OBESITY: A STUDY OF CALORIE INTAKE, ENERGY EXPENDITURE AND SUCCESS IN WEIGHT REDUCTION OF A GROUP OF OBESE WOMEN

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by

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This study attempted to discover whether differences in food intake and/or activity existed between a group of successful and unsuccessful reducers. Twenty-five obese women, members of the Streamliners Club, participated in the study, and were classified into two groups according to their pattern of weight loss throughout the period of membership in the Club. The food intake and energy expenditure of each group, as calculated from 7-day food and activity records, were compared. Eight women of normal weight were selected to serve as control subjects.

The successful reducers were found to have a significantly lower mean daily Calorie intake than the unsuccessful reducers. The successful reducers also had better food habits than the unsuccessful group.

When energy expenditure of the obese was calculated with both ideal and actual weight, the ideal weight was found to be a more accurate guide. Mean daily energy expenditure was similar for all groups. The successful reducers spent twice as much

time in the more active category of activities as compared with the unsuccessful reducers. Pedometer readings for ten subjects indicated a wide individual variation in amount of walking.

Both groups of obese women scored higher than the control group on Shipman's Anxiety-Depression Scale, but there was no significant difference between the mean scores of the reducers. Scores of some of the individuals appeared to be related to dieting success.

A 1000 Calorie reducing diet was followed by eighteen of the obese women for a period of four weeks. The total weight loss was small for both groups, although the successful reducers showed a better performance index. On the basis of the difference between predicted and actual weight loss, general adherence to the diet was poor.

Some of the difficulties encountered by obese women on a reducing program were noted. The social club-type of group therapy as a method of treatment for obesity appeared to be effective with only some individuals.

TABLE OF CONTENTS

TABLE OF CONTENTS CONTINUED

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

In the fall of 1957, the Foods and Nutrition Department of the School of Home Economics, University of Manitoba, began a weight control program with a group of obese women who were members of the Winnipeg Branch of the Streamliners Club. The aim of the project was to provide instruction on weight control and to assist with individual problems in reducing. Diets of different composition were given, and the pattern of weight reduction was followed over an extended period. It was this initial work with overweight women that prompted the present study.

The response of overweight persons to a variety of reducing diets has been studied by many workers. However, more information is needed on the activity pattern of the obese and their Calorie expenditure when compared to that of normal weight persons engaged in the same level of activity. The work required in moving a large body may be assumed to increase Calories expended in physical activity over that of normal weight persons. On the other hand, the very obese are unable to engage in strenuous exercise and may have learned to be more efficient than other persons in physical movement exerted in various activities.

It was believed that a detailed study of a group of overweight women with respect to their Calorie intake, energy expenditure, and response to a reducing diet, would provide

further information on the problem of energy balance and also a deeper insight into the difficulties associated with weight reduction. The Streamliners Club afforded an excellent group of cooperative subjects for this purpose.

When the pattern of weight loss of a group of obese persons is followed, it becomes apparent that some individuals are able to reduce successfully, while others are not. Many of the unsuccessful dieters claim to be rigidly following a low Calorie regime. A number of reasons may account for the failure to achieve the expected weight loss.

REVIEW OF LITERATURE

"Of all the parasites that affect humanity, I do not know of, nor can I imagine, any more distressing than that of obesity" (4). This statement, taken from Banting's "Letter on Corpulence," 1864, was made one hundred years ago, but aptly describes the modern conception of obesity. As evidence of the present approach to this condition, the literature is filled with statements to the effect that, "Inside every fat man, a thin man is wildly signalling to be let out" (4). There is no doubt about the public's preoccupation with this problem. The never-ending list of low-calorie foods, crash diets and magical reducing programs indicates a universal concentration on the achievement of the slender figure.

This concern with overweight is not unwarranted when the prevalence and serious complications of the condition are considered. "The Report on Canadian Average Weights, Heights, and Skinfolds" showed 13 per cent of Canadian men, and 23 per cent of Canadian women to be obese (81). Figures from the "Build and Blood Pressure Study," compiled by the United States Society of Actuaries in 1959 (102), indicate that one quarter of the American population is overweight. Between the ages of 15 and 69, 20 per cent of men and 23 per cent of women are 10 per cent overweight while 6 per cent of men and 11 per cent of women are at least 20 per cent above the ideal

weight for their age and height. With advances in medical skill and knowledge, people are living to an older age where it is more difficult to maintain the ideal weight. This fact may partially account for the apparent increase in the incidence of overweight.

Many factors are probably responsible for the prevalence of obesity in today's world. With the era of automation, Western society has largely become a sedentary group, with fewer working hours and more leisure time. To a greater degree than formerly, adults enjoy sports as spectators and participate in very light forms of exercise. With the present high standard of living, the availability and variety of foods has increased, and food plays an ever-increasing role in social and business functions.

