



Nutrition education for and biochemical results of a weight reduction program for college women  
by Marie S Harris

A THESIS Submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree  
of Master of Science in Home Economics

Montana State University

© Copyright by Marie S Harris (1957)

Abstract:

This experiment was set up to test the hypothesis that it is possible for a healthy, overweight young woman with a good nutrition education to lose weight and maintain good health on an ordinary diet without the aid of special foods, dietary supplements or appetite depressants.

Three different determinations were made during the course of the experiment on the serum cholesterol level and the basal metabolic rate of each individual to determine if this sort of diet regime would have any effect on these values.

Ten obese freshman women, varying from 14 to 54 pounds overweight, volunteered to give their time for the experiment. The volunteers attended a weekly class in Nutrition for Weight Reduction and then proceeded to apply the knowledge they had gained to the selection of food that was available to them on the dormitory menu.

During the three months when the special nutrition class was in session, the ten girls had an average weight loss of 6.25 pounds per person. A control group of 158 girls who lived in the same dormitory and were served the same menu as the experimental group, but who did not attend the special nutrition class, had an average weight gain of 2.3 pounds per person during the same period of time.

During the second three-month period of the experiment, the experimental group did not attend the special nutrition class and were on their own in their attempt to lose weight. During this period, the group was able to maintain the weight loss that they had previously achieved. The total average weight loss for the six-month period was 6.3 pounds per person.

The conclusion was drawn that, while it is possible for an obese young woman to lose weight under these circumstances, a three-month period of instruction is not sufficient to bring about enough change in faulty dietary habits to enable all the girls to continue losing excess weight at a regular rate.

A statistical analysis of the periodic serum cholesterol determinations and the basal metabolic rate determinations show that this sort of diet regime has no statistically significant effect on these biochemical aspects.

130  
NUTRITION EDUCATION FOR  
AND  
BIOCHEMICAL RESULTS OF  
A  
WEIGHT REDUCTION PROGRAM FOR  
COLLEGE WOMEN

by

MARIE S. HARRIS

A THESIS

Submitted to the Graduate Faculty

in

partial fulfillment of the requirements

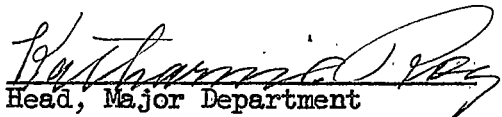
for the degree of

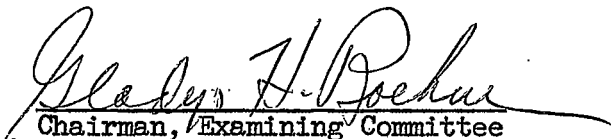
Master of Science in Home Economics

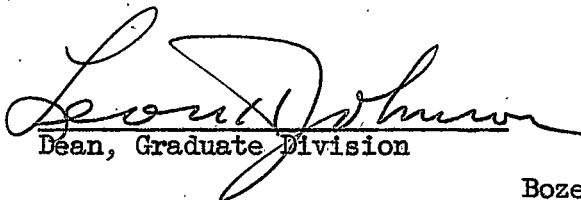
at

Montana State College

Approved:

  
Head, Major Department

  
Chairman, Examining Committee

  
Dean, Graduate Division

Bozeman, Montana  
June 1957

RECEIVED  
MONTANA STATE COLLEGE  
JUN 24 1957

N378  
H242n  
cop.2

1098

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS . . . . .	3
ABSTRACT . . . . .	4
INTRODUCTION AND REVIEW OF LITERATURE . . . . .	5
Health Implications of Obesity . . . . .	5
Serum Cholesterol and its Relation to Weight Changes and Diet . . . . .	7
The Basal Metabolic Rate and its Relation to Serum Cholesterol and Weight Loss. . . . .	10
The Control of Obesity through Nutrition Education . .	11
PURPOSE . . . . .	14
PROCEDURE . . . . .	15
Selection of the Experimental Group . . . . .	15
The Program for Nutrition Education for Weight Reduction . . . . .	15
Biochemical Studies . . . . .	17
RESULTS AND DISCUSSION . . . . .	19
The Experimental Group . . . . .	19
Nutrition Education and Weight Reduction . . . . .	20
Biochemical Studies . . . . .	30
SUMMARY AND CONCLUSIONS . . . . .	36
LITERATURE CITED . . . . .	38

ACKNOWLEDGMENTS

The author takes this opportunity to express her gratitude to Dr. Gladys H. Roehm for her tireless and patient assistance and to Dean Katharine Roy for her understanding and guidance during the college career that has culminated in this investigation.

#### ABSTRACT

This experiment was set up to test the hypothesis that it is possible for a healthy, overweight young woman with a good nutrition education to lose weight and maintain good health on an ordinary diet without the aid of special foods, dietary supplements or appetite depressants.

Three different determinations were made during the course of the experiment on the serum cholesterol level and the basal metabolic rate of each individual to determine if this sort of diet regime would have any effect on these values.

Ten obese freshman women, varying from 14 to 54 pounds overweight, volunteered to give their time for the experiment. The volunteers attended a weekly class in Nutrition for Weight Reduction and then proceeded to apply the knowledge they had gained to the selection of food that was available to them on the dormitory menu.

During the three months when the special nutrition class was in session, the ten girls had an average weight loss of 6.25 pounds per person. A control group of 158 girls who lived in the same dormitory and were served the same menu as the experimental group, but who did not attend the special nutrition class, had an average weight gain of 2.3 pounds per person during the same period of time.

During the second three-month period of the experiment, the experimental group did not attend the special nutrition class and were on their own in their attempt to lose weight. During this period, the group was able to maintain the weight loss that they had previously achieved. The total average weight loss for the six-month period was 6.3 pounds per person.

The conclusion was drawn that, while it is possible for an obese young woman to lose weight under these circumstances, a three-month period of instruction is not sufficient to bring about enough change in faulty dietary habits to enable all the girls to continue losing excess weight at a regular rate.

A statistical analysis of the periodic serum cholesterol determinations and the basal metabolic rate determinations show that this sort of diet regime has no statistically significant effect on these biochemical aspects.

## INTRODUCTION AND REVIEW OF LITERATURE

Considerable interest has been shown in the problem of controlling obesity and a great deal of experimentation has been directed toward the solution of this problem. However, in spite of this prolific experimentation and the many different methods and diets for weight reduction which have been proposed and tried, much of the work has been considered unsuccessful when subjected to the long-range view. That is, most obese people who diet and lose weight, by whatever system, gain all or a large portion of the weight back in time. It is quite likely that reducing diets would be more successful and much more consistent in theory if more exact information were available regarding the biochemical and psychological effects of obesity and dieting upon the individual. However, theories concerning the physiological effects of obesity and dieting continue to be widely diverse and sometimes conflicting. Upon one point, however, scientists are generally in agreement: obesity is not desirable and should be either avoided or corrected.

### Health Implications of Obesity

Before treating obesity, it is necessary to establish the point at which it begins. A person is considered obese who is 15 percent or more over "ideal" weight. In an adaptation of Baldwin, Wood, Symond and Strecher's tables prepared by Justin, Rust and Vail (17), age, height, sex and body build are considered in determining the "ideal"

weight for the individual. If obesity is measured in this way as percent over the "ideal" weight without regard for the actual percentage of active tissue present, this measurement can only be an approximate one. For more exact experimentation with the obese, Keys (18) proposes the use of skin fold measurements or the determination of body density by water displacement. This method, while scientifically sound, is not easily used by the untrained worker and the height, weight, sex, age and body build tables remain the best instrument for determining the "ideal" weight and the degree of overweight.

Admonitions to maintain or achieve "ideal" weight come from many quarters. Dr. James M. Hundley (13) in a report to the Iowa State College Colloquium on Obesity cites from life insurance statistics that one-fifth of the adults over thirty years of age are sufficiently overweight to affect their health. He also cites work done by Downes who not only found more heart disease, hypertensive vascular disease and gall bladder disturbances in overweight individuals, but also found that the incidence of chronic illness in the obese was nearly twice that found in the non-obese subjects of his experiment. Dr. Hundley concludes that, "Whatever the causal relationship between obesity and associated diseases, reduction of body weight carries with it a distinct health advantage in adult groups or populations which normally contain a definite proportion of overweights."

In a study of Metropolitan Life insurees, Armstrong et al. (2) treat obesity with a definite causal slant. They found that the

aggregate mortality rate among both male and female obese was one and a half times the expected rate. They concluded that, "Overweight shortens life, is an etiological factor in several principal diseases and hastens their downward course."

Serum Cholesterol and Its Relation  
to Weight Changes and Diet

Cholesterol and its concentration in the blood has been the subject of much research (36, 48), especially since there is a possibility of using such data for diagnostic purposes (10). Information regarding the factors that influence the serum cholesterol level is of importance. Diet, fluctuating weight, and possibly even obesity itself are among these influencing factors.

Keys (21) states that on a moderate reducing diet producing a gradual weight loss the body draws upon the stored fat and there is a temporary rise in the serum cholesterol level, which tends to drop again as the body adjusts to the restricted calorie intake. Experimenting with men on semi-starvation diets, he found that during drastic calorie restriction the serum cholesterol level dropped considerably below the pre-starvation level for the individual. Keys (20) also states that in abortive dieting, where the individual eats very few calories, loses weight and then overeats and gains rapidly, the serum cholesterol level did rise to 31 percent above the pre-diet control levels for the individual.

There are differences of opinion regarding the effect of various foods in the diet upon the concentration of cholesterol in the blood serum. Mayer et al. (27) report that Messinger and his associates have claimed that an increased dietary cholesterol level does bring about an increased plasma concentration of this substance. Mayer himself did not find this to be so. His findings agree with those of Urbach et al. (49) and Curran (6) who found that dietary cholesterol had no effect on the serum cholesterol, but that the amount of total dietary fat showed a direct relationship to the serum cholesterol level. These same investigators also found that the more highly saturated animal fats brought about a greater rise in the serum cholesterol than did the less saturated vegetable fats. It has been reported (35) that some of the more highly unsaturated fats, like sunflower seed oil and pilchard oil, can actually bring about a definite drop in the cholesterol level of the blood. Stare (41) cites references which indicate that groups of people who habitually eat very little fat throughout their lives have very low serum cholesterol levels according to accepted standards. Stare also draws attention to a Department of Agriculture survey of the American diet in which it was reported that the percentage of total calories derived from fat in our diet has increased from 36 percent to 43 percent in the last twenty years. If we associate our national trend toward increasing numbers of obese (13) with the trend toward increased fat consumption, we might expect to find some relationship between obesity and elevated serum cholesterol.

Although theoretically the serum cholesterol level of the blood should have value in diagnosis and prognosis of some diseases, actually data obtained from experiments are difficult to evaluate. Thomas (48) proposes a formula  $(1.8 \times \text{age} + 160)$  for predicting the serum cholesterol in the blood but Sperry (40) reports that the variation of the cholesterol level between individuals is so great that any "normal" values are without meaning when referring to the individual. The value which would appear "normal" for one "healthy" individual would not be "normal" for another. Peeler et al. (32), working with 72 men, found that the concentration of cholesterol in the serum of "normal" healthy humans varied over a wider range than did most other components of the blood. Keys (19) found that patients with recognized atherosclerosis showed such a wide range in serum cholesterol levels that they overlapped those in the "normal" healthy range to a considerable degree. Moore et al. (28) found a wide range in the serum cholesterol levels of women whether they were on a reducing diet or acting as controls on a maintenance diet.

Contrasted to the wide range in serum cholesterol levels between individuals, Sperry (40) found that the cholesterol level of the healthy individual himself varied very little over a period of time. The maximum deviation from the individual mean for 17 of the 25 "healthy" subjects of his experiment was 6.2 percent. The other 8 subjects had a maximum deviation of 12.3 percent from the mean for the individual.

Since there is much evidence to verify the existence of a wide variation in the serum cholesterol levels between individuals, it appears that in diagnosis the actual value for prediction of serum cholesterol, if any, will be associated with the variation in the individual rather than with the variation from a norm based on values derived from large groups of people.

The Basal Metabolic Rate and Its Relation  
to Serum Cholesterol and Weight Loss

In an experiment dealing with the treatment of hypothyroidism, a British scientist (36) found that the serum cholesterol level gave an approximate indication of thyroid activity although it was liable to unaccountable fluctuations. This report seemed to indicate that the basal metabolic rate as a measure of thyroid activity is inversely related to the amount of cholesterol circulating in the blood.

However, Peeler et al. (32) found that in "normal" healthy individuals there was no relationship between the serum cholesterol level and the basal metabolic rate. This agrees with the findings of Swanson et al. (46) in their work with 184 women ranging in age from 18 to 92 years.

During weight loss, a relationship was noted between the basal metabolic rate and the serum cholesterol level by Young et al. (54) in an experiment with overweight women on a ten-week moderate reducing diet of 1400 calories per day. There was a drop in the B. M. R. and a rise in the serum cholesterol level compared to those levels determined at

the beginning of the experiment. In the Michigan State College experiment (29) with overweight college women on various reducing diets, there was a decrease in the B. M. R. when calories were reduced below the customary intake. Serum cholesterol data were not reported for this experiment. During drastic calorie restriction and weight loss as reported in the Minnesota starvation studies with men (5), the mean B. M. R. of the group dropped to -39.9 percent and the serum cholesterol concentration dropped below the pre-starvation levels for the individual.

Keys (21) proposes that the decrease in the metabolic rate during weight loss in adults is a physical adaptation to the reduced calorie intake. The drop is associated with weight loss in the individual while the "normal" B. M. R. is associated with calorie equilibrium even in underweight people.

#### The Control of Obesity through Nutrition Education

There is evidence that the level of knowledge of good nutrition in the general populace leaves much to be desired. Jolliffe (16) believes that the reason many dieters are unsuccessful in losing weight is that they have never learned the "whys" of dieting and have never developed proper eating habits so that they could maintain "ideal" weight once they achieve it. Simmons (39), in his report on the Herrick Memorial Hospital research with approximately 450 obese men and women, states that in spite of the patients' long concern with weight control and

their statements that they knew all about good diets, most were completely ignorant of good dietary practices. This agrees with the observations of Young et al. (52, 53) who surveyed rural families to determine the extent of the homemaker's knowledge of good nutrition.

The layman's general lack of knowledge regarding good nutrition practices has made him a victim of the faddist and the pseudoscientist who beseech him to try different and unusual approaches to dieting (3, 37). Contrasted to the unique approach of the faddist's "magic", the realistic approach of nutritional adequacy built around everyday foods (23, 24) seems unromantic by comparison.

It is easy to see the relationship between overnutrition and overweight but the relationship between overweight and undernutrition is not so obvious. Swanson et al. (47) state that nutritional inadequacy can actually offset the reducing value of a low calorie diet and predispose a person to the accumulation of fat. Johnson (14) and Eppright et al. (9), both working with children, associated a weight gain in excess with a poor or inadequate diet. Stearns (42) states that obesity goes with malnutrition more than with overnutrition. In order that the general public may be apprised of facts such as these, it is obvious that a great deal more must be done in nutrition education.

There have been various organized group approaches to weight reduction based on careful planning and research (22, 25, 30, 39, 44, 45). A few have had good immediate results with no follow-up reported. In general, though, if success is measured in terms of maintained weight loss, the results have been discouraging. Jolliffe (15) says that

90 percent of those who reduce gain their weight back sooner or later. The fact that about 96 percent of the approximately 450 who entered the Herrick Memorial Hospital experiment (39) had dieted before entering and were still obese would seem to indicate that success is not characteristic of the dieting individual.

It is the author's belief that lack of sufficient nutrition education which would influence dietary habits is responsible for a large number of the failures to maintain weight loss after dieting.

PURPOSE

Concern has been expressed on the Montana State College Campus, as it has on many campuses, regarding the number of obese young women who register for college classes. Efforts have been made by interested faculty members to assist these overweight young women to lose weight but, due to lack of time and an organized approach, little has been accomplished on an individual basis.

Since it was not possible to include a weight reduction class as part of the regular college curriculum it appeared that an organized volunteer group project might possibly be the answer to the problem. For such a project to fit into campus life, it was necessary that the dieting regime be adapted to dormitory living and that any special class instruction be attended on a voluntary basis and held in the evening after the regular college class hours. This reported weight reduction experiment was planned and organized to fulfill these requirements.

The purpose of this experiment is twofold: first, to test the hypothesis that it is possible for a healthy, overweight young woman with a good nutrition education to lose weight and maintain good health on an ordinary diet without the aid of special foods, dietary supplements or appetite depressants; second, to record the effect, if any, of this sort of diet regime upon the blood serum cholesterol level and the basal metabolic rate of the individual.

## PROCEDURE

### Selection of the Experimental Group

Volunteer subjects for the experiment on weight control were obtained during the college entrance physical examination for freshman women at Montana State College in the fall of 1956. During the examination the author acted as the physician's receptionist and checked the medical record of every girl who was 15 percent or more over "ideal" weight (17). If, in the opinion of the physician, the girl actually did have an obesity problem, he explained the weight control program to her and suggested that she might like to take part.

In order that there might be a degree of uniformity in the living conditions among the members of the experimental group, final acceptance of volunteers was limited to freshman women who were to board and room in the women's dormitory on the college campus.

As a method of screening out those who might have severe emotional problems associated with their obesity, the Minnesota Multiphasic Personality Inventory (12) and the Edwards Personal Preference Schedule (8) were administered with the assistance of a psychologist on the college staff. The control group for these two tests included every fifth "normal" weight freshman girl who went through the entrance physical examination line.

### The Program for Nutrition Education for Weight Reduction

In order to better understand the particular circumstances connected

with each of the volunteers' weight gain, a case history was filled out by the author for each girl in a private interview before the nutrition class and dieting regime began. To eliminate misunderstanding and misinterpretation in answering questions, the author asked the questions from a pre-planned list and then filled in the responses herself.

The teaching program, "Nutrition for Weight Control," was planned and outlined as a part of an adult education methods course in the summer of 1956. This course outline was used in the ten-week nutrition class for the experimental group. The general procedures for this class were based on work done in group therapy experiments for weight reduction at the Herrick Memorial Hospital (39,43,50), the Boston Pilot Study (22) and the Cornell study (51). Special teaching techniques used were derived from Dale (7), Radke et al. (33, 34) and the Harvard School of Public Health research in nutrition education (26).

The nutrition education class was attended on a voluntary basis and met one evening a week for ten weeks. The length of the class period was approximately one and one-half hours. At the beginning of each class, the volunteers "weighed in" and then recorded their weights on individual weight graphs. Fifteen to twenty minutes of each class period was spent in "small talk" aimed at developing the feeling of group identity. The remainder of the class time was devoted to teaching Nutrition for Weight Control.

Since attendance at this nutrition class was on a voluntary basis and the results of the experiment in weight reduction depended largely upon the effectiveness of the teaching methods used, every effort was

made to make the subject of nutrition alive and interesting for the experimental group (11). The discussion-decision method of teaching was used to give each individual an opportunity to take part. Considerable emphasis was placed on audio-visual teaching aids using appropriate films, flannel board posters and graphs, and schematic models and graphs made from tinker toys.

The dormitory supplied advance menus for use in the instruction of the experimental group. Using these menus and a set of cardboard food models, the possible dietary modifications of the dormitory menu were illustrated.

The diet recommended for the experimental group did not specify a definite restricted caloric intake. However, elimination of high calorie foods was suggested and a nutritionally well balanced diet was emphasized.

#### Biochemical Studies

Serum cholesterol determinations were made on blood samples taken from each member of the experimental group. Blood samples were taken in September at the beginning of the experiment, in December at the completion of the scheduled nutrition classes for weight control and again in March for the follow-up study. The microtechnique of Abell, Levy, Brodie and Kendall (1) was used for the determination of total serum cholesterol. From the serum of each blood sample two aliquots were taken and each aliquot was analyzed in duplicate.

A series of basal metabolic rate determinations were obtained for each member of the experimental group using a Benedict-Roth basal metabolism machine. The lowest value of two successive determinations that were in close agreement was used as recommended by Roth (38). The Boothby, Berkson and Dunn (4) normal standards were used in computing the metabolic rate of the individuals. These determinations were made at a time corresponding to the drawing of the blood samples for the cholesterol determinations.

RESULTS AND DISCUSSION

The Experimental Group

Ten freshman girls volunteered to give their time for the experiment in weight reduction. These girls varied from 14 to 54 pounds over "ideal" weight and all lived in the college women's dormitory. Information regarding the weight status of the experimental group will be found in Table I.

Table I

Weight Data for the Experimental Group in  
Weight Reduction from September to March

Subject	Beginning Weight	"Ideal" Weight	Pounds Overwt.	Wt. Change in Pounds	Percentage Overwt. Lost
S.A.	193	152	41	+1	- 2.4
M.E.B.	161	135	26	- 3	11.5
M.H.	180	126	54	- 8	14.8
I.H.	152	138	14	- 1	7.1
T.J.	170	118	52	-29	55.8
W.K.	183	150	33	-10	30.3
B.P.	150	126	24	- 1	4.2
D.R.	160	123	37	- 4	10.8
J.T.	194	161	33	+ 2	- 6.1
K.W.	149	130	19	-10	52.6

The final column of Table I is a comparison of the weight loss for the individuals during the course of this experiment and was calculated as percentage loss of the pounds over "ideal" weight.

A psychologist's analysis of the Minnesota Multiphasic Personality Inventory and the Edwards Personal Preference Schedule indicated that there was no significant difference between the responses made by the obese girls who volunteered for the weight control experiment and the responses made by the control group whose weights were "ideal". All girls tested fell within the limits of the normal range on all of the phases of personality measured by the tests.

#### Nutrition Education and Weight Reduction

Excellent cooperation was received from each girl during the filling out of her case history before the commencement of the special nutrition class and diet regime. The girls all seemed willing and anxious to talk about their particular situation and problems involving their obesity.

Only two of the ten volunteers were an only child and all but one of the girls reported having had a happy childhood. In answer to the question, "When did you first become overweight?" two girls said they had "always been overweight"; three said, "at age 6"; and the others reported ages 10, 11, 12, 13, and 14 respectively. All members of the group had tried to lose weight before, ranging from two to twenty times, and four of the ten had sought a doctor's help. None of the girls had

been able to maintain the weight loss that they had achieved regardless of the method they used to achieve it. One girl was using thyroid as prescribed by her doctor and another commenced the use of a thyroid preparation shortly before the completion of the nutrition class sessions in December.

Each of the girls reported at least one other member of their immediate family as being overweight. Six of the group said that they had no previous nutrition education of any kind, three reported "some" in high school and only one reported nutrition instruction from her doctor other than a list of foods to eat or avoid.

The girls gave various reasons why they thought they had gained too much weight. Eight thought that they had gained because they overate or ate improperly. One thought that she "just put on weight easily" and the other "had no idea" why she had gained. When asked, "Why do you want to lose weight?" six gave as their primary reason, "I don't like myself this way." Social acceptance, clothes, morale and "to please someone else" were of primary importance to the other four members of the group.

A brief summary of the responses regarding the general dietary pattern of the group is given in Table II.

Table II

Summary of Responses to Questions Regarding Dietary Habits of the Experimental Group in Weight Reduction

Topic	Number of girls responding	
	Yes	No
Regular meals	8	2
Breakfast skipped	3	7
Eat more than three meals per day	7	3
Preponderance of sweets and starches in the diet	6	4
Adequate milk in diet	7	3
Craving for special foods	8	2

Volunteer attendance at the weekly nutrition class was good, with an average of nine members a week in attendance for the ten-week period. Although technical information was not emphasized, the girls acquired an understanding of the principles of good nutrition and their application to weight reduction as evidenced by the subsequent weight loss.

Diet modification rather than the restriction of calories was emphasized in the nutrition class. The girls reported that they modified their dormitory diet when possible by eating lightly of the starchy and fatty foods served, taking second helpings of salad or vegetables when allowed, and eliminating some of the rich desserts. Snacking and room parties called for moderation and self discipline.

A periodic weight record was kept covering the six months of the experiment (Table III). During the first three-month period while the

girls attended the special nutrition class, there was an average weight loss of 6.25 pounds per person. The calculation of a student's t-test with matched pairs (31) gave  $t = 4.34$  which is significant at the .01 level ( $t$  for .01 is 3.25).

Between December and March when the group did not attend the special nutrition class and the girls were on their own as far as dieting was concerned, a t-test indicated that there was no significant change of weight in the experimental group ( $t = .03$ ). However, five members of the group actually did gain some weight during this second period (S.A., M.E.B., I.H., B.P., J.T.) two of whom, S.A. and J.T., gained sufficiently so that they weighed one and two pounds more respectively at the end of the experiment than they did at the beginning. Three members (M.H., T.J., and D.R.) continued to lose weight at a regular rate and the remaining two (W.K. and K.W.) maintained the weight loss that they had achieved during the first three-month period.

The average weight loss for the six-month period covered by this experiment was 6.3 pounds per person.

Table III

Weight Record of Freshman Girls During  
Weight Loss Program from September to March

Subject	September (Beginning)	December (Class ends)	March (Follow-up)	First pd. wt. change ( $t = 4.34^*$ )	Second pd. wt. change ( $t = .03^{**}$ )	Total wt. change ( $t = 2.20^{***}$ )
S.A.	193 lbs.	190 lbs.	194 lbs.	- 3 lbs.	4 lbs.	1 lb.
M.E.B.	161	154.5	158	- 6.5	3.5'	- 3
M.H.	180	175	172	- 5	- 3	- 8
I.H.	152	149	151	- 3	2	- 1
T.J.	170	154	141	- 16	-13	-29
W.K.	183	173	173	-10	- 0	-10
B.P.	150	145	149	- 5	4	- 1
D.R.	160	157	156	- 3	- 1	- 4
J.T.	194	193	196	- 1	3	2
K.W.	149	139	139	-10	- 0	-10

\* Significant value of  $t$  at .01 level.

\*\* Value of  $t$  not significant.

\*\*\* Value of  $t$  nearly significant at .05 level ( $t = 2.26$ ).

The t-test using the September and March weights gave  $t = 2.196$  which is very nearly significant at the .05 level ( $t = 2.26$  for the .05 level). The final weights show a loss over the six-month period varying from 1 to 29 pounds for eight members of the group. The other two members gained one and two pounds respectively over their beginning weights.

Weights for the control group, consisting of 158 freshman women chosen at random from the dormitory in which the experimental group lived, indicate that the controls, who were served the same daily menu as the experimental group, gained on an average of 2.3 pounds per person from September until December. This gain gave a  $t = 6.15$  which is decidedly significant at the .001 level ( $t = 3.37$  for the .001 level).

When one considers the very significant weight gain of the weight control group, the average weight loss of 6.25 pounds per person of the experimental group during the same period of time is more impressive. Under the dormitory living conditions indicated by these results, even weight maintenance would be an accomplishment for one who is inclined toward obesity.

It is difficult if not impossible to explain the difference in weight loss of the experimental group in terms of a common factor. A graph of the weight record for each member of the experimental group covering the six months of the experiment appears in Figure 1.

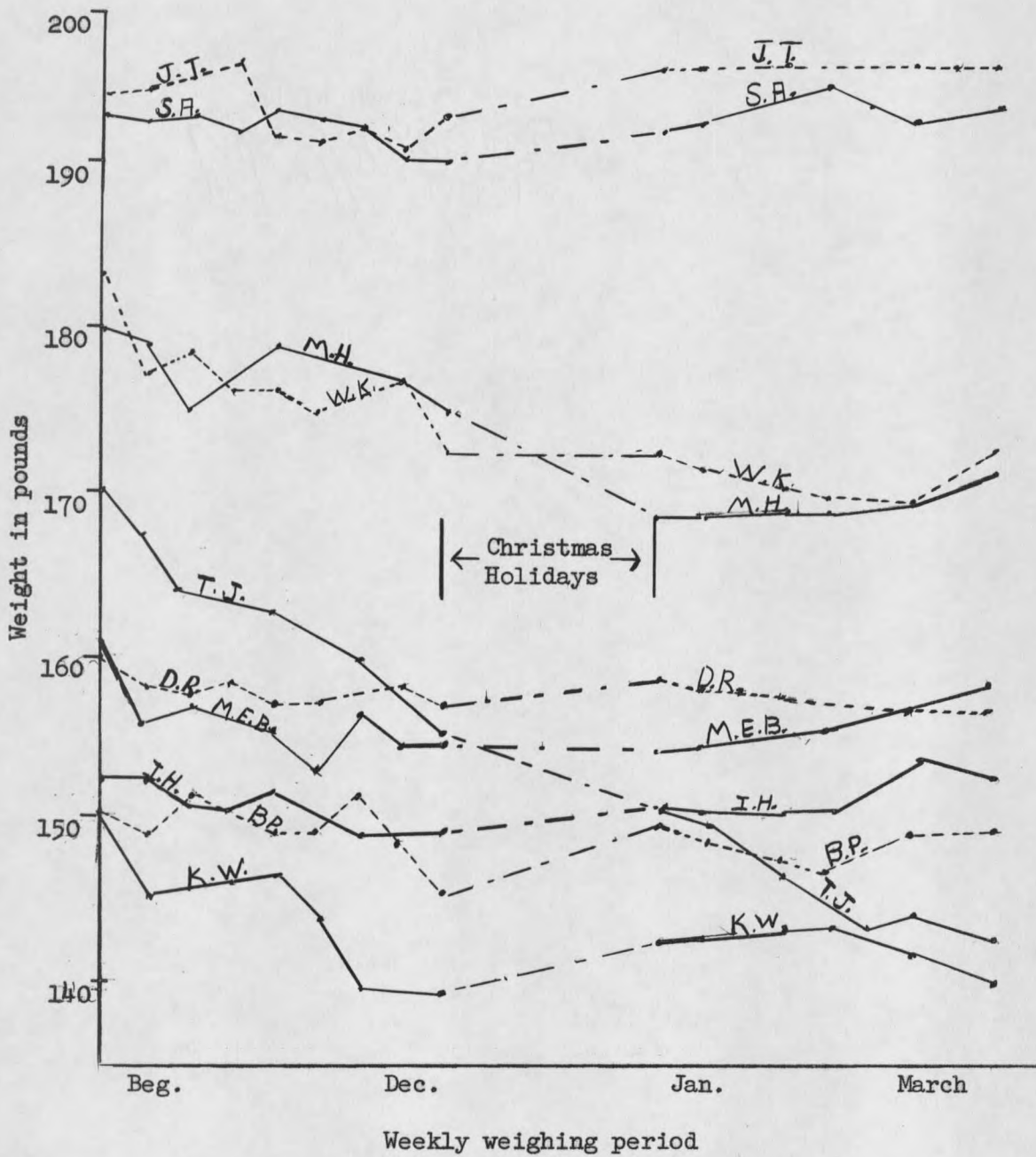


Figure 1. Weekly weight graph for the experimental group during a six-month weight reduction experiment.

All of the girls taking part in this experiment had a familial tendency toward obesity. The two who gained weight during the course of the experiment (S.A. and J.T.) were both tall and large framed. However, J.T. was athletic and firm fleshed while S.A., who was taking thyroid when she entered college, led a sedentary life and was soft and flabby. Each of these girls was an only child (the only two in the group) and it is possible that they were homesick and eating was a source of comfort to them that they could not give up.

M.H. and W.K. were 54 and 33 pounds overweight respectively and lost weight (8 and 10 pounds) at nearly the same rate. W.K. was tall, large framed and very active, while M.H. was inactive and of moderate height and build. W.K. had a family history of good nutrition and enjoyed eating, while M.H. never ate meat if she could help it and disliked everything about dormitory food.

I.H. and D.R., whose weight loss graphs were similar and with little fluctuation, were both of stocky build. D.R. was more sedentary and more overweight than I.H. and was able to lose four pounds during the experiment with promise of going on losing weight at a gradual rate. I.H. restricted herself to less than two-thirds of the customary 3500 calories that she ate at her ranch home and was still able to lose only one pound. In her case it was considered a distinct accomplishment that she did not gain weight in the college environment where good food was plentiful and available and her customary strenuous outdoor activity was no longer possible.

M.E.B., B.P. and K.W. were all of the same general medium build and were all moderately active. They were 26, 24 and 19 pounds overweight respectively. M.E.B. lost three pounds and B.P. lost one pound while K.W. lost ten pounds during the course of the experiment. K.W. had less weight to lose than most of the others yet was able to lose 52.6 percent of her overweight.

T.J., who was sedentary and small framed, was 52 pounds over "ideal" weight and one of the most overweight girls in the experimental group. She succeeded in losing 29 pounds which was over 55 percent of her excess weight.

All of the girls appeared to have a deep desire to lose weight, although it is obvious from the results that they did not enjoy equal success for their efforts. For some girls it appears that weight loss is definitely more difficult to achieve than it is for others. Individual physiological differences as well as individual differences in motivation and drive are a possible explanation for this variation in ability to lose weight by dieting.

The results of this experiment show that it is possible to bring about a weight loss in obese young women by emphasizing the importance of good nutrition and without using special diets, food supplements or appetite depressants. It is interesting to note in this experiment, however, that the major weight loss was accomplished during the time when the experimental group maintained its identity and had regular contact with the group leader. When the girls were on their own in their effort to lose weight, they were just able to maintain their earlier weight

loss. Although the control group was not weighed during this period, the living conditions for all remained the same as during the first three-month period, and it was considered an accomplishment that the experimental members as a group did not gain weight.

One might infer two things from this part of the experiment: first, that group association and nutrition training are important to continued successful weight loss; second, that one can not, ordinarily, in three months of effort, entirely change the dietary pattern that has been established by years of incorrect eating. For physically and mentally healthy young women, the elimination of obesity through the correction of faulty dietary habits would be eliminating the symptoms by correcting the cause. Since it appears from this experiment that a complete change of dietary habits can not be accomplished in a relatively short time, one must look for another approach, namely, a long-term project for improving the nutrition knowledge of people in general.

Seven of this experimental group of ten said that they had no previous nutrition education in school. Three reported "some" previous instruction in this field. Whether or not there had been an effort to teach nutrition in the schools that these girls had previously attended is not the issue. The fact remains that most of the girls did not remember any nutrition instruction or else did not recognize it for what it was.

The careful integration of nutrition education into the entire education system should be a goal for future planning if certain

individuals are to correct their present poor dietary habits. Although many people can be reached by this method, there will always be those who, in spite of their education, will not put their knowledge into practical application.

Good dietary habits are the product of a lifetime of learning and until knowledge of good nutrition is available for the people in general we will probably continue to have a high percentage of "habitual" obese in our population.

#### Biochemical Studies

A mean value of four determinations for total serum cholesterol was calculated for each of the three blood samples taken from each member of the experimental group (Table IV). These samples were taken in September, December and March. A t-test with matched pairs indicated that there was no significant difference between any of the series of serum cholesterol determinations (September-December  $t = .09$ ; December-March  $t = .13$ ; September-March  $t = .165$ ).

With the exception of one subject, B.P., the percentage of variation from the mean of the individual's serum cholesterol levels was well within the limits of variation found by Sperry (40) for the "healthy" members of his experiment. The percentage variation from the mean of the periodic serum cholesterol determinations for the experimental group are listed in Table V. The 14.5 percent variation of B.P.'s March serum cholesterol level is likely due to the commencement of thyroid medication for her in late November.

Table IV

Periodic Changes in Serum Cholesterol Values  
(milligrams of cholesterol/100 ml. of serum)

Subject	September (Beginning)	December (Class ends)	March (Follow-up)	First pd. change ( $t = .09^*$ )	Second pd. change ( $t = .13^*$ )	Total change ( $t = .165^*$ )
S.A.**	190.0**	158.9***	173.5**	-31.1	14.6	-16.5
M.E.B.	214.5	227.1	239.5	12.6	12.4	25.0
M.H.	194.0	190.0	209.3	- 4.0	19.3	15.3
I.H.	161.9	142.0	141.7	-19.9	- 0.3	-20.2
T.J.	173.9	184.3	180.1	10.4	- 4.2	6.2
W.K.	190.0	220.9	226.5	30.9	5.6	36.5
B.P.	242.8	237.7**	191.6**	- 5.1	-46.1	-51.2
D.R.	228.4	228.3	214.9	- 0.1	-13.4	-13.5
J.T.	163.3	172.9	163.1	9.6	- 9.8	- 0.2
K.W.	196.4	187.9	201.9	- 8.5	14.0	5.5

\* Value of  $t$  not significant

\*\* Taking thyroid extract as prescribed by private physician

\*\*\* Increase in existing thyroid prescription

Table V

The Percentage Variation from the Mean of the Periodic Serum Cholesterol Determinations for the Experimental Group in Weight Reduction

Subject	Sample	Cholesterol Mean Value (mg./100 ml. serum)		Percent Variation from Mean
S.A.	Sept.	190.0	174.1	9.1
	Dec.	158.9		8.7
	March	173.5		.04
M.E.B.	Sept.	214.5	227.0	7.3
	Dec.	227.1		.04
	March	239.5		7.2
M.H.	Sept.	194.0	197.8	2.2
	Dec.	190.0		4.5
	March	209.3		5.8
I.H.	Sept.	161.9	148.5	9.0
	Dec.	142.0		4.4
	March	141.7		4.6
T.J.	Sept.	173.9	179.4	3.1
	Dec.	184.3		2.7
	March	180.1		.4
W.K.	Sept.	190.0	212.5	10.6
	Dec.	220.9		3.9
	March	226.5		6.6
B.P.	Sept.	242.8	224.0	8.4
	Dec.	237.7		6.1
	March	191.6		14.5
D.R.	Sept.	228.4	223.9	2.0
	Dec.	228.3		2.0
	March	214.9		4.0
J.T.	Sept.	163.3	166.4	1.9
	Dec.	172.9		3.9
	March	163.1		2.0
K.W.	Sept.	196.4	195.4	.5
	Dec.	187.9		3.8
	March	201.9		3.3

As can be seen in Table IV, four of the ten members of the experimental group had a total decrease in their serum cholesterol during the course of the experiment. Two of these, S.A. and B.P., were the subjects who were either taking thyroid or had their existing thyroid prescription increased. The other two with a total decrease in their total serum cholesterol level, I.H. and D.R., did not show a corresponding increase in their B. M. R. D.R. varied little from her mean throughout the series of determinations. The drop from September to December for I.H. could be a reflection of this subject's conscientious limiting of fat and calories in her diet.

Of the three members whose serum cholesterol definitely rose (M.E.B., M.H. and W.K.), only one, M.E.B., had a corresponding drop in her basal metabolic rate during the course of the experiment. The rather large increase in the serum cholesterol level of W.K. could mean that this girl was not always following the advice of moderation in dieting and was subjecting herself to periods of relative fasting interspersed with periods of overeating (20).

The basal metabolic rate for each member of the experimental group was determined at a time coincident with the drawing of the blood for the serum cholesterol determinations (Table VI). A t-test with matched pairs showed no significant difference between any of the three series of B. M. R.'s (September-December  $t = .86$ ; December-March  $t = .83$ ; September-March  $t = .39$ ). The actual numerical values for the B. M. R. within the individual show little change during the course of the experiment in spite of the dieting regime.

Table VI

The Periodic Basal Metabolic Rates for the  
Experimental Group in Weight Reduction  
Expressed as Percent of the Normal Standard

Subject	September (Beginning)	December (End of class)	March (Follow-up)
S.A.*	-23.3*	- 8.2**	-13.6*
M.E.B.	-15.3	-19.7	-22.1
M.H.	-12.8	-18.5	-16.0
I.H.	.3	-10.3	-10.0
T.J.	0	- 5.9	- 2.0
W.K.	-18.3	-22.5	-14.6
B.P.	-17.4	-19.7*	-13.8*
D.R.	-10.8	- 5.3	-11.8
J.T.	- 7.3	-16.8	- 8.0
K.W.	-16.9	-15.8	-16.9

\* Taking thyroid extract as prescribed by private physician.

\*\* Increase in existing thyroid prescription.

The "ideal" B. M. R. is taken as 0 percent with the normal range being within plus or minus 10 percent. With this in mind, it was of interest to note that with two exceptions (September I.H. and T.J.), all of the B. M. R.'s of the experimental group were negative in value. One would not find this situation under the conditions of normal distribution. Also, over half of the total determinations fell well below -10 percent. This could mean either of two things: that a low B. M. R.

is associated with obesity in the members of this experiment, or that our present standards for a normal B. M. R. are too high. This latter point has been the object of much discussion and research which may result in a revision of our present standards for the normal basal metabolic rate.

The periodic values for the serum cholesterol level and the basal metabolic rate of the individual members of this experiment in weight reduction did not appear to be associated with the degree of overweight of the individual nor with the percentage of overweight lost during the course of the experiment.

SUMMARY AND CONCLUSIONS

Ten obese freshman girls who lived in the women's dormitory at Montana State College volunteered to take part in an experiment for weight reduction. These girls attended a weekly class in Nutrition for Weight Control in which good nutrition rather than restricted calorie intake was emphasized. The girls modified their dormitory diet by eating lightly of starchy and fatty foods, taking second helpings of salads and vegetables when possible and omitting rich desserts.

During the first three months of the experiment from September to December when the nutrition class was in session, there was an average weight loss of 6.25 pounds per person. The control group, who lived and ate in the same dormitory but did not attend the special nutrition class, had an average weight gain of 2.3 pounds per person during this same period.

During the second three-month period from December to March when the members of the experimental group did not attend the special nutrition class and were more or less on their own in their efforts to lose weight, only three of the group continued to lose at a regular rate. Two were able to maintain their previous weight loss and five members of the group gained some weight back.

The average total weight loss for the six months of the experiment was 6.3 pounds per person. All but two members of the experimental group weighed less at the end of the experiment than they did at the beginning. The two who gained weight gained one and two pounds respectively.

From the results of this experiment in weight reduction, it appears that it is possible for overweight young women with a good nutrition education to lose weight and maintain good health on an ordinary diet without the aid of special foods, dietary supplements or appetite depressants. However, nutrition instruction and association with a group that has weight loss as a common goal are important to continued success.

Obesity can be corrected in many people by the elimination of faulty dietary habits and good nutrition education is a means by which this can be accomplished. Generally speaking, though, it is difficult in the relatively short period of three months to completely change dietary habits that are the product of years of incorrect eating.

A statistical analysis of the periodic serum cholesterol determinations and the basal metabolic rate determinations for the individuals of the experimental group indicated that this sort of diet regime has no statistically significant influence on these biochemical values.

LITERATURE CITED

1. Abell, L. L., Levy, B. B., Brodie, B. B., and Kendall, F. E.:  
A simplified method for the estimation of total  
cholesterol in serum and demonstration of its  
specificity. *J. Bio. Chem.* 195:357, 1952.
2. Armstrong, D. B., Dublin, L. I., Wheatley, G. M., and Marks, H. H.:  
Obesity and its relation to health and disease. *J. Am. Med.  
Assoc.* 147:1007, 1951.
3. Beeuwkes, A. M.: The self-styled scientist. *J. Am. Diet. Assoc.*  
32:627, 1956.
4. Boothby, W. M., Berkson, J., and Dunn, H. L.: Studies of the  
energy metabolism of normal individuals: a standard for  
basal metabolism with a nomogram for clinical application.  
*Am. J. Phys.* 116:468, 1936.
5. Brozek, J., Chapman, C. B., and Keys, A.: Drastic food reductions:  
Effect on cardiovascular dynamics in normotensive and  
hypertensive conditions. *J. Am. Med. Assoc.* 137:1569,  
1948.
6. Curran, G. L.: A rational approach to the treatment of athero-  
sclerosis. *Am. Pract. - Digest of Treat.* 7:1412, 1956.
7. Dale, E.: *Audio-visual Methods*. Rev. Ed., Dryden Press, New York,  
1954.
8. Edwards, A. L.: *Edwards Personal Preference Schedule*. The  
Psychological Corp., New York, 1953.
9. Eppright, E. S., Sidwell, V., and Jebe, E.: Food intake and body  
size of Iowa children. *Weight Control*, Iowa State College  
Press, Ames, Iowa, 1955.
10. Gofman, J. W., Hanig, M., Jones, H. B., Lauffer, M. A., Laury, E. J.,  
Lewis, L. A., Mann, G. V., Moore, F. E., Olmsted, F.,  
Yeager, J. F., Andrus, E. C., Barasch, J. H., Beams, J. W.,  
Fertig, J. W., Pag, J. H., Shannon, J. A., Stare, F. J.,  
and White, P.D.: Evaluation of serum lipoproteins and  
cholesterol measurements as predictors of lipoproteins  
and atherosclerosis. *Circulation*, 14:691, 1956.
11. Harris, M. A., and Roehm, G. H.: Teaching nutrition toward a  
measured goal. *J. Am. Home Ec. Assoc.* (In press)  
June 1957.

12. Hathaway, S. R. and McKinley, J. C.: Minnesota Multiphasic Personality Inventory. The Psychological Corp., New York, 1943.
13. Hundley, J. M.: Need for a weight control program. Weight Control, Iowa State College Press, Ames, Iowa, 1955.
14. Johnson, J. A.: Deviations from normal weight in children. Weight Control, Iowa State College Press, Ames, Iowa, 1955.
15. Jolliffe, N.: Reduce and Stay Reduced, Simon and Schuster, New York, 1952.
16. Jolliffe, N.: The importance of protein in the reducing diet. Food and Nutri. News, 24:#7, 1953.
17. Justin, M. M., Rust, L. O., and Vail, G. E.: Foods. Houghton Mifflin Co., Boston, 1956.
18. Keys, A.: Body composition and its change with age and diet. Weight Control, Iowa State College Press, Ames, Iowa, 1955.
19. Keys, A.: Cholesterol "giant molecules" and atherosclerosis. J. Am. Med. Assoc. 147:1514, 1951.
20. Keys, A.: Weight Changes and Health of Man. Weight Control, Iowa State College Press, Ames, Iowa, 1955.
21. Keys, A., Brozek, J., Henschel, A., Mickelsen, O., and Taylor, H. L.: The Biology of Human Starvation - Vol. I, University of Minnesota Press, Minneapolis, Minnesota, 1950.
22. Kurlander, A.: Group therapy in reducing. J. Am. Diet. Assoc. 29:33, 1953.
23. Leverton, R. M.: The merry-go-round of reducing diets. J. Am. Diet. Assoc. 29:333, 1953.
24. Leverton, R. M.: Weight control propaganda. Weight Control, Iowa State College Press, Ames, Iowa, 1955.
25. Liggett, A.: Group weight control programs--what do they accomplish. Nutri. News, 20:#1, 1956.
26. Lockwood, E. A.: Activities in Nutrition Education. Nutrition Foundation Inc., New York, 1950.

27. Mayer, G. A., Connell, W. F., DeWolf, M. S., and Beveridge, J. M. R.: Diet and plasma cholesterol levels. *Am. J. Clin. Nutri.* 2:316, 1954.
28. Moore, N. S., Fryer, J. H., Young, C. M., and Maynard, L. A.: Blood lipid levels as influenced by weight reduction in women. *Am. J. Med.* 17:348, 1954.
29. Ohlson, M. A., Cederquist, D. C., Brewer, W. D., Beegle, R. M., Wagoner, A. N., and Dunsing, D.: Weight reduction on low fat and low carbohydrate diets. *J. Am. Diet. Assoc.* 28:113, 1952.
30. Ohlson, M. A., Brown, E. G.: Weight reduction of obese women of college age. Clinical results and B.M.R. *J. Am. Diet. Assoc.* 22:849, 1946.
31. Ostle, B.: *Statistics in Research.* Iowa State College Press, Ames, Iowa, 1954.
32. Peeler, A. L., Hepler, O. E., Kinney, V. M., Cisler, L. E., and Jung, F. T.: Normal value for serum cholesterol and basal metabolic rates and their correlation in normal man. *J. Appl. Phys.* 3:197, 1950.
33. Radke, M., and Caso, E. K.: Lecture and discussion-decision as methods of influencing food habits. *J. Am. Diet. Assoc.* 24:23, 1948.
34. Radke, M., and Klisurich, D.: Experiments in changing food habits. *J. Am. Diet. Assoc.* 23:403, 1947.
35. Review: Unsaturated fatty acids and serum cholesterol levels. *Nutri. Rev.* 14:327, 1956.
36. Robertson, J. D., Kirkpatrick, H. F. W.: Changes in basal metabolism, protein bound iodine, and cholesterol during treatment of hypothyroidism with oral thyroid and L-thyroxin sodium. *Brit. Med. J.* 1:624, 1952.
37. Rosenberg, R. S.: Nutritional claims in food advertising. *J. Am. Diet. Assoc.* 32:631, 1956.
38. Roth P.: The importance of the basal metabolism test in routine physical examination. *The Bull. of the Battle Creek Sanitarium and Hosp. Clin.* 26:193, 1931.

39. Simmons, W. D.: Group methods in weight reduction. Weight Control, Iowa State College Press, Ames, Iowa, 1955.
40. Sperry, W. M.: The concentration of total cholesterol in blood serum. J. of Biol. Chem. 117:391, 1937.
41. Stare, F. J.: Research in atherosclerosis. J. Am. Diet. Assoc. 32:309, 1956.
42. Stearns, G.: Factors relating to normal weight control in children. Weight Control, Iowa State College Press, Ames, Iowa, 1955.
43. Suczek, R. F.: Psychologic aspects of obesity in group reduction. J. Am. Diet. Assoc. 30:442, 1954.
44. Suczek, R. F.: Psychologic aspects of weight reduction. Weight Control, Iowa State College Press, Ames, Iowa, 1955.
45. Sussman, M. B.: Psychosocial correlates of obesity. J. Am. Diet. Assoc. 32:423, 1956.
46. Swanson, P., Leverton, R. M., Gram, M. R., Roberts, H., and Pesek, I.: Blood values of women; cholesterol. J. Gerontology 10:41, 1955.
47. Swanson, P., and Roberts, H.: Food intake and body weight of older women. Weight Control, Iowa State College Press, Ames, Iowa, 1955.
48. Thomas, C. B.: Observation on some possible precursors of essential hypertension and coronary artery disease: V Hypercholesteremia in healthy young adults, Am. J. Med. Science. 232:389, 1956.
49. Urback, F., Hildreth, E. A., and Wackerman, B. A.: The therapeutic uses of low fat, low cholesterol diets: 1. Treatment of essential Xanthomatosis. J. Clin. Nutri. 1:52, 1952.
50. Walch, H. E.: As the nutritionist sees it. J. Am. Diet. Assoc. 30:447, 1954.
51. Young, C. M.: Helping the overweight individual. Weight Control, Iowa State College Press, Ames, Iowa, 1955.
52. Young, C. M., Berresford, K., and Waldner, B. G.: What a home-maker knows about nutrition I and II. J. Am. Diet. Assoc., 32:214, 1956.

53. Young, C. M., Berresford, K., and Waldner, B. G.: What the home-maker knows about nutrition, III: Relation of knowledge to practice. J. Am. Diet. Assoc. 32:321, 1956.
54. Young, C. M., Ringler, I., and Greer, G. J.: Reducing and post-reducing maintenance on a moderate fat diet. Metabolic studies. J. Am. Diet. Assoc. 29:870, 1953.

RECEIVED  
MAY 1956



3 1762 10014200 7

N378  
 H242n  
 cop.2  
 123696  
 Harris, M. S.  
 Nutrition education for and  
 biochemical results of a wt.  
 reduction program for college

WOMEN.	NAME AND ADDRESS
FEB 12 60	<i>[Handwritten name]</i>
2-15-63	Ruthy Parsons 308 Hamilton
NOV 23 1963 ② Jcd	Lora Mcdegaard 505 N. 3rd
	DEC 14 1964
4-28 65	<i>[Handwritten name]</i>
MAY 24 1965	Jennie 405
1-15-66	<i>[Handwritten name]</i>
P - -	1.
DEC 12 1965	

2-24-6  
 N378  
 H242n  
 cop.2

123696