, making the vegetables palatable and more easily digested. Overcooking means a loss of color, flavor, and texture. Overcooking also increases the loss of minerals and destroys certain
vitamins. The time of cooking depends upon the age, size, and freshness of the vegetables. The unpopularity of this class of foods is due largely to careless preparation.

The consumption of vegetables exerts a potent influence either toward health or toward disease, according to whether we eat the right kind and an adequate amount or the wrong kind and an inadequate amount. Appreciation of the vital importance of proper eating is becoming almost universal.\(^1\) Seemingly, people are beginning to realize that food is the best medicine for the prevention and treatment of diseases. Many are eager to secure substantial information concerning the requirements for an adequate and well-balanced diet along with facts about food and the body. Without scientific language, medical terminology, or burdensome calculations, they want information that will help in planning everyday meals.

Classification of Vegetables

Vegetables are the flowers, fruits, leaves, stems, bulbs, roots, tubers, and seeds of plants which we use as foods. Table 1 contains a classification of common vegetables that are familiar to most people. Although different varieties of vegetables are grown in different parts of the world, many are common to all sections of the United States.

TABLE 1

CLASSIFICATION OF COMMON VEGETABLES*

<table>
<thead>
<tr>
<th>Flowers</th>
<th>Fruit</th>
<th>Leaves</th>
<th>Stems</th>
<th>Pulbs</th>
<th>Roots</th>
<th>Tubers</th>
<th>Seeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broccoli</td>
<td>Egg-plant</td>
<td>Cabbage</td>
<td>Asparagus</td>
<td>Onion</td>
<td>Peets</td>
<td>Irish</td>
<td>Beans</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>Tomato</td>
<td>Brussels</td>
<td>Celery</td>
<td>Shallot</td>
<td>Carrots</td>
<td>potato</td>
<td>Peas</td>
</tr>
<tr>
<td>French</td>
<td>Pumpkin</td>
<td>Endive</td>
<td>Leek</td>
<td>Turnips</td>
<td>Ruta-bagas</td>
<td>Jerusalem</td>
<td>Corn</td>
</tr>
<tr>
<td>Artichoke</td>
<td>Okra</td>
<td>Lettuce</td>
<td>Garlic</td>
<td>Sweet</td>
<td>artichoke</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Squash</td>
<td>Spinach</td>
<td></td>
<td></td>
<td>potato</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Adapted from L. Jean Bogert and Mame T. Porter, Dietetics Simplified, p. 507.

Alkaline Potency of Vegetables

The acid-base balance of the body is controlled largely by the amount and kind of food consumed by the individual. Foods containing proteins tend to leave an acid residue, and vegetables tend to yield an alkaline residue which is useful in neutralizing the acids.

Every individual, young and old alike, should consume enough of the alkaline foods to neutralize the acid-forming foods, because the former tend to build up more resistance to disease germs than the latter. Table 2 contains data on the types of vegetables which yield an alkaline residue in the body. This group of foods is able to neutralize the residue left by the acid-forming foods.
<table>
<thead>
<tr>
<th>Vegetables</th>
<th>cc. Normal Alkali Per 100 gms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinach</td>
<td>27.1</td>
</tr>
<tr>
<td>Chard</td>
<td>15.8</td>
</tr>
<tr>
<td>Lima beans, fresh</td>
<td>14</td>
</tr>
<tr>
<td>Parsnips</td>
<td>12</td>
</tr>
<tr>
<td>Beets</td>
<td>10.9</td>
</tr>
<tr>
<td>Carrots</td>
<td>10.8</td>
</tr>
<tr>
<td>Rutabagas</td>
<td>8.5</td>
</tr>
<tr>
<td>Cucumbers</td>
<td>7.9</td>
</tr>
<tr>
<td>Celery</td>
<td>7.8</td>
</tr>
<tr>
<td>Lettuce</td>
<td>7.4</td>
</tr>
<tr>
<td>Potatoes, white</td>
<td>7</td>
</tr>
<tr>
<td>Potatoes, sweet</td>
<td>6.7</td>
</tr>
<tr>
<td>Cabbage</td>
<td>6</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>5.6</td>
</tr>
<tr>
<td>String beans</td>
<td>5.4</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>5.3</td>
</tr>
<tr>
<td>Mushrooms</td>
<td>4</td>
</tr>
<tr>
<td>Radishes</td>
<td>2.9</td>
</tr>
<tr>
<td>Turnips</td>
<td>2.7</td>
</tr>
<tr>
<td>Onions</td>
<td>1.5</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>1.5</td>
</tr>
<tr>
<td>Peas, fresh</td>
<td>1.3</td>
</tr>
<tr>
<td>Asparagus</td>
<td>0.8</td>
</tr>
</tbody>
</table>

*Adapted from Bogert and Porter, *op. cit.*, p. 441.

Mineral Contribution of Vegetables

About 3.5 per cent of the body, by weight, is composed of mineral elements which must be furnished by the food which we eat. Calcium, phosphorus, sodium, chlorine, magnesium, potassium, iron, and iodine are the most important mineral elements. They are used for replacement,
for building new tissues, and for regulation of body processes. Some of the more obvious ways in which minerals aid in the regulation of body processes include their influence on the contractility of muscles; determination of the irritability of nerves; control of the movement of liquids in the body; assistance in blood coagulation, digestion, and neutralizing of the blood; aid in the transportation of oxygen from the lungs to the tissues and of carbon dioxide from the tissues to the lungs; and contribution to the structure of certain complex chemical compounds connected with metabolism.3

Since the body constantly loses some of each mineral element, it is necessary for each individual to replace the loss through the consumption of foods, including vegetables, which replenish the body supply.

Calcium and phosphorus. -- The amount of calcium and phosphorus in the body is more than twice as much as the amount of all other minerals combined, because these two elements make up the main constituent of the bones for the skeletal framework.4

Calcium plays an especially important role in the program of body building. Its work is obvious in the development

4Bogert and Porter, op. cit., p. 46.
of bones and the teeth. In addition, it contributes to the contractility of muscles, the rhythm of the heart's beat, normal response of nerve tissues to stimuli, coagulation of the blood, and coordination among the mineral elements. Since calcium's functions are constructive and regulatory, growing children should be supplied with vegetables which provide an adequate amount of this element.

Phosphorus is a necessary element for all body tissues. It contributes to cell multiplication and movement, maintenance of an adequate liquid content of the tissues, regulation of the blood's neutrality, and the oxidation and liberation of carbohydrates. Since the growth of new body tissues calls for phosphorus, it is imperative that foods rich in this mineral be included in the child's daily diet. Emphasis should be placed on the fact that a child needs about one and one-half times as much phosphorus as an adult man.

Daniels and her associates at the Iowa Child Welfare Research Station made a study in 1935 of the calcium needs of preschool children. They concluded that the dietary standard of one gram daily seemed adequate.

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5Rose, op. cit., pp. 162-164.
6Ibid., pp. 160-161.
7Ibid., p. 162.
In 1934 Stearns and Jeans carried on an investigation regarding the proper amount of calcium for children. At the College of Medicine of the University of Iowa, they gave children, four to twelve years of age, diets in which the calcium was equivalent to that in either one pint or one quart of milk. They noted that better retention was gained with the larger intake. 9

In 1922, Sherman and Hawley conducted 417 experiments regarding calcium requirements on twenty-one healthy children ranging in age from three to fourteen years. In the experiments, the amount of calcium was kept at different levels by changing the amount of milk consumed in successive periods. Findings led to the conclusion that the best utilization of calcium was engendered when approximately one quart of milk a day was included in a simple, adequate diet of other required elements. 10 Later studies have tended to confirm these facts.

Rose recommends that a dietary standard of 0.68 gram of calcium per man per day and one gram per child per day seems well established. The requirements of women are increased to between three and four grams or more by pregnancy.

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and lactation.\textsuperscript{11} Rose also says that the dietary standard of 1.32 grams of phosphorus per day per laboring man, 0.044 gram per one hundred calories for the average adult, and one gram per day for children up to fourteen years of age seems to cover the ordinary requirements.\textsuperscript{12}

\textbf{Iron and Iodine.} -- The body requires only a very small amount of iron daily. The quantities of this mineral in foods are very minute, so it is necessary that proper foods be eaten in order that the intake of iron will not be below the optimum. The red blood corpuscles contain most of the iron in the body, but small amounts are in practically every cell. Although all of the iron in the body does not equal the weight of a one-cent piece, it is necessary to the blood and to the tissues.\textsuperscript{13}

The amount of iodine in the body is only one hundredth the amount of iron, yet the proper functioning of the body depends largely upon this small amount, less than the weight of a grain of wheat.\textsuperscript{14}

\textbf{Foods rich and poor in minerals.} -- Table 3 contains data on the vegetables richest in calcium, phosphorus, and iron, listed in the order of milligrams of each element furnished by one hundred grams of food.