The medical profession has focussed its attention on the problem of overweight because of the serious consequences which may be associated with obesity or result from it. The most startling finding is the effect of obesity on life expectancy. Life insurance statistics have shown that among men aged 15 to 69 years, the mortality rate was 20 per cent higher for persons 10 per cent overweight, 33 per cent higher for those 20 per cent overweight, and 42 per cent higher for those 30 per cent overweight, when compared to the mortality rate for standard risks. For women of the same age group, the mortality rate increased from 18 to 30 per cent above that

for standard risks. This increased mortality rate was principally due to hypertension, cardiovascular diseases, vascular lesions of the central nervous system, and digestive disturbances (102). Obesity is also associated with diabetes mellitus, arthritis, gout, hernia, cancer of the endometrium and skin complications (5,47,56,67,100,102). It may lead to complications during pregnancy and surgery. Obese persons usually suffer postural difficulties, shortness of breath, and intolerance to heat. A greater susceptibility to accidents is also likely.

For many obese individuals, the greatest disadvantage of excess weight lies in the social and psychological handicaps which accompany or develop from this condition (13,42). Bruch, in discussing the psychological effects of being obese, emphasizes the general attitude toward the obese person (15). Such individuals are believed to be slow and lethargic, to be self-indulgent, and lacking in will-power. Obese persons generally feel discriminated against, and in fact, are, both in job competitions and social situations. The public attitude may contribute to the obese persons' self-contempt, force them to withdraw from society, and perhaps eat more than ever.

DEFINITION OF OBESITY

Obesity is commonly defined as being 20 per cent above the ideal weight, which is the average weight of healthy persons

of the appropriate sex and height, age 25 (2,76). It appears that, with advancing age, a certain accumulation of adipose tissue is a natural physiologic process, just as the female has a higher proportion of adipose tissue than the male (22). It becomes difficult, then, to distinguish between the amount of fat which is natural and that amount which may be considered excessive. Consequently, only when obesity is defined as a percentage of adipose tissue in relation to body weight, may degrees of overweight be recognized. When the adipose tissue content reaches 30 per cent of the body weight, an individual is considered obese (68,55).

Tables of ideal weight may provide a satisfactory if somewhat imprecise, diagnostic guide to indicate those who are appreciably above the average weight. Because of variations in body composition, such tables have only limited usefulness (56,54). A person whose muscles are unusually well-developed could be considered overweight by tables of average height-weight values. The amount of adipose tissue can only be determined by more accurate measurements. These include skin caliper tests, body density techniques, estimation of body water by the antipyrene space, and x-ray methods (54). Probably the most practical method for the physician is the skin caliper test or the pinch test which is a simplified version of it.

Skin caliper measurements are made on three different

areas of the body (33), on the back, one inch below the angle of the scapula, on the chest over the lower rib in the mid-anxillary line, and on the back of the arm over the triceps muscle, midway between the tip of the shoulder and the elbow. These areas give a good indication of the amount of subcutaneous fat present. However, it must be emphasized that subcutaneous fat accounts for only about 50 per cent of the total adipose tissue content (74).

Skin caliper measurements were related to body weight in the "Report on Canadian Average Weights, Heights, and Skinfolds" (83). The skinfold calipers used were designed to exert a constant tension of 10 grams per square millimeter and to measure a constant area of skin (40 mm). The site used was the back of the upper arm. More than 22,000 Canadians from all age groups and occupations were weighed and measured. The range of skinfolds used as a standard was drawn from the 25th and 75th percentile of the 25 to 29 age group. The range for men was from 4 to 9 mm. and for women, 8 to 16 mm. Arm skinfold measurements below 3 for men or below 8 to 10 for women were considered a sign of undernutrition, while measurements over 10 for men and over 22 for women were considered to be indicative of obesity. This study suggested that excessive skinfold measurements as well as weight in excess of that of the 60th percentile were dangerous to health.

When the Caloric intake exceeds Caloric expenditure,

overweight and eventually obesity can be the only possible outcome. However, to define obesity as the result of overeating is, as Mayer points out, (76), not much better than saying an alcoholic is one who drinks too much. This merely redefines the problem.

ENERGY METABOLISM

The first law of thermodynamics states that living creatures can neither create nor destroy energy but only transform it. Energy exists in five forms: solar, chemical, mechanical, thermal, and electrical (22). Through the process of photosynthesis, plants convert solar energy directly into the chemical energy of carbohydrates, proteins, and fats. Animals are unable to use solar energy as such, and so derive it directly or indirectly from plants. The energy of food is then available for the needs of the organism. A measure of the inefficiency of the human body in the transformation of energy is the finding that only about 25 per cent of this energy is converted to mechanical energy, while the remainder is lost as heat (22).

Energy metabolism is the term applied to "the heat changes observed during the metabolic transformations of body constituents and of foodstuffs" (41). The digestive end-products of carbohydrates, proteins, and fats enter into a series of oxidation-reduction reactions, catalysed by a number of enzyme systems, to ultimately yield carbon dioxide and energy. This

chemical energy is stored in compounds such as adenosine triphosphate and creatine triphosphate, and may be readily transformed to mechanical and thermal energy on demand (22). The quantity of heat produced as a result of these metabolic transformations may be measured in terms of kilocalories (22). Each unit, (commonly expressed as a Calorie in nutrition work), represents the amount of heat required to raise the temperature of 1 liter of water 1 degree Fahrenheit.

The heat produced in metabolism may be measured by direct or indirect means(116). The former method measures the heat directly in a calorimeter, while the latter, a more practical and less costly method, measures the oxygen consumption and carbon dioxide production. Heat, carbon dioxide, and water, are produced in direct proportion to the amount of oxygen consumed.

The ratio of carbon dioxide produced to the amount of oxygen consumed indicates the metabolite or body constituent being oxidized. This ratio is known as the respiratory quotient (22). Values of 1, 0.7, and 0.8 are used for carbohydrates, fats, and proteins respectively, while the figure 0.825 is taken to apply to the usual North American mixed diet (47). From these figures, the total calorie equivalent of the oxygen consumed in a given time may be calculated. Two types of apparatus widely used for the indirect measurement of energy expenditure during various forms of activity are the

Douglas Bag and the Kofranyi-Michaelis respirometer (116). The Douglas Bag is satisfactory for tests of various activities as performed in the laboratory, while the Kofranyi-Michaelis respirometer has the advantage of lightness and motility when subjects are tested during their regular working schedule (22).

The energy needs of the body have been arbitrarily classified into that for basal metabolism, the specific dynamic action of foods, and physical activity (28,35,41,116). West and Todd (122) define basal metabolism as the rate at which the body carries out its overall cellular metabolism under a set of empirical circumstances known as basal conditions. Expressed in a slightly different way, basal metabolism is the "totality of the processes required to maintain the status quo of the organism" (41). The basal metabolic rate is calculated in terms of heat production. To be in a basal state the subject must be in a post-absorptive condition, relaxed, at normal body temperature, and in an environmental temperature of 70° Fahrenheit. The higher the rate of metabolism, the more heat is produced.

Basal metabolism may be influenced by a variety of factors, the most important being the amount of active metabolizing tissue (17). Calorie requirements should not be considered directly proportional to body weight as allowances become too small for imdividuals below the average weight and

excessive for those above (11). A more accurate guide to calorie needs is a fractional power of the body weight, which is referred to as the metabolic body size (17).

Kleiber, one of the foremost workers in animal energetics, has shown that metabolic rate and body size are highly correlated (59). The metabolic rates of large and small animals are more closely related to body surface than to body weight. Studies on groups of animals, ranging in size from mice to cattle, indicated the metabolic rate per unit of surface area was greater, the larger the animal. When the logarithm of the metabolic rate is plotted against the logarithm of body weight, a linear relationship was achieved, showing that the metabolic rate was proportional to a given power function of body weight. The three-quarter power was found to be the most suitable fraction. The metabolic body size then, is measured by the weight in kilograms to the three-quarter power ($Wt._{kg.}^{0.75}$). Studies with twenty-six groups of mammals demonstrated that the basal metabolic level of adult homeotherms averages about 70 ($Wt._{kg.}^{0.75}$) Calories per day or 3 ($Wt._{kg.}^{0.75}$) calories per hour. Individual variation in basal metabolism represented a standard deviation of $\pm$ 7 percent.

The intensity of basal metabolism is considerably influenced by age (17, 35, 36). It reaches its highest peak between the years of one and two, after which it gradually

falls through childhood, rising through adolescence, and then slowly declining throughout adult life. The Canadian Dietary Standard suggests the decrement in Calorie requirement for basal metabolic rate with advancing age to be 2.5, 5, 7.5, 10, and 12.5 per cent for each decade over 25 years of age (17).

The formula by Kleiber for metabolic body size does not differentiate between differences in body composition of lean muscle mass and fatty tissue. Women have a greater percentage of fatty tissue than men and a basal metabolic rate lower than that of men of comparable weight or surface area. When basal Calories are related to lean body mass this difference disappears (22). Similarly, the formula for metabolic body size when calculated on actual weight will give erroneously high values for basal caloric expenditure in the obese.

Bruch believes that the adipose tissue of obese persons cannot be considered metabolically inactive and that oxygen consumption, even under basal conditions, is elevated in the obese state (12). She presents data from studies of obese children to support this hypothesis. Ljunