A NUTRITION SURVEY OF GIRLS IN RESIDENCE AT THE UNIVERSITY OF MANITOBA

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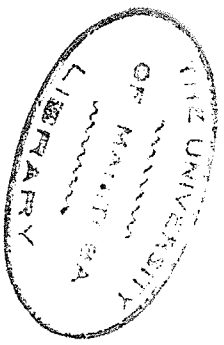

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ABSTRACT

of the thesis entitled

A NUTRITION SURVEY OF GIRLS IN RESIDENCE
AT THE UNIVERSITY OF MANITOBA

Lillian Miller

During the spring of 1956, a nutrition survey was carried out with 84 girls from the Women's Residence at the University of Manitoba. The nutritional status of the group was determined by means of 7-day food intake records, blood and urine analyses and measurements of height, weight and skinfold thicknesses. Nutrient levels in the individual diets and the residence food supply were calculated using food composition tables. The nutritional adequacy of the diets and the food supply was judged on the basis of Canada's Recommended Allowances for the age group studied (16 to 23 years).

The analysis of nutrient levels revealed that four-fifths of the girls received inadequate supplies of iron and three-quarters received insufficient calories. The other nutrients in decreasing order of the number of times they were found poorly supplied were: vitamin A, riboflavin, calcium, protein, thiamine, phosphorus and niacin. No diet had less than the recommended amount of ascorbic acid. Since the residence food supply contained each nutrient in

amounts above the requirements of any subject surveyed, each girl could have had an adequate diet if she had selected foods more judiciously. The study of meal patterns and food preferences showed that 10% of the meals were omitted altogether and that less nutritious foods were often selected when there was a choice.

The blood levels of hemoglobin, vitamin A and ascorbic acid were below average in 70% or more of the group while that of carotene was low in 15%. All protein readings were satisfactory. Thirteen to 23% of the girls appeared to have insufficient body stores of thiamine, riboflavin or niacin. Anthropometric measurements revealed that less than half of the group was within the normal weight range and that a larger portion was underweight than overweight. The scapular skinfold measurement correlated best with leanness and fatness.

The results of this survey should assist those responsible for the food servicing and nutrition education of university students.

TABLE OF CONTENTS

CHAPTER		PAGE
I.	INTRODUCTION	1
II.	REVIEW OF LITERATURE	3
	A. Adequate Nutrition and Malnutrition . .	3
	B. Areas of Study in Nutrition Surveys . .	4
	1. Records of dietary intake	4
	a) Methods of obtaining dietary intake data	5
	b) Comparison of results from these methods	6
	c) Length of time for dietary record	7
	d) Nutrients to study in a survey	9
	e) Differences between calculated and analyzed values	9
	f) Standards to use for the appraisal of diets	11
	g) Place of dietary studies in investigations of nutritional status	13
	2. Value of laboratory data and its interpretation	14
	a) Protein	15
	b) Iron and hemoglobin	17
	c) Vitamin A	18
	d) Vitamin B complex	19
	e) Ascorbic acid	22
	f) Calcium and vitamin D	23
	3. Clinical examination and diagnosis	24
	a) Medical case histories	25
	b) Therapeutic trials	25
	c) Anthropometric analysis . . .	26
III.	EXPERIMENTAL PROCEDURE	31
	A. Survey Population	31

CHAPTER PAGE

B. Food Intake Records 33

1. Forms 33
2. Compilation of food intake data . . 33
3. Analysis of the adequacy of food intakes 33

C. Available Food Supply 35

D. Biochemical Tests 36

E. Physical Measurements 37

F. Letters to Volunteers in the Survey . . . 39

IV. DISCUSSION OF RESULTS 40

A. Levels of Nutrient Intake 40

1. Adequacy of diets 40

a) Calories 42
b) Protein 43
c) Fat 44
d) Carbohydrate 45
e) Calcium 46
f) Phosphorus 47
g) Iron 48
h) Vitamin A 49
i) Thiamine, riboflavin, niacin . 50
j) Vitamin C 51
k) Possible sources of error . . . 51

B. Extent of Nutrient Deficiencies in the Diets 52

C. Extent of Nutritional Deficiencies in the Diets of Girls from Different Faculties . 55

D. Nutritional Adequacy of the Residence Food Supply 60

E. Biochemical Evaluation of Nutritional Status 60

1. Blood analysis 60

a) Hemoglobin 60
b) Protein 67

CHAPTER PAGE

c) Vitamin A and carotene 67
d) Ascorbic acid 69

2. Correlation of blood and dietary nutrient levels 69

3. Urinalysis 70

F. Anthropometric Assessment 71

1. Overweight and Underweight 71

2. Skinfold thickness measurements . . 72

3. Comparison of survey group and average Canadian measurements . . . 73

G. Food Habits 75

1. Meal patterns 75

2. Snacks 76

a) Breakfast patterns and mid-morning snacks 76
b) Number of snacks 76
c) Nutritive value of snacks . . . 77

3. Food preferences 79

H. Limitations in Survey 83

V. CONCLUSIONS AND RECOMMENDATIONS 84

A. Conclusions 84

B. Recommendations 85

VI. SUMMARY 89

APPENDIX A - Forms and data related to the Experimental Procedure 94

APPENDIX B - Data related to the Discussion of Results 106

BIBLIOGRAPHY 111

LIST OF TABLES

TABLE		PAGE
I.	A Comparison of the Faculty Representation and University Year of Girls in the Available Residence and Survey Populations	32
II.	Number of Girls with Nutrient Intake Levels Above or Below the Canadian Recommended Allowances	41
III.	The Extent of Nutrient Deficiencies in the Diets of the Survey Population	53
IV.	The Extent of Nutritional Deficiencies in the Diets of Girls from Different Faculties . . .	56
V.	Chi-Squares for Nutrient Deficiencies in Home Economics and non-Home Economics Girls	59
VI.	Nutrient Levels in the Available Residence Food Supply	61
VII.	Blood Nutrient Levels of Residence Girls According to Age	62
VIII.	Comparison of Average Blood Values of the Survey Group and Recommended Levels and the Per Cent of Girls with Below Average Levels in the Five Components	65
IX.	Number of Girls with No Excretion of B Vitamins in the Urine and the Adequacy of Their Diets .	70
X.	Comparison of Average Canadian Height, Weight and Arm Skinfold Measurements to Those of the Residence Girls Surveyed	
XI.	Nutritive Levels of Snacks and Their Contribution to Daily Intake Levels	78

CHAPTER I

INTRODUCTION

During the spring of 1956, a nutrition survey was carried out among the college women living in the Women's Residence at the University of Manitoba. This study was designed to assess the nutritional status and dietary patterns of a group of college women living under conditions of the same available food supply. Information was collected from food intake records, biochemical tests, physical measurements and data on the residence food supply.

The survey was planned to reveal how well college women are able to select an adequate diet and to give information about their food habits. Nutritional status was assessed by correlating food intake data with that of physical and biochemical measurements. No other study of this type has been done in Canada.

Adequate nutrition is especially important during the college years for this is a period of physical demand and considerable tension. Since these are also the pre-marriage and pre-motherhood years for girls, it is very important that nutrition be adequate for the maintenance of good health. It is hoped that the results of this survey will aid in the nutrition education of young

women and will be of assistance to those responsible for the food services to college students.

CHAPTER II

REVIEW OF LITERATURE

A. ADEQUATE NUTRITION AND MALNUTRITION

The twofold aim of modern nutriture is to diagnose and prevent malnutrition and to provide for adequate nutrition. No simple system has yet been devised for the assessment of nutritional status but useful information is gathered in nutrition surveys by means of(48):

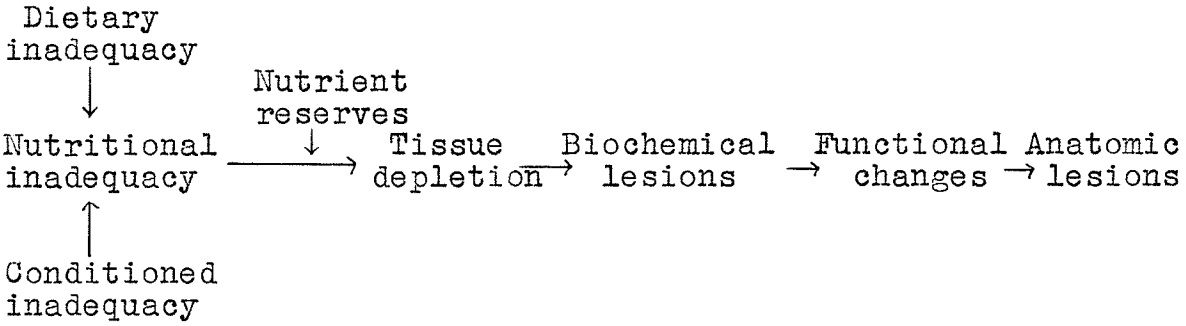
1. Dietary histories
2. Medical histories
3. Physical examinations
4. Laboratory tests
5. Diagnoses

Emphasis today is placed on the whole organism, the psychobiological individual, and the relationship of an adequate dietary to that individual's well being.

Nutritional inadequacy results whenever sufficient amounts of the essential nutrients are not supplied to the tissues which require them. This inadequacy may result from:

1. A dietary inadequacy or primary nutritional inadequacy.
2. Environmental conditions and body states that interfere with ingestion, absorption and utiliza-

tion of essential nutrients, or from factors that increase the requirements or cause the destruction or abnormal excretion of these nutrients. This is secondary or conditioned nutritional inadequacy. When nutrient reserves are sufficiently exhausted in nutritional inadequacy, tissue depletion takes place. This is followed in succession by biochemical "lesions", functional changes and, finally, anatomic lesions. One step in this process need not be complete before another begins. The pathogenesis of nutritional deficiency diseases may be illustrated as follows(32):



B. AREAS OF STUDY IN NUTRITION SURVEYS

Each of the instruments used in obtaining information on nutritional status will be discussed separately.

1. Records of dietary intake.

A record of past and present food intake is of the greatest importance in nutrition surveys. This is used not

only to confirm or question other findings but also to form the basis of any advice for improvement.

a) Methods of obtaining dietary intake data.

(1) The intake record.

The subject keeps a detailed report of all the foods eaten during a specified period of time. The amount of each food included may be estimated or weighed. Errors arise if the subject does not estimate or measure carefully the quantities of food actually eaten. The analyst may err in translating the quantitative measures or estimates into units employed in the food table used. Finally, errors arise when the food table is not applicable to the particular case.

The American Research Council has concluded that these records seem to permit a reasonably good characterization of the dieting habits of groups(48).

(2) The dietary history.

This type of study aims to discover the usual food patterns over a relatively long period of time. It is designed to reveal any major deviations from the usual concept of good food habits. Even without calculations of nutrient content, these histories can furnish a basis of classifying individuals into certain broad groups; for example, those whose diets are obviously poor with respect to one or more

nutrients, or those whose diets are probably better than average, and those whose diets have nutrients approximating the recommended levels.

(3) The 24-hour recall.

In this study the subject is asked on three or four different occasions to recall the foods eaten in the previous 24-hour period. Errors arise in the reliability of the subject's recall and in his estimation of actual quantities consumed. The 24-hour recall record is valuable in discovering the relative quantities of the different food groups included in the dietary.

b) Comparison of results from these methods.

Young(77) compared the information collected by the three above techniques. She found that the dietary history did not give the same estimate of intake as the 7-day intake record in each of the following groups studied; grade 7, 8 and 9 students, high school and college students, pregnant women and male industrial workers. The difference was smallest when applied to college students.

The results from a 24-hour recall and dietary history were also compared by Young(77) using grade, high school and college students. These two methods did not yield the same results. When compared to the 7-day diet record, Young(78) found the results of the 24-hour recall were closer than those from the dietary history. Young concluded that under

certain circumstances, the 24-hour recall may be substituted for the 7-day diet record in the estimation of intakes. Results from surveys done in the Northeast Region of the United States support this conclusion(13).

Trulson(69) compared the results of the same three techniques using 214 out-patients. She found that the 7-day record and dietary history gave comparable information as evidenced by correlation coefficients. Trulson decided that the prediction of individual intake by any one of these three methods varied in accuracy according to the food or nutrient.

c) Length of time for dietary record.

The length of time the dietary record should cover is a matter of considerable dispute. The period must be long enough to furnish an adequate picture of nutrient intake but it must also be short enough to maintain the interest and cooperation of the subjects involved.

Koehne(35) studied five children on weighed diets for 14 to 25 consecutive weeks. He found that 96 to 100% of the weekly averages for calories, protein, fat, carbohydrate, calcium and phosphorus were within 10% of the final averages. Eighty-five to 90% of the weekly averages for iron and acid and base values were within 10% of the final averages.

Widdowson and McCance(71) found widely fluctuating caloric intakes from day to day in a number of children but when seven days of each week were averaged, the figures agreed very closely. They concluded that, while one week is

the shortest period advisable for a dietary survey, results of one week are probably fairly representative of the person's customary food intake. Leverton and Marsh(41) agree with this and add that Saturday and Sunday should be included in the 7-day record or it will give a distorted estimate.

Yudkin(81) compared weekly averages with four-week averages for a group of six post graduate dietetic students. He found that weekly intakes of calories and nutrients showed considerable variation. Greatest variations were found for vitamins A and D and ascorbic acid. Yudkin states that a 7-day dietary study could not be considered long enough to give an accurate assessment of calorie and nutrient intake levels.

Young(76) studied the recorded intakes of 18 adults, 23 to 50 years of age, for 28 days. She believed one week was representative of the 28-day period when average intakes for the group were examined. This was true for calories, protein, phosphorus, iron, vitamin A, thiamine, riboflavin and niacin but not for calcium and ascorbic acid. Young decided that the observation period should last more than seven days for most subjects.

Chalmers(10) experimented with 1-day, 3-day and 11-day records but used these results only to estimate the mean intakes of groups. She pointed out that 11-day records would probably give a truer picture of intake levels but felt that 1-day records gave important savings in time, money and personnel.

d) Nutrients to study in a survey.

In nutrition surveys there is the problem of deciding which of the forty or so nutrients needed by the body should be particularly studied. Whether or not it is desirable to calculate a given nutrient in a diet depends on whether or not it is likely to be deficient and on the intercorrelation of nutrients; for example, many studies have shown that if calcium and protein are adequately supplied, phosphorus will also be supplied in sufficient quantities(12). McLester(42) states that even an American diet of mediocre quality easily supplies the daily copper requirement so that this nutrient need not be specifically calculated in nutrition surveys.

e) Differences between calculated and analyzed values.

Investigators have compared the results derived from computations using tabulated tables with those obtained through chemical analysis of aliquots of the diets being studied in order to find any discrepancies, their extent and direction. They have found that agreement is remarkably good. Comparisons of the mean analyzed caloric value of individual diets with those calculated from modern food tables reveal that, despite differences between corresponding individual pairs, calculated and determined means may differ by less than 10%. Agreement becomes better when the number of meals included is twenty or more and when the intakes are measured on the raw basis. When a single nutrient, protein, was studied, the calculated and determined means showed good

agreement, usually within 5%. Calculated values for the fat content of diets generally tend to be higher than the values obtained by analysis(54). Widdowson and McCance(48) found that the calculated means of potassium are in excellent agreement with the analyzed means. The calculated amount of phosphorus exceeded the determined mean of diets by 17% in studies by Hummel et al.(30).

The use of calculations for determining the calcium and iron content of diets is somewhat more problematical. Simmons and McHenry(65) found that the calculated means tended to exceed the determined means in the 21 meals they studied. Widdowson and McCance(48) found the opposite tendency but attributed this to the hard water used for cooking. Actual intake of iron may exceed the calculated amounts in the diet because of contamination during the process of food preparation, or because of differences in locality. Kaucher et al. (33) reported the calculated values to be approximately two-thirds of the actual intake in an iron-rich locality. On the other hand, for the 21 meals analyzed by Young and McHenry (79), the calculated content exceeded the actual mean content of 6.3 mg. by a difference of 0.6 ± 3.1 mg.

The greatest discrepancies have been found in vitamin values because of wide natural variations and the chance for losses to occur in the handling of foods. Calculated ascorbic acid intakes are likely to exceed the actual determined values, particularly if the food tables employed are based on

required for body activity above the maintenance level are indicated in the tables(8). The recommended allowances for calories, protein, vitamin A, calcium and phosphorus are based on body weight. Those for thiamine, riboflavin and niacin are dependent upon the calorie content of the diet. The requirements for iron, vitamin D and ascorbic acid are not calculated according to weight or calorie intake but are based on experiments in which determinations were made of the levels of these nutrients required for health.

The American food allowances have a factor of safety added to the nutrient levels required for maintenance(74). This factor of safety may vary from 30 to 100% of the maintenance level depending on the nutrient considered, but is included so that even healthy people with greater than average requirements in some nutrients will be provided for in the standards. Whether or not a factor of safety should be included in the standards used to assess diets is a matter of much dispute. It does not seem justifiable to determine the adequacy of intakes with the use of any standards which are higher than necessary to promote good health in average persons.

Recommended dietary allowances serve as a means of description but should not replace the more basic data - the quantities of various kinds of foods consumed or available for consumption and the quantities of nutrients provided by the food. Too often results of dietary studies are

reported only in terms of the percentage of some standard of adequacy. Thus, they are tied to a measure which is itself subject to revision.

g) Place of dietary studies in investigations of nutritional status.

The ultimate test of the adequacy of diets is the long-term nutritional health of the persons consuming them. Lack of correlation between dietary intake and clinical condition may mean inadequate data or wrong interpretation or both. Points to be borne in mind in such a comparison include the following(74):

(1) The state of nutritional health at any one time represents the cumulative effect of food consumption over a long period as well as the recent intake of certain nutrients.

(2) Errors are introduced when tables of average food values are applied to an individual's diet which has been studied for too short a time. These errors are magnified if values for foods as they enter the kitchen are applied to foods as eaten. The methods of obtaining food consumption data from individuals also vary in reliability.

(3) Only within broad limits can a judgment be made as to the adequacy of a calculated or determined dietary intake for a given individual. Wide individual variations in requirements are known to exist and, in

fact, they may vary from time to time in the same individual.

For these reasons one cannot expect to find complete correlation between an individual dietary intake over a short period of time, and clinical or laboratory findings. For groups of persons, on the other hand, and for certain nutrients or aspects of nutrition, results may show fairly good correlation.

2. Value of laboratory data and its interpretation.

A presumptive diagnosis of nutritional inadequacy by a clinician should be confirmed by therapeutic trial or by laboratory examinations of the blood, tissues, urine and feces(32). Nutritional disturbances adversely affect every tissue in the body and are reflected in morphological changes, functional changes and alterations in the chemically analyzable constituents(74). It is difficult to interpret the findings from microbiological and chemical tests with respect to the adequacy of nutrition because data concerning human nutritional requirements are insufficient, knowledge of what constitutes optimal health is lacking, and neither standards or methods of precision for measuring normal health are available.

The diagnosis of malnutrition is made more difficult because there is much metabolic adaptation to malnutrition, emaciation and starvation(32). The rate of development of malnutrition determines the end results since the adaptive

as that of albumin in evaluating protein nutrition, since serum protein is influenced by the globulin fraction which may be increased in a number of pathologic states(20). Hypoproteinemia occurs when the protein in the diet is severely curtailed for long periods of time, or in a number of disorders including those involving the liver, certain types of renal pathology, and conditions involving loss of protein from the body.

There is a considerable time lag between a deficient protein intake and an actual decrease in serum concentration(66). If circulating blood proteins drop below 6.0 gm. per 100 ml. of blood, one can conclude a long standing protein deficiency is present but edema can develop long before blood proteins reach this level.

Malnutrition is frequently accompanied by a diminution in extra-cellular space volume, especially that of the circulating blood. Then the total amount of plasma proteins in circulation may be greatly reduced with little or no change in concentration. In this case, normal values give a false feeling of security(32).

Serum protein concentrations reflect adequate intake in only the broadest sense. However, in the light of available evidence, it seems fair to interpret a low concentration of protein in the blood, particularly of the albumin fraction, as indicative of dietary protein deficiency(20). Most observers agree that it is better to determine the adequacy of protein intake by a nitrogen balance study but this