Data in Table 3 show that many vegetables are excellent

\textsuperscript{11}Rose, \textit{op. cit.}, pp. 165-169. \textsuperscript{12}Ibid., pp. 161-162. \textsuperscript{13}Bogert and Porter, \textit{op. cit.}, p. 46. \textsuperscript{14}Ibid.
### TABLE 3

**VEGETABLES RICH IN MINERAL ELEMENTS***

<table>
<thead>
<tr>
<th>Foods Containing Calcium</th>
<th>Milligrams per 100 gms.</th>
<th>Foods Containing Phosphorus</th>
<th>Milligrams per 100 gms.</th>
<th>Foods Containing Iron</th>
<th>Milligrams per 100 gms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turnip tops</td>
<td>347</td>
<td>Soy beans, dried</td>
<td>669</td>
<td>Beans, dried</td>
<td>7.9</td>
</tr>
<tr>
<td>Soy beans, dried</td>
<td>234</td>
<td>Beans, dried</td>
<td>463</td>
<td>Peas, dried</td>
<td>5.7</td>
</tr>
<tr>
<td>Collards</td>
<td>202</td>
<td>Peas, dried</td>
<td>411</td>
<td>Turnip tops</td>
<td>3.5</td>
</tr>
<tr>
<td>Kale</td>
<td>181</td>
<td>Lentils, dry</td>
<td>383</td>
<td>Beet tops</td>
<td>3.2</td>
</tr>
<tr>
<td>Beans, dried</td>
<td>150</td>
<td>Beans, baked, canned</td>
<td>229</td>
<td>Parsley</td>
<td>3.1</td>
</tr>
<tr>
<td>Watercress</td>
<td>157</td>
<td>Peas, fresh</td>
<td>127</td>
<td>Watercress</td>
<td>3.0</td>
</tr>
<tr>
<td>Broccoli</td>
<td>140</td>
<td>Brussels sprouts</td>
<td>121</td>
<td>Dandelion greens</td>
<td>3.0</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>122</td>
<td>Corn, sweet, fresh</td>
<td>103</td>
<td>Mustard greens</td>
<td>2.9</td>
</tr>
<tr>
<td>Endive</td>
<td>104</td>
<td>Artichokes, French</td>
<td>94</td>
<td>Cowpeas, fresh</td>
<td>2.5</td>
</tr>
<tr>
<td>Lentils, dried</td>
<td>102</td>
<td>Parsnips</td>
<td>76</td>
<td>Spinach</td>
<td>2.5</td>
</tr>
<tr>
<td>Chard</td>
<td>100</td>
<td>Hominy, uncooked</td>
<td>70</td>
<td>Kale</td>
<td>2.5</td>
</tr>
<tr>
<td>Beet greens</td>
<td>94</td>
<td>Broccoli</td>
<td>68</td>
<td>Beans, lima, fresh</td>
<td>2.4</td>
</tr>
<tr>
<td>Okra</td>
<td>75</td>
<td></td>
<td></td>
<td>Peas, fresh</td>
<td>2.1</td>
</tr>
<tr>
<td>Beans, baked, canned</td>
<td>82</td>
<td></td>
<td></td>
<td>Broccoli</td>
<td>1.4</td>
</tr>
<tr>
<td>Lettuce</td>
<td>62</td>
<td></td>
<td></td>
<td>Cabbage, green</td>
<td>1.2</td>
</tr>
<tr>
<td>Parsnips</td>
<td>60</td>
<td></td>
<td></td>
<td>Brussels sprouts</td>
<td>1.2</td>
</tr>
<tr>
<td>Beans, string</td>
<td>55</td>
<td></td>
<td></td>
<td>Endive</td>
<td>1.2</td>
</tr>
</tbody>
</table>

sources of calcium, phosphorus, and iron. Many foods appearing in the lower part of the table can furnish appreciable amounts of minerals because larger quantities of these foods can be consumed than of the more concentrated foods. A large amount of these foods which contain only a moderate or small amount of minerals must be eaten daily in order to obtain an adequate supply of the necessary substances.

Table 4 contains two diets. One provides calcium, phosphorus, and iron in liberal amounts; while the other, seemingly similar, is decidedly deficient in its mineral contents.

An analysis of data in Table 4 shows that the diet inadequate in minerals contains no lettuce and mineral-poor juicy vegetables instead of mineral-rich leafy vegetables. Since many people prefer not to eat leafy vegetables every day, larger amounts of these mineral bearers should be included when they are in the diet.

Vitamin Contribution of Vegetables

Vitamins are organic substances, not proteins, fats, or carbohydrates, which are essential for normal growth and the maintenance of health. They are formed in the plant world and are stored to some extent in roots and tubers. The parts of the plant which have the most chlorophyll or green pigment have the most vitamins, hence
TABLE 4

CONTENTS OF AN ADEQUATE-MINERAL DIET AND
AN INADEQUATE-MINERAL DIET*

<table>
<thead>
<tr>
<th>Diet Adequate in Minerals</th>
<th>Diet Inadequate in Minerals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 pint of milk (2 glasses)</td>
<td>$\frac{1}{2}$ pint of milk (1 glass)</td>
</tr>
<tr>
<td>1 egg</td>
<td>1 large</td>
</tr>
<tr>
<td>1 serving lean meat (75 gms.)</td>
<td>or ) servings lean meat 2 small (100 gms.)</td>
</tr>
<tr>
<td>Cheese, American, 1$\frac{1}{4}$ in. cube</td>
<td>Bread, 3 slices, white</td>
</tr>
<tr>
<td>Potato, baked, 1 medium</td>
<td>1 serving farina, light (1/2 c. cooked)</td>
</tr>
<tr>
<td>Lettuce, $\frac{1}{2}$ small head</td>
<td>Potato, baked, 1 medium</td>
</tr>
<tr>
<td>2 servings mineral-rich vegetables</td>
<td>2 servings mineral-poor vegetables -- tomato, 1 fresh squash, 100 gms.</td>
</tr>
<tr>
<td>-- chard ) 100 gms.</td>
<td>-- grapefruit, $\frac{1}{2}$ small</td>
</tr>
<tr>
<td>-- cauliflower each</td>
<td>1 serving mineral-poor fruit</td>
</tr>
<tr>
<td>2 servings mineral-rich fruits</td>
<td>2 servings mineral-poor vegetables -- tomato, 1 fresh squash, 100 gms.</td>
</tr>
<tr>
<td>-- dates, 4-5 prunes, 6 medium</td>
<td>2 servings mineral-poor vegetables -- tomato, 1 fresh squash, 100 gms.</td>
</tr>
<tr>
<td>( calcium 1.202 gms.</td>
<td>( calcium 0.400 gms.</td>
</tr>
<tr>
<td>( phosphorus 1.330 gms.</td>
<td>( phosphorus 0.750 gms.</td>
</tr>
<tr>
<td>( iron 0.016 gms.</td>
<td>( iron 0.008 gms.</td>
</tr>
</tbody>
</table>

*Diet from Bogert and Porter, op. cit., p. 55.

Thin green leaves and growing shoots or stems of vegetables are rich sources. Vitamins exert a powerful influence in the coordination processes of the body. Scientists have established the existence of six vitamins, A, B, C (ascorbic acid), D, E, and G.

Vitamins A, B, C, D, E, and G. -- Vitamin A, which is contributory to growth, is closely associated with the green or yellow coloring substance in plants where it is

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15 Ibid., p. 58.
first formed. Green and yellow vegetables are both excellent sources as they contain carotene, the yellow pigment most noticeable in carrots, from which vitamin A comes. Tomatoes also supply this vitamin in appreciable amounts. Other vegetables contain smaller quantities, and the outer leaves of lettuce and cabbage are richer in this vitamin than the colorless inner parts.

Vitamin B is necessary to normal functioning of the nerve tissues, but it is not stored to any extent in the body. Therefore, each individual must depend upon his food for this supply. Vitamin B is widely distributed in nature but is present in very small quantities in most foods. Green vegetables are among the sources from which we get the bulk of our supply, but yeast, yeast extracts, and wheat germs are our most concentrated sources.

Vitamin C, or ascorbic acid, functions in holding cells together in specialized tissues. It is not stored or manufactured in the body. Fresh and raw vegetables are among the main sources of supply for this vitamin, since it is readily destroyed by oxidation in drying or storing and by heat in canning.

Vitamin D is essential for assimilating mineral elements and for depositing calcium and phosphorus in the teeth and bones. Although nature has not supplied our ordinary food with an abundance of this vitamin, traces
of it are found in green vegetables. Concentrated supplies are found in cod-liver oil, egg yolk, and butter.

Vitamin E is specifically related to fertility. Sterility in men and death and reabsorption of the embryo in women may be traced to the lack of this substance. It is widely distributed in foods and is found in seeds and green leaves of vegetables.

Vitamin G promotes growth in children and bodily vigor in adults. It is heat-resistant and is present in green leaves of vegetables, roots, and tubers, although the richest sources are yeast and liver.

Vitamin requirements for health. -- Low-vitamin diets are never prescribed, but they are often chosen because of a dislike of many vitamin-rich foods -- that is, vegetables -- or because of indigestion, undue economy, or an actual food shortage. In addition to inviting deficiency diseases, such as ophthalmia, beri-beri, scurvy, rickets, and pellagra, low-vitamin diets are associated with the following conditions: underweight; lack of appetite, vigor, and endurance; nervous instability; digestive disturbances; constipation; joint pains; skin lesions; infections, such as colds; sinus infections; abscesses in ears; boils; arthritis; tuberculosis; and poor mineral assimilation, as in anemia, poor bones and teeth.\textsuperscript{16}

\textsuperscript{16}ibid., p. 405.
Scientists have determined the minimum requirements for each vitamin in terms of the number of units designed to protect an individual against the disease which a vitamin deficiency will cause. An optimum allowance is the minimum requirement plus an extra amount which will cover any variation in vitamin content of food, losses in cooking or losses due to poor digestion. This extra amount of vitamins should be large enough to meet additional needs of the body and to build up a reserve store for emergencies. Children require larger amounts of vitamins than adults. Expectant and nursing mothers need an abundance for their own bodies in addition to a supply for their baby's body.

Fogert and Porter suggest that the standard quota of vitamin A for an adult is 2,000 to 4,000 units daily or 100 units for every 100 calories of the food intake -- for children, from 200 to 300 units per 100 calories. Vitamin B's quota for an adult is 300 to 600 units daily or from ten to twenty units per 100 calories of food -- for children, about thirty units per 100 calories. Vitamin C's quota is forty to eighty units daily or two units per 100 calories of food for the adult -- for children, seventy-five units per day up to 2,000 calories of food; after that, two units per 100 calories. Vitamin D's quota for children varies but is generally considered to be from 135 to 400 U. S. P. units daily. The needs of an adult
are considerably lower. Vitamin G's quota for an adult is 600 Sherman-Bourquin units daily -- for children, twenty units for every 100 calories of food. Vitamin E's quota has not been quantitatively determined, but a diet containing an adequate supply of green vegetables, milk, fruit, and whole grains will protect against a deficiency of this vitamin.\textsuperscript{17}

An abundance of all the vitamins can be insured by following these dietary rules about vegetables, along with consuming an adequate supply of fruit, whole grains, foods, milk, and milk products: (1) have at least two rich sources of each vitamin in the daily menu; (2) eat some raw vegetables every day -- have one large serving or two small servings of raw salad daily; (3) eat daily two or more liberal servings of vegetables, not including starchy foods like potatoes, corn, and peas; (4) use leafy vegetables at least three times per week.\textsuperscript{18}

Vegetables as sources of vitamins. -- Scientists have worked out standard units for practically all vitamins and have determined the relative amount present in different foods. Although the content of many foods has not been accurately measured, Table 5 contains the names of vegetables which are sources of vitamins A, B, C, and G. Foods supplying the largest amounts are listed first, and those

\textsuperscript{17} Ibid., pp. 87-89. \hfill \textsuperscript{18} Ibid., p. 89.
supplying the smallest amounts assume the lowest positions in the listings.

<table>
<thead>
<tr>
<th>Vitamin A</th>
<th>Vitamin B</th>
<th>Vitamin C</th>
<th>Vitamin G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artichokes</td>
<td>Turnip greens</td>
<td>Peppers, green</td>
<td>Beet tops</td>
</tr>
<tr>
<td>Broccoli</td>
<td>Asparagus</td>
<td>Spinach, raw</td>
<td>Turnip greens</td>
</tr>
<tr>
<td>Brussels sprouts</td>
<td>Beans, navy, kidney, and lime</td>
<td>Tomatoes, fresh or canned</td>
<td>Asparagus</td>
</tr>
<tr>
<td>Chard</td>
<td>Cabbage</td>
<td>Artichokes</td>
<td>Cabbage, raw</td>
</tr>
<tr>
<td>Corn</td>
<td>Carrots</td>
<td>Broccoli</td>
<td>Carrots</td>
</tr>
<tr>
<td>Dandelion greens</td>
<td>Corn</td>
<td>Cabbage, raw</td>
<td>Dandelion</td>
</tr>
<tr>
<td>Lettuce</td>
<td>Dandelion greens</td>
<td>Kale</td>
<td>greens</td>
</tr>
<tr>
<td>Peas, green</td>
<td>Kale</td>
<td>Lettuce</td>
<td>Kale</td>
</tr>
<tr>
<td>Peppers, green</td>
<td>Lettuce</td>
<td>Spinach</td>
<td>Lettuce</td>
</tr>
<tr>
<td>Potatoes, sweet</td>
<td>Peas</td>
<td>String beans</td>
<td>Spinach</td>
</tr>
<tr>
<td>Squash, Hubbard</td>
<td>Spinach</td>
<td>Turnips, especially raw</td>
<td>Watercress</td>
</tr>
<tr>
<td>String beans</td>
<td>String beans</td>
<td>raw</td>
<td>Beans</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>Sweet potatoes</td>
<td>Watercress</td>
<td>Cauliflower</td>
</tr>
<tr>
<td>Asparagus</td>
<td>Tomatoes</td>
<td>Beans, lime</td>
<td>Onions</td>
</tr>
<tr>
<td>Beans, dried, navy, or lime</td>
<td>Turnips</td>
<td>Beets</td>
<td>Cauliflower</td>
</tr>
<tr>
<td>Cabbage</td>
<td>Artichokes</td>
<td>Brussels sprouts</td>
<td>Celery</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>Beets</td>
<td>Cabbage, cooked</td>
<td>Celery</td>
</tr>
<tr>
<td>Cucumbers</td>
<td>Brussels sprouts</td>
<td>Carrots</td>
<td>Corn</td>
</tr>
<tr>
<td>Eggplant</td>
<td>Cauliflower</td>
<td>Cauliflower</td>
<td>Cucumbers</td>
</tr>
<tr>
<td>Endive</td>
<td>Celery</td>
<td>Celery</td>
<td>Dandelion</td>
</tr>
<tr>
<td>Potatoes, white</td>
<td>Chard</td>
<td>Chard</td>
<td>greens</td>
</tr>
<tr>
<td></td>
<td>Eggplant</td>
<td>Endive</td>
<td>Eggplant</td>
</tr>
<tr>
<td></td>
<td>Endive</td>
<td>Kale</td>
<td>Endive</td>
</tr>
<tr>
<td></td>
<td>Onions</td>
<td>Lettuce</td>
<td>Kale</td>
</tr>
<tr>
<td></td>
<td>Parsnips</td>
<td></td>
<td>Lettuce</td>
</tr>
<tr>
<td></td>
<td>Peppers, green</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Potatoes, green</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>white</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## TABLE 5 -- Continued

<table>
<thead>
<tr>
<th>Vitamin A</th>
<th>Vitamin B</th>
<th>Vitamin C</th>
<th>Vitamin D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Potatoes, white or sweet</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spinach, cooked</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Turnip greens</td>
<td></td>
</tr>
</tbody>
</table>

*Adapted from Bogert and Porter, *op. cit.*, pp. 81-84.

**Vegetables in Low-cost, Moderate-cost, and High-cost Diets**

One of the greatest problems of the low-cost diet is to get enough minerals and vitamins into the dietary. Restriction in amount and in choice of vegetables to a few cheap ones requires careful planning to insure adequacy of diet.

Meals at a moderate cost are far easier to plan than when price is a restriction. A liberal amount of vegetables and a variety may be included in the diet by selecting the less costly fresh foods, avoiding out-of-season varieties, and using canned and dried vegetables along with green leafy ones.

A high-cost dietary provides an unlimited variety of foods. However, care should be exercised in the selection of vegetables as well as other classes of food in order
that extravagance and over-indulgence may be prevented. An abundance of money should not mean unwise buying of unhealthful but well-liked foods. Raw salads and succulent vegetables can be used attractively and for the maintenance and promotion of health. The consistency of the diet, the amount of indigestible residue it carries, and the forms in which fiber is taken are of prime importance regardless of the amount of money available for food, because these factors are connected with correcting chronic constipation and intestinal putrefaction.\(^{19}\)

Foods which are too largely digestible cause constipation, because there is not enough bulk to the food residue left in the colon to produce normal muscular activity of the intestines. Table 6 contains information on the indigestible residues of certain vegetables, whether high, moderately high, or moderate, indicating their ability or inability to provide enough intestinal activity conducive to optimum health.

Value of Vegetables to the Preschool and Elementary School Child

Rapid growth and development characterize the first few years of life. The permanent character of certain tissues is largely determined, and rapidity and extent of

\(^{19}\)Henry C. Sherman, *Chemistry of Food and Nutrition*, p. 257.
### Table 6

**High, Moderately High, and Moderate Indigestible Residue of Certain Vegetables**

<table>
<thead>
<tr>
<th>High Indigestible Residue</th>
<th>Moderately High Indigestible Residue</th>
<th>Moderate Indigestible Residue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beans, navy, dry, soy, green</td>
<td>Beans, lima, snap Broccoli</td>
<td>Asparagus</td>
</tr>
<tr>
<td>Peas, dried, green Artichokes, globe</td>
<td>Brussels sprouts Cabbage Carrots</td>
<td>Bamboo shoots Beets Cauliflower</td>
</tr>
<tr>
<td>Onions, green Parsnips Celeriac (celery root) Greens, beet or endive Kale Kohlrabi Okra Onions Peppers Potatoes, sweet Pumpkin Squash, winter Turnips and turnip tops</td>
<td>Celery Chard Chicory Corn, sweet Cucumbers Eggplant Endive Lettuce Potatoes, white Radishes Spinach Squash, summer Tomatoes Watercress</td>
<td></td>
</tr>
</tbody>
</table>

*Adapted from Bogert and Porter, op. cit., p. 263.

Growth are greatly influenced by the child's diet. 20

A lack of any of the nutritive elements necessary for body building may result in stunted growth. The best way to insure maximum growth and development is to choose foods that furnish plenty of all the tissue-building essentials.

During the preschool years, which constitute a transition period following infancy, an appetite for a variety of vegetables should be developed. As the child grows older, the quantity of milk in his diet generally remains stationary or even decreases. The consumption of foods rich in minerals needs to be increased so that the quantities necessary for growth and regulation of body processes can be maintained.\textsuperscript{21}

Since proper feeding is a matter of vital significance to the preschool child, food is probably the most important single factor in promoting growth and development. Vegetables are especially necessary because the child's need of vitamins and minerals is high during periods of rapid growth. Defects may result from a deficiency of either of these requirements. Stunted growth, poor quality of bones and teeth, malformed bones, narrow chest which invites lung trouble, and contracted pelvis may be attributed to a lack of calcium, phosphorus, or vitamin D in the early period of life. Anemia is caused by an insufficient supply or iron. Low vitality or deficiency diseases like rickets or scurvy may be caused by a prolonged lack of any of the vitamins.

Certain child specialists have suggested that children's dietary habits, their likes and dislikes of food,
are fairly well established by five years of age. If this thesis is true, too much emphasis cannot be placed on preschool eating habits. At this age, the diet should still be limited to the simple, easily digested foods used in the earlier period. Vegetables should be finely minced or mashed. They may be combined with well-liked foods if the child shows a distaste or dislike.

Mothers and teachers, feeding preschool children in the home or in the nursery school, face a problem that must be met daily with intelligence and judgment. An adequate supply of foods, including a serving of two or three vegetables, one being a green leafy vegetable, is the first essential in planning preschool children’s meals.

Even young children are sensitive to texture in foods. Studies show that crisp food in most cases is popular and should be served along with one soft and one chewy food. The skillful blending of flavors, producing balance and harmony, should not be neglected. Ease of manipulation should also be considered. No meal should include more than one food which is difficult to eat, such as pieces of carrots that slide across the plate or beet cubes that are too large, or stringy spinach. New foods should be introduced singly and sparingly and should be served with a

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favorite food. The noon meal is generally the logical time for the introduction, since hunger is at its peak at midday.24

The consumption of new or customary foods is often conditioned by how well the food has been cooked. The goal in preparing children's food as well as adults' is retention of desirable color, flavor, and texture in addition to retention of food elements. With a program of proper food selection and consumption throughout the preschool period, hordes of sturdy, well-nourished six-year-old children will enter the schools every fall instead of an inferior group, bearing scars of malnutrition, physical defects, and wrong habits of eating.25

In the early elementary school period, in which children are generally between the ages of five and nine years, vegetables are especially necessary to the diet, because they supply body-building materials. They should be cooked, in most instances, and minced or mashed as for the preschool child. The variety may be widened, but strongly flavored and harsh-textured vegetables should be included only occasionally.

In the later elementary school period, in which children are usually from nine to twelve years of age, the

24 Ibid., pp. 7-9.
same kinds of vegetables should be consumed as are recommended for the earlier period. The amount may be increased and the range widened. Raw vegetables in salads can be introduced. Lettuce, cabbage, carrots, and celery should be shredded. If the noon meal is eaten at school, parents and teachers should be sure that an adequate amount of necessary vegetables is included.

The Value of Vegetables to Junior-Senior High School Students and Older Adults

Children between the ages of twelve and eighteen years of age need special attention given to their eating, because of the requirements of adolescence and rapid growth. An effort should be made to cater to their tastes, but at the same time plenty of nutritious foods should be provided. Green vegetables should be used freely to furnish needed vitamins, minerals, and fiber.

The function of food in adult life primarily is to provide energy and materials for the upkeep of tissues which were built in earlier life. In addition, a small quota of substance for building new cells, repairing them, and keeping them in a healthy condition is needed. Vegetables help to supply the fuel for these types of work. They are necessary in the diets of aged persons because some minerals and vitamins are essential for the maintenance of tissues as long as there is life. However, the
required amounts of these substances are less in old age than in previous years.

Hazel K. Stiebeling, senior food economist and chief of the Bureau of Human Nutrition and Home Economics, United States Department of Agriculture, summarized the significance of proper diet throughout life's span in the following paragraph:

Laboratory experiments and human experiments indicate that proper diets not only can lengthen the entire span of life but that they also can lengthen the active, fruitful period, postponing the effects of advancing age. They can make old age itself more healthful, less a period to be looked forward to with dread, and less of a burden on society. 26

Summary

Vegetables are among the prerequisites to optimum health because of their contribution to body building, maintenance, and repair. The classifications of this group of foods include flower, fruit, leaves, stems, bulbs, roots, tubers, and seeds.

Vegetables tend to alkalize the system or to neutralize the acid residue. They also supply an appreciable amount of calcium, phosphorus, iron, and other minerals. These elements play important roles in body building and development.

Vegetables are sources of vitamins also. These

substances are essential to normal growth and the maintenance of optimum health. Minimum requirements of vitamins A, B, C (ascorbic acid), D, and G have been determined and are available for those who wish to plan meals properly.

Senility, which is the weakening of tissues with age, can be postponed and the active period of life prolonged by proper eating, which includes consumption of leafy vegetables. To reach maximum efficiency the diet, from infancy to old age, should be of the nature suited for building and maintaining strong bodies. Vegetables play an important part at every age in promoting health and preventing disease.
CHAPTER III

REVIEW OF LITERATURE ON VEGETABLES IN
THE DIETS OF THE AMERICAN PEOPLE

The present chapter contains a review of thirty-five investigations regarding the consumption of vegetables by the American people. These investigations date from 1917 through 1944 and pertain to the following groups: preschool children, school children, non-school adults, and families.

Laird and Breen made a study of sex and age alterations in taste preferences. They demonstrated the gradual disappearance of taste buds throughout life. They report that in early childhood these buds are located on the inside of the cheek and in the throat, in addition to being on the tongue. During the period of adolescence, those on the tongue are practically the only ones to be found. Little change is noted in adult life, but in old age there is a decline, both structural and functional, in the taste buds.1 These basic changes explain to some degree the

alteration in food enjoyment as the individual passes through life, and may account, at least partially, for the seemingly universal dislike of many vegetables.

Vegetables in the Diet of Preschool Children

Few studies seem to have been made on vegetables consumed by children of the preschool age. Available investigations have been included in this discussion with the hope that additional research will be done soon, since the health of the child before he enters school is so important.

In 1915 the United States Children's Bureau made one of the earliest and most extensive dietary studies of preschool children in Gary, Indiana. Trained workers visited the homes of 6,015 children of preschool age and obtained first-hand information regarding their dietary habits. Results showed that 50.4 per cent of the group had no vegetables other than potatoes. According to accepted standards of what foods constitute a diet that promotes normal development, less than ten per cent of the group ate adequately and approximately two-thirds of the children's diets were unquestionably inadequate.²

A report on a 1924 dietary study made by Roberts and Waite in a day nursery of Chicago in which a majority of the eighty children were Italians, showed caloric deficiencies.

²Reported by Lydia J. Roberts, op. cit., p. 531.
One-fourth of the group, among whom were many preschool children, received an inadequate supply of phosphorus, and many were deficient in calcium. Over two-thirds of the children received an inadequate amount of iron. These facts are easily understood when it is remembered that Italians eat much polished rice, white bread, spaghetti, and few leafy vegetables.

In 1931, McLaughlin and her associates made a study of the contribution of vegetables to the health of a group of preschool children in Iowa. Daily records of foods were kept for periods varying from one to four weeks during seasons when fresh vegetables were not scarce. Findings indicated that the children received more than two servings of vegetables per day in addition to potatoes. Nine or more different vegetables were served each week, with lettuce, carrots, and tomatoes being used most frequently.

An individual dietary study of six of the nursery school children in McLaughlin's experiment was made in order to determine the specific contribution of vegetables in the diet. All foods eaten by each child during a week were weighed. Vegetables, by weight as served, constituted one-seventh of the total intake of food. An analysis of

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the experiment showed that a liberal amount of vegetables supplied a liberal amount of minerals, including seventeen per cent of the total iron. In addition, they furnished approximately ten per cent of the total energy for the children.

A study of the effect of nursery school training upon the nutritional status and food habits of children in later years was made by Milroy in 1936.\(^5\) Thirty children, ranging in age from five to eleven years, who had attended the nursery school at the Texas State College for Women sometime during the period between 1930 and 1936, were available for the investigation.

In order to ascertain whether or not the diets of the children studied attained the accepted standards, the parents recorded quantitatively the actual food intake for three consecutive days for each child. For consistency and accuracy, standard measuring cups and spoons were used for measuring all foods that could be measured by this method. Other foods were measured by approximate size or slice. The nutritive value of the foods eaten by each child was calculated for energy value in calories, for values of protein, calcium, and phosphorus in grams, and for iron.

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\(^5\)Elsie Curlin Milroy, "A Study of the Effects of Nursery School Training upon the Nutritional Status and Food Habits of Children in Later Years" (Unpublished Master's Thesis, Graduate Division, Department of Home Economics, Texas State College for Women, June, 1937.)
in milligrams. The values of vitamins A, B, C, and G were estimated in Sherman units.

The average food intake of the thirty children revealed an adequacy in each food constituent of the diet. Grouped according to physical rating by the physician, the diets of the average and the above-average groups were adequate in all respects, but the groups composed of the children who ranked the lowest or below average by the physician, showed a deficiency in all of the food constituents except vitamins A and G. The group of children of average classification physically received milk and green, leafy, and yellow vegetables each day. Calculation of the diets of the children in the group of average classification revealed that they were receiving liberal amounts of the nutrients. The group of above-average classification, consisting of six children, was served vegetables eighty-three per cent of the time. The foods were supplied in very liberal amounts for the group, thus providing the children with diets containing all of the necessary nutrients in ample portions. The diets for the classification of below-average did not contain a sufficient number of servings of any food except vegetables. The children were inadequately supplied in all of the vitamins, except vitamins A and G.

A summary of the study of food habits showed the fol-

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6 Ibid., p. 37.  
7 Ibid., p. 43.
ollowing points:

1. There was a very definite relation between the type of meal served and the food habits of the child. Whether or not the meal was well planned and whether or not the foods were attractive, palatable, and of the proper consistency apparently were important factors.

2. The vegetables with a definite flavor and color, such as spinach and tomatoes, were the most popular.

3. The most popular food served to the children was spinach, which was included in the dietaries of seventy per cent of the children at least one time. The frequent use of spinach was a result of the education of the parents, and probably accounted for the high vitamin A content of the diets. 8

Vegetables in the Diets of School Children and College Students

Smooth functioning of various organs in the body and the building and maintenance of healthy bones and tissues seem to depend upon an adequate supply of vitamins and certain mineral elements which are found in leafy vegetables. The studies which are reviewed in the following pages reveal the extent to which school children used vegetables as body builders and the extent to which college students used this class of foods to maintain health. The investigations are reported by date, the earliest report being

8 Ibid., pp. 63-65.
included first and the last available report included at
the end of this discussion.

In 1917, MacLeod and Griggs made a dietary investi-
gation at Vassar College. The group studied was comprised
of 115 adults, most of whom were about nineteen years of
age. Findings showed that, on an average, the relative
expenditure per person for vegetables was 9.8 per cent.
Supplementary food was generally sugar in some form, as in
candy, cake, or ice cream.9

Hosman made a nutrition study of consolidated schools
in Nebraska in 1928. In three prosperous farming commu-
nities the results showed that on the day the survey was
made sixty-nine per cent of the children had no vegetables
other than potatoes.10

Ahman, Abbott, and Westover reported an investigation
of the diets of 2,110 white school children in five rep-
resentative rural counties of Florida during 1929. On the
days when the dietary survey was made, seventy-three per
cent of the children ate no leafy vegetable and forty per
cent ate no kind of vegetable.11

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9 Annie Louise MacLeod and Mary A. Griggs, "Dietary
Study at Vassar College," Journal of Home Economics, X
(March, 1918), 106.

10 I. Hosman, "A Nutrition Study of Consolidated Schools
in Nebraska" (Unpublished Master's Thesis, University of
Chicago, 1929, reported by Lydia J. Roberts, op. cit., p. 13.

11 C. F. Ahman, O. D. Abbott, and G. Westover, Nutri-
tional Study of the White School Children in Five Representa-
tive Counties of Florida, Florida Agricultural Experiment
Station Bulletin No. 216, reported by Lydia J. Roberts, op.
cit., p. 13.
A study of the diet and physical progress of 161 children in the Boles Orphans' Home, Quinlan, Texas, was made by Dumas in 1935. The investigator noted that food for the home was furnished by members of the Churches of Christ in Texas. Each congregation was visited twice a year and the food collected was carried by truck to the home. The orphanage had its own dairy, produced its own livestock, feed, and its own poultry products, and raised its own garden in the spring and summer.  

In 1935 communities in East Texas sent fresh vegetables. In October a truckload of apples, carrots, and onions was received. This supplied the table for about two weeks. Potatoes which arrived the last day of October lasted until another supply was sent. Consequently, the children ate potatoes practically all winter. Fresh vegetables were served on fourteen days in October. Canned vegetables were used when fresh ones were unavailable.

In November fresh turnip greens were donated and were served for more than a week. Later on in the month, canned greens, including mustard, kale, and spinach, were served along with green beans.

From December 1 until January 1 vegetables from the Rio Grande Valley were served. Cabbage, carrots, eggplants,

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green peppers, and tomatoes were included, with the three latter ones being served scantily. Table 7 contains information on the distribution of the seasonal foods from October through May.

**TABLE 7**

**DISTRIBUTION OF SEASONAL FOODS AT BOLES ORPHANS' HOME**

(Figures represent the number of days the food was served)

<table>
<thead>
<tr>
<th>Vegetables</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabbage</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turnips</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrots</td>
<td>14</td>
<td>14</td>
<td>7</td>
<td></td>
<td>7</td>
<td>30</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Onions</td>
<td>7</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Green beans</td>
<td>16</td>
<td>15</td>
<td>15</td>
<td></td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Potatoes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>Turnip greens</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Watermelons</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Eggplants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Green peppers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Canned corn</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radishes</td>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

*Dumas, *op. cit.*, p. 28.

Records of all food intake for the institution were kept for one week in October, December, and February. An analysis of nutrients consumed showed that calcium was deficient for the preschool group, the pre-adolescent and the adolescent girls. Phosphorus and iron were also below standard for the adolescent girls. Vitamin A was low
except in October, December, April, and May, when the diet was supplied liberally with carrots. Vitamin B was abundant from the large amounts of whole cereals, fruits, and vegetables. The amount of vitamin C was variable with the seasonal variety of foods and was probably deficient in November and May, when the diet contained less fresh vegetables and fruit than at other times. Vitamin C was supplied in October by carrots, cabbage, and apples; in November by potatoes, turnip greens, and apples; in December by carrots, onions, potatoes, and grapefruit; in January and February by potatoes, grapefruit, and tomatoes; and in April and May by carrots, onions, greens, and radishes.13

McKay and Patton investigated the food intake of freshmen college women in 1937. Fifteen girls kept a record of their daily food intake for periods ranging from three to twenty weeks. When data were tabulated, the investigators found that the average amount of green or yellow vegetables ranged from an average of 2.6 to 10.3 pounds weekly. Thirteen of the fifteen girls used at least the amount recommended in a restricted diet for emergency use. Only six consumed the amount required for an adequate diet at a minimum cost.14


The food habits of fifty junior-high-school students of Denton, Texas, were studied by Wilson in 1938. Findings showed that potatoes ranked first in consumption by this group. For fifty-four per cent, or more than one-half of the 250 days, this vegetable was consumed. Forty-four, or eighty-eight per cent, of the fifty children ate some potatoes during this period, and fifteen children, or thirty per cent, ate at least one serving of potatoes on four out of five days. Tomatoes appeared next in frequency of use on the records. This vegetable was included on 33.2 per cent of the daily records, cabbage on 28.4 per cent, and lettuce on twenty-four per cent. Such vegetables as greens and spinach were included very seldom. The former was listed on 3.2 per cent and the latter on 9.2 per cent of the daily records.\textsuperscript{15}

An analysis of Wilson's study leads to the conclusion that the children under investigation in the junior high school of Denton, Texas, did not include in their diets all of the food classes necessary for an ideal diet. The omission of vegetables was prevalent.

Irene S. Hall and Calvin S. Hall made an investigation of disliked and unfamiliar foods among 693 university

\textsuperscript{15}Ruby Wilson, "A Nutritional Study of Denton Children" (Unpublished Master's Thesis, Graduate Division, Department of Home Economics, Texas State College for Women, June, 1938, pp. 33-34.)
students in 1938. Results showed that more than one out of every five had an aversion toward parsnips and eggplant. The leek was the most universally unknown food. Okra was unfamiliar to more than one-half of the group. Over thirty per cent were not familiar with chard. The most often cited reason for disliking a particular food was that it did not taste good. Texture, general appearance, physical disagreement, and smell were other reasons mentioned more than five per cent of the time. Women students had more food aversions than men students, but the former were familiar with more foods than the latter.16

In 1938 Charlotte Kyle Clark made a dietary study of twenty-six low-income farm families in Denton County, Texas. Four owned their homes and twenty-two were tenants. The size of the families varied from two to nine persons. The group included eleven children under four years of age and four adults past sixty years of age. Records were kept on all the families from November 18, 1937, to March 30, 1938. Each family in the group had borrowed money from the Farm Security Administration and was under the supervision of the County Supervisor of Home Plans.

A summary of the findings shows that the average amount of food consumption was adequate. However, only

fifty-seven per cent of the families had diets in which sufficient quantities of all nutrients were provided. The nutrient most frequently below the standard amount required was iron. Next in order of frequency of inadequacies were calcium, phosphorus, and proteins, all of which may be supplied in part, at least, by vegetables.\footnote{Charlotte Kyle Clark, "A Dietary Study of Farm Families in Denton County on Low Income" (Unpublished Master's Thesis, Graduate Division, Department of Home Economics, Texas State College for Women, August, 1938), pp. 1-13.}

Seventy-two girls enrolled in the homemaking department of the Huntsville, Texas, public schools were investigated by Driskill regarding their consumption of vegetables over a period of four months. Showing the food habits of the students over the designated period, the study indicated that not one girl ate the recommended amount of leafy, green, and yellow vegetables and of all foods consumed, the consumption of vegetables as a class was lowest.

A summary of the findings is contained in the following paragraph:

The scanty use of vegetables was evident through this group of girls, showing the usual dislike of vegetables by children. In no case did the diets of the girls measure up to either low or moderate standard, which was for each sixty-four ounces, in fact on the average only twenty-one per cent of the standard was attained. This was the lowest percent achieved of standards for all classes of foods. The average intake of this class of food for the group was 13.47 ounces per week. The highest intake
recorded was 41.9 ounces, which was only 65 per cent of the amount which should have been eaten.\textsuperscript{18}

The Virginia State Nutrition Committee in cooperation with the Virginia Agricultural Experiment Station and the Virginia Polytechnic Institute, made a report in 1941 on their twenty-one-day nutritional study of 2,914 white and Negro school children of rural and urban communities in thirty-one county schools and six city schools, representing all ten of the major social and economic type-regions of Virginia. The investigators found that green vegetables were consumed adequately by only seventy-three per cent of the people interviewed. It was found also that the families, both white and Negro, who raised vegetables ate them more abundantly and in greater varieties than families who bought all their vegetables.\textsuperscript{19}

A nutritional study of one hundred Latin-American school children in Kingsville, Texas, was made by Hambright in 1941. The study revealed that spinach, carrots, white potatoes, and dried beans were familiar to at least

\textsuperscript{18}Sue Lindley Driskill, "A Study of the Diets of the Junior High School Girls Enrolled in the Homemaking Department of the Huntsville Public Schools" (Unpublished Master's Thesis, Graduate Division, Department of Home Economics, Texas State College for Women, August, 1940), pp. 1-26.

\textsuperscript{19}Virginia State Nutrition Committee in Cooperation with the Virginia Agricultural Experiment Station and the Virginia Polytechnic Institute, \textit{Rural Sociology Report No. 20}, Blacksburg, Virginia, November, 1941, p. 8.
ninety per cent of the group. All the other vegetables except asparagus were familiar to over half of the group. Only twenty-nine were familiar with asparagus. Beans, potatoes, carrots, corn, and celery were listed as vegetables liked by the largest number of boys, while the girls listed potatoes, beans, tomatoes, rice, corn, carrots, cabbage, and lettuce. Beans were the first favorite of the girls and second of the boys. Okra was the favorite food of no more than one boy. Beans and potatoes were scored as favorite foods of both boys and girls. Milk, beans, rice, potatoes, and some type of breads were most frequently listed for dinner. Corn was listed four times; tomatoes, avocados, onions, and pumpkin, three times; and cabbage, carrots, and celery were mentioned one time each. Beans, potatoes, meat, eggs, and milk were listed most often as foods eaten for supper. Carrots, corn, beets, lettuce, and tomatoes were the only vegetables included on the supper lists. Green and leafy vegetables were seldom listed. It is to be concluded that the Latin-American diet was deficient in the major protective foods. Green and leafy vegetables were among the chief deficiencies.²⁰

Denton public school cafeterias in 1942. She made a special study of the diets of 198 children in the Stonewall Jackson Elementary School of the city for a period of four weeks, beginning October 19 and ending November 13.

The final figures showed that of the total amount of money spent by all the cafeterias (including the amount furnished by the government), 45.9 per cent was spent for vegetables and fruits, and 44.2 per cent was spent by the Stonewall Jackson School for vegetables and fruits.

An analysis of the menus served at the cafeteria of the Stonewall Jackson School for a period of four weeks during the fiscal year of 1942-1943 showed that the school children of Denton were offered a hot nourishing meal at low cost. The menus as calculated from the per capita food intake were found to furnish one-third of the child's daily nutritive requirements, plus a surplus in calories, protein, iron, vitamin A, vitamin C, thiamine, and riboflavin. These additional nutrients were most important to the children from low-income families whose home diets were inadequate. This was significant in that it brings to light one of the main purposes of the school lunch -- that

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22 Ibid., p. 41. 23 Ibid., p. 34. 24 Ibid., p. 68.
of supplementing the shortages of the child's home meals. The menus served at the cafeteria were low-cost ones, yet the cost of the cereal group was kept low in comparison to that spent for other foods. The miscellaneous and fat groups were also low in relative cash expenditures, which meant that more money was spent for fruits and vegetables for the diets of the underprivileged children.

The final average showed the actual food intake was above the recommended requirements for certain nutrients. The nutritive values above the required amounts were expressed in the following percentages: calories, 9.9; protein, 11.4; iron, 75.0; vitamin A, 430.0; thiamine, 4.8; vitamin C, 189.0; and riboflavin, 45.0. Calcium, the only nutrient below the requirement, was found to be two percent deficient. 25

Whitacre made a report on the diets of four hundred rural families in Texas during 1943. 26 Project workers made personal and nutritional fact-finding visits to the homes of each of the families, distributed among five counties and including three different regions. The investigators found that brussels sprouts, watercress, and dandelion greens were not used by all of the four hundred families. Leafy vegetables were used less than others.

25bid., pp. 21-22.

26Jessie Whitacre, The Food Supply of Texas Rural Families, Bulletin No. 642, Division of Rural Home Research, Texas Agricultural Experiment Station, October, 1943.
Mexicans used fewer kinds of vegetables than any other group. Nearly every family used practically all classes of vegetables. They were used abundantly when home supply was available and with greater frequency during the season. Leafy vegetables alone were eaten from 4.1 to 8.9 times per week by white and Negro groups, but only 2.2 times by Mexican families. Green and yellow vegetables were used from 1.5 to 5.3 times per week by white and Negro groups and ten times per week by Mexicans, whose choice of green vegetables was green peppers. Legumes, most used "other" vegetable, were eaten from 1.7 to 4.5 times per week by white and Negro families; by Mexicans, twice a day. Pinto beans were the favorite ripe legume for all groups. Tomatoes were the most popular single vegetable, the average weekly frequency ranging from 2.1 to 8.1. In a final analysis, indications were that the diets of the farm families studied were fairly adequate in general, but recommendations were made for effecting improvement by making constant the supply of vegetables and other protective foods.

During 1943-1944 Bailey investigated the foods served in a cafeteria of the public schools of Fort Worth, Texas, over a five-months' period.\(^27\) Findings showed that

\(^{27}\)Katherine W. Bailey, "A Study of the Foods Served and Purchased in a Fort Worth Cafeteria During the Year 1943-1944" (Unpublished Master's Thesis, Graduate Division, Department of Home Economics, North Texas State Teachers College, June, 1944).
potatoes were the most popular food on the menu during the sixty days when a check was made. Other vegetables were not chosen often. Not one lunch of the 159 analyzed for nutritive value met the recommended allowance of all nutrients. The most significant conclusion to be drawn from the study was that in spite of the well-selected foods provided by the cafeteria personnel, the children were not well-fed because of poor selection of food.\textsuperscript{28}

The nutritive value of lunches served in the Dallas, Texas, public schools was analyzed by Spearman in 1945.\textsuperscript{29} Sixty menus which had been used at various times were evaluated as to adequacy according to the criterion established by the National Research Council for the ten-to-twelve-year-old children. Results of the analysis showed that only eight of the sixty menus were adequate in all nutrients. Ascorbic acid with nineteen inadequacies ranked next to highest in frequency. The proper amount of this nutrient was lacking in practically all menus unless a raw vegetable or a citrus fruit was included. Raw cabbage and tomatoes were added many times to improve the menus. Cabbage slaw was the more economical of the two, and to avoid monotony, its appearance was changed by adding other green leafy vegetables.

\textsuperscript{28}ibid., pp. 39, 43.

\textsuperscript{29}Rosa Spearman, "A Study of the Nutritive Value of Lunches Served in the Dallas Public Schools" (Unpublished Master's Thesis, Graduate Division, Department of Home Economics, Texas State College for Women, May, 1945).
Although no menu was lacking in calcium, several of the menus were enriched by the addition of turnip greens or mustard to such an extent that it was unnecessary to depend upon the calcium of milk alone for adequacy.

Seventeen of the menus were inadequate in iron. Enrichment was accomplished by adding tomatoes and carrot slips along with other rich sources.

Six menus were inadequate in vitamin A. Carrot strips, green pepper, tomatoes, and green and yellow vegetables were added for removing this inadequacy.

Ascorbic acid inadequacies were noted in twenty menus. Raw vegetables and tomatoes were the most common sources of enrichment for these inadequate menus.

The writer made the following recommendations:

1. Make a careful study of the food value of each tested recipe and use as a reference in making menus.

2. Green leafy vegetables and milk and egg desserts give a good amount of calcium.

3. Check the menu carefully for iron adequacy. Vegetables, with emphasis upon the leafy green ones, are additional good sources of iron.

4. Carrots and the leafy greens, such as mustard, spinach, turnip greens and collards, supply all of the day's recommended amount of vitamin A.

5. Make an effort to supply a liberal amount of
ascorbic acid in the school lunch, since it may not be found as readily in the home meals of children; its sources are limited but the foods containing it are practical for use. A generous serving of raw vegetables, especially cabbage or tomato, gives approximately enough ascorbic acid for one meal.

6. Small amounts of riboflavin occur in many foods. The leafy greens furnish about one-fifth of the day's need.

An investigation of the ascorbic acid content of school lunches served at the North Texas State Teachers College Demonstration School during March and April, 1944, was made by Bryan in 1944.30 Nine hundred forty-eight samples of food, including many vegetables, were used in the experiment. It was found that the best sources of ascorbic acid at the end of the food preparation period were tomatoes, green peppers, onions, and lettuce salad.31 Findings also showed that the ascorbic acid content of lunches for primary children, for elementary children, and for high school girls and boys on five days chosen at random was inadequate except on one occasion when oranges, which are high in this vitamin, were served for dessert.32

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31 Ibid., p. 30.

32 Ibid., p. 32.
Vegetables in the Diet of Non-school Adults and Families

On the home front as well as on the military front, vegetables in the diet play an important part in keeping up the morale as well as nourishing the body. The problem of providing wholesome well-balanced meals for the adult is the immediate concern of everyone interested in winning the war. An adequate diet contributes to the health, happiness, and physical well-being of the adult, and thus increases his mental alertness and interest in his work. On the other hand, the tired, listless, uninterested individual is very often the one who has not only had an inadequate diet but also the one whose entire day's food intake is insufficient to meet the demands of his body for energy, repair, and maintenance.

The investigations that follow are reports of surveys made from 1924 to 1944 and are included in the order of dates. They all concern the consumption of vegetables by non-school adults and families.

The *Yearbook of Agriculture* reported an investigation on the increased use of certain vegetables in the United States from 1924 to 1933. A steady rise in consumption of lettuce, tomatoes, and spinach was noted. The consumption of lettuce reached its peak in 1930. The consumption of
spinach was highest in 1928, while tomatoes were used most abundantly in 1930.  

In 1934 the Department of Agriculture, Washington, compiled data on the per capita consumption of basic foods in the United States. An analysis of the compilation shows that 294 pounds of vegetables, excluding potatoes, dried beans, peas, tomatoes, and sweet potatoes, were consumed per capita. The required amount for a liberal diet as suggested by the Bureau of Home Economics, is 325 pounds. This study shows that the per capita consumption of vegetables in the United States failed signally in 1934 to meet the optimum requirement for dietary adequacy.

Dorothy Dickins reported on health conditions in the South before a joint session of the home economics, agricultural economics, rural sociology, and agricultural engineering sections of the Southern Agricultural Workers' Association at Atlanta, Georgia, in February, 1938. Findings in Georgia, Mississippi, and South Carolina, where family diets were studied, revealed a shortage of vegetables and other protective foods. Insufficient quantities of pellagra-preventing foods, including green leafy vegetables,

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33Lydia J. Roberts, op. cit., p. 17, quoting the Yearbook of Agriculture, 1934.
34Ibid., p. 15.
35Ibid.
were designated as one cause of the low health status of Southern people.36

Buttrill, in 1939, made an investigation of the diets of families participating in Home Demonstration Club work and of families not connected with club activities.37 Records of twenty club women from Denton County, Texas, and of nineteen non-club women from McLennan, Rockwall, and Lampasas Counties were utilized. Selection of the club women was based on their former activities with the Home Demonstration program in the county. The non-club women were selected at random but were on a comparable economic level with the club members. Records were kept on the amount and kinds of foods consumed by each family over a period of thirty days. As a final study, an analysis was made of the thirty-nine diets. This study was made in the winter months when the cost of vegetables was high and when the production of vegetables was low. This fact affected the money value of vegetables contained in the diets of the families participating in this study.

36 Dorothy Dickins, "Health in Relation to Prosperity in the South," Journal of Home Economics, XXX (June, 1938), 373.

Results of the study showed that the largest average per cent of total money value given to any one class of foods was allotted to fruits and vegetables, a condition which prevailed in both groups; the average per cent of total money value was 29.4 for the club group and 23.4 for the non-club group. Legumes represented a small amount of the average total money value in the diets of the families in both groups; for this item the average per cent of value was 1.7 in the club families and 1.3 in the non-club families.\textsuperscript{38}

Two club families and four non-club families received less than the standard for calcium. The average for phosphorus consumption per man unit per day was 2.39 grams for the club group and 1.88 grams for the non-club group. The average iron consumption per man unit per day for the club group was 0.025 gram, a positive deviation of 63.6 per cent from standard. The average iron consumption per man unit per day for the non-club group was 0.023 gram, a positive deviation of 50.4 per cent from standard.\textsuperscript{39}

The greatest variety of vegetables other than potatoes used during the month was twenty-two and the smallest was five, which consisted of lettuce, greens, pinto beans, navy beans, and nuts. The club families had an average of fifteen varieties and the non-club families had an average of

\textsuperscript{38}Ibid., p. 36. \hspace{1cm} \textsuperscript{39}Ibid., p. 51. 
ten varieties. Twenty club families used 466 pounds of Irish and nineteen club families used 508 pounds of sweet potatoes, which gave an average of thirteen pounds of Irish and sweet potatoes per person per month. In the non-club families, nineteen had 467 pounds of Irish and fourteen had 230 pounds of sweet potatoes, which gave an average of nine pounds of Irish and sweet potatoes per person per month. The club families allocated one-third of their money value for vegetables and fruit, while non-club members allocated one-fourth. In calcium and phosphorus, which are supplied in appreciable quantities by vegetables, the averages of the club group exceeded the averages of the non-club group. The diets of six of the families studied were deficient in this nutrient, while four diets out of the thirty-nine family dietaries were deficient in iron.

Taken as a whole, the families without children in both groups had the best diets from a nutritive standpoint; and, of this group, the club families were shown to have diets more adequate in nutrients than those of non-club families. Although the average food consumption was more than enough to meet the standard requirements for good nutrition, only eighty per cent in the club group and fifty-six per cent in the non-club group had diets in which all the nutrients studied were supplied in a sufficient

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40 Ibid., p. 61.
amount. The most frequent deficiencies were in calories and calcium in both the non-club and the club groups. The families with children had more inadequacies in their diet than did families without children.  

Incidence of nutritional and vitamin deficiency among four hundred consecutive patients admitted to the clinic wards of Stanford University Hospital in California was studied by Krupp in 1940-1941. Results showed that approximately one-fourth of these patients had been taking an inadequate diet. Among those with inadequate diets, 11.4 per cent showed definite signs of vitamin deficiency. In the nutritional dietary history, many entries read "little green vegetables," "quantity of food low, especially in greens," "low in greens," and other similar notes.

A report on the food and nutrition of industrial workers in wartime made by the Committee on Nutrition in Industry of the National Research Council seemingly has a broad significance. Thirty-three industrial plants were surveyed during 1941, and only two employed either a nutritionist or a dietician. As a result, it was concluded that the industrial workers were evidently receiving an inadequate supply of many nutrients essential to optimum health.

41 Ibid., pp. 78-79.
43 Ibid., p. 1479.  
44 Ibid., p. 1478.
Many of these nutrients should have been supplied by fresh vegetables. Improvement in the nutrition of industrial workers is a problem of prime importance to the nation at this time, when the maximum production of our factories is essential to a shortening of war in the Pacific.45

Bethell, Blecha, and Hastings made an investigation of nutritional inadequacies of expectant mothers in 1942. The 484 mothers studied as subjects were interviewed in their homes in order that a fairly accurate economic and social classification could be achieved. Data were secured on financial income, environmental factors, financial obligations, government or other assistance, and foods available at home. Of the 484 women investigated, 246 lived on small farms, and 238 resided in small towns. Among the group, 233 raised vegetables and canned them for their winter use. Most of the subjects were in comfortable financial conditions and were able to procure food without special effort or strain. Three hundred twenty-six were able to obtain food for adequate nutrition, but the procurement called for careful planning and intelligent buying. Sixty-six women were in severe economic straits and were unable to procure, without public assistance, the basic foods required

to meet even the minimum standards.\textsuperscript{46}

An analysis of the nutritional status of the group showed that relatively few of the diets were critically deficient in the matter of vegetables consumed, yet a small percentage met present-day requirements for expectant mothers. The incidence of anemia was 25.4 per cent, and a positive correlation was established between the occurrence and dietary deficiencies of iron.\textsuperscript{47}

Bertha S. Burke and her associates made a study of the effect of proper eating upon 216 expectant mothers in 1943. Nutritional histories of each subject included information on food likes and dislikes, daily food intake for a certain period, and special information on the consumption of vegetables and other protective foods. Each nutritional essential was rated in accordance with recommended standards. Findings showed that only fourteen percent of the women consumed "excellent" or "good" diets during pregnancy. All stillborn infants, all infants who died within a short time (except one), most infants who had congenital defects, all premature and all functionally immature infants were born to mothers whose diets were inadequate during pregnancy, as measured by accepted


\textsuperscript{47} Ibid., p. 172.
nutritional standards.48

The diets of twenty women from low-income groups who lived in various projects of the Austin, Texas, Housing Authority were analyzed by Winters and Leslie in 1943. The subjects included Anglo-Americans, Latin-Americans, and Negroes. Results of the investigation showed that the calcium and phosphorus intakes of the women were well below the recommended allowances. An investigation of the typical daily food lists showed that a small variety of vegetables was consumed, and in most instances these were of a cheap class. The economic factor, of course, was involved, since it determined, in general, the kind and amount of food bought.49

A study of the adequacy of the vitamins in the noon meal consumed by a group of workers in the Brooklyn Navy Yard was made by Heller, McCay, and Lyon in 1943. Investigation showed that the cafeteria meals usually consisted of roast meat, a meat-vegetable dish, mashed potatoes, one green vegetable, enriched bread, dessert, and coffee, tea, or milk. All men did not select the cafeteria meal, but

48Bertha S. Burke and others, "The Influence of Nutrition During Pregnancy upon the Condition of the Infant at Birth," Journal of Nutrition, XXVI (July-December, 1943), 569-582.

many brought sandwiches from home and supplemented them with coffee or milk. The results of all the vitamin determinations led to the conclusion that the noonday meal failed to furnish a third of the day's vitamin needs.  

A survey of the food practices of sixty-three Lubbock, Texas, families was made by Drake and Lamb in 1943. The investigators classed twenty-one per cent of the dietaries as good, twenty-four per cent as fair, and fifty-six per cent as poor. The greatest deficiency was noted in the consumption of all vegetables, especially green and yellow ones.  

In 1943 Grych made a dietary study of low-income groups in a certain central Texas town. Twenty-five families, composed of eighty-one members, were chosen from a mill district. The willingness of each member to cooperate in the investigation was the basis on which the selection was made. The size of the families considered in the study varied from two to four persons. The fathers of seven families

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52Agnes Grych, "A Dietary Study of Low-income Families in a Central Texas Town" (Unpublished Master's Thesis, Graduate Division, Department of Home Economics, Texas State College for Women, June, 1944).
were in the armed forces or away from home working in defense plants. Twenty-nine of the children were of high-school age, and six were of elementary-school age.

Through the questionnaire method, it was found that potatoes were used frequently; the favorite method of preparation was creaming. Thirty-six per cent ate the skin when the potatoes were baked. Sixteen per cent of the mothers thought that all vegetables had the same food value, and all of them saw the need of serving raw vegetables; yet eighty-eight per cent of the mothers served their vegetables boiled.53

Seventy-two per cent of the families raised some food at home; sixty per cent of the families had victory gardens. Eighty-four per cent of the families canned from five quarts to six hundred quarts in 1943. Many varieties of foods were represented in the canned supplies. The pressure cooker method was the most prevalent procedure. Green beans were the most frequently canned vegetable, with English peas a close second. Tomatoes, beets, cucumbers, greens, and corn were also often canned.54 Fifty-six per cent of the mothers discarded the outside leaves of a head of cabbage and lettuce, and forty-eight per cent threw away the juices in which food was cooked.55 Most of the mothers

53Ibid., p. 15. 54Ibid., p. 17. 55Ibid., p. 18.
knew that fresh vegetables should be used as quickly as possible, and fifty-six per cent kept their food covered in the refrigerator.\footnote{ibid., p. 19.}

Calculations of the nutritive value of the diets of the twenty-five mill-town families showed that on the average all the diets were severely deficient in calcium and ascorbic acid (vitamin C). The girls' diets revealed a deficiency of seven out of eight nutrients considered. The most striking deficiency was in calcium. A similar condition was noted in the boys' diets. The diets of the fathers and mothers were deficient in five of the eight nutrients studied, including calcium and ascorbic acid, both of which can be supplied by vegetables.
CHAPTER IV

SUMMARY AND CONCLUSIONS

Summary

The present study deals with the consumption of vegetables by the American people as indicated by thirty-two scientific investigations. Vegetables are necessities of everyday living, whether the nation is at peace or war. To furnish facts that will help American families select and use these essentials so as to promote health and well-being is the long-time objective of nutritionists in America.

During the critical year just past, research has been directed toward furnishing families with a steady stream of timely information designed to help with day-to-day problems. For agencies responsible for policies and programs affecting civilian welfare, there has been an equally constant supply of basic facts and figures on a wide variety of topics touching the home and the school. At the request of industrial leaders, some research activities were focussed on their specialized needs.

At the same time fundamental contributions have been
made to science and plans have been laid for attacking some of the problems which the home, school, and industry face in the postwar world. Increased purchasing power has, of course, helped raise dietary levels by enabling many families to buy more of needed protective foods. Rationing has given every family its chance at the scarcer foods. But when this war's food history is written, much credit for improved diets will justly go to the families in town and country for the hard work, good grace, and firm determination with which they produced more of their own food, especially vegetables, preserved more fresh food for later use, and conserved food values through better care and cooking. Thus they helped to change into an upward trend what might have been a serious drop in the nutritive quality of family meals.

Many of these wartime achievements would have been impossible had not research been quietly building up a backlog of facts, which could be put to practical use when the emergency developed. Indeed, our wartime food program is a demonstration on a vast scale of the importance of research in human nutrition and the nutritive values of food.

Chapter I of this study contains an introduction including a statement of the problem and its purposes, motivation, and background of the problem, and a discussion of the sources and treatment of data; Chapter II contains data on the contribution of vegetables to health, emphasizing
scientific data on the contribution of vegetables, together with laboratory experiments; Chapter III is a review of thirty-two investigations of vegetables in the diet, including data on children of preschool age and those in elementary school, junior high school, senior high school, college, and non-school adults; Chapter IV contains the summary and conclusions.

The discussion on the contribution of vegetables to health reveals that every food can make some contribution to the diet. Some foods make a much more important contribution than others. What everybody needs for abundant health is a proper balance of many different kinds of food. When diets are poor or only fair they are short in certain food values. Foods that are rich in these values have come to be called protective foods. Protective foods not only protect against acute dietary diseases, but they also help to lift bodies from a low to a higher level of good health. Among the first foods to be called protective were the green, leafy vegetables. They enrich diets greatly in minerals and vitamins.

Diets often are limited in variety by personal food likes and dislikes, by religious scruples, by allergies, or by disease. Even within such limits, good meals can be planned, but it takes more thought and knowledge to make sure that they supply what the body needs. We are learning
that if orange juice is too expensive as a source of vitamin C, it is possible to use canned tomatoes, cabbage salad, or cheap fresh fruits in season. If butter adds too many calories to the diet of overweight persons, they can get vitamin A from the green and yellow vegetables. Wise meal planners learn, too, the seasons when different vegetables are cheapest, the most economical forms in which each one comes, and the most economical quantities in which to buy them. Facts like these make better diets possible for any given sum allotted to the family food budget.

Vegetables, according to classification, are flowers, fruit, leaves, stems, bulbs, roots, tubers, and seeds. Many vegetables in practically all of the classifications contain an alkaline potency which tends to neutralize the acids of the body.

Vegetables are a source of minerals which are used for replacement, building of new tissues, and regulation of body processes. An adequate supply of calcium, magnesium, sodium, potassium, chlorine, and phosphorus in the tissues, blood, and other body fluids determines the ready response of muscles and nerves to impulses, the rhythm of the heart's beat, the passage of fluids in and out of the tissues, and the maintenance of a neutral condition in the body. The blood's transportation of oxygen to the tissues and carbon dioxide to the lungs for excretion and the
oxidation processes of cells are determined by the proper amount of iron.

Results of a deficiency of minerals do not show up as quickly as the results of other deficiencies because the daily requirement is so small. During the growing period and in pregnancy, when the amounts needed are increased, an insufficient supply will be noted. Then bones and teeth will show the deficiencies in calcium and phosphorus. The red corpuscles will show a lack of iron, which can result in anemia, and the thyroid gland will show a lack of iodine, which can result in a goiter. Practically all mineral deficiencies in the body can be overcome by the consumption of proper kinds and amounts of leafy vegetables.

Vegetables are excellent sources of most vitamins, especially A, B, C, and G. These vitamins are needed by the body for growth, reproduction, lactation, and maintenance of health and vigor. The last function is brought about through promotion of normal functioning of the digestive tract, normal nutrition, health of the tissues and resistance to infection of bacteria. Low-vitamin diets are never prescribed but they are often chosen because of a dislike of many vitamin-rich vegetables, or because of indigestion, undue economy, or an actual food shortage. In addition to inviting deficiency diseases, such as ophthal-mia, beri-beri, scurvy, rickets, and pellagra, low-vitamin
diets are associated with the following conditions: underweight; lack of appetite, vigor, and endurance; nervous instability; digestive disturbances; constipation; joint pains; skin lesions; infections, such as colds; sinus infections; abscesses in ears; boils; arthritis; tuberculosis; and poor mineral assimilation, as in anemia, poor bones and teeth.

A review of investigations reveals that preschool children, school children, college students, non-school adults, and families do not, on the average, consume an adequate amount of vegetables for proper development, repair, and maintenance of the body.

Conclusions

A review of thirty-two investigations made of the consumption of vegetables by preschool children, school children, college students, and non-school adults leads to the conclusion that the daily intake of this class of foods is inadequate for optimum health. It is also concluded that the dietary studies described in this review of literature present a fair picture of the vegetable consumption of the people in the United States in general. This defect in our national diet presents a direct challenge not only to nutritionists and others interested in public health, but also to food manufacturers and distributors as well.
It costs a great deal of money to obtain satisfactory diets unless special care can be given to food buying, meal planning, and cooking. With little planning, liberal-cost diets are likely to be better than those bought when money is scarce. But it is possible to spend a lot of money without buying all of the foods needed for good nutrition. High-priced foods may be no more nutritious than cheap ones.

Appetite is not a safe guide. Malnutrition may exist in the midst of plenty, if food is wasted or if well-balanced meals are refused by members of the family because of poor cooking, bad eating habits, or faddist ideas. No two families, free to choose, would make the same food selections. Each follows to some extent the habits handed down from past generations. Each is influenced also by personal likes and dislikes among the foods that are available in markets or through home production. Each is more or less bound by the cost of food and by the amount of money that can be spent for it.

Millions of families are not getting the foods their bodies need. Many lack the resources for an adequate food supply. They may have little money. They may not have the land, the equipment, the time, or the skills needed to raise part of their food at home. Many families lack the knowledge and skills they need to choose foods wisely and to prepare them well. Furthermore, some have poor food
habits and do not know, or do not believe, that it would be worth their while to change. The millions of people in this country who have poor diets are not strangers. They are our neighbors. Some live in every community in every state.

The proportion of families with diets that are good would, of course, shift with changes in income distribution and in food-purchasing power. Even without changes in the economic situation, the proportion with good diets could be greatly increased if all families used their resources for food to the best advantage.

The writer believes that nutrition education can produce significant results in the consumption of vegetables by the people of America. We as teachers, in particular, should take as our goal the indoctrination of the public with a desire for securing a diet amply fortified with vegetables for every man, woman, and child in the United States. Such a diet would be of great value in producing and maintaining a population of physically fit people.
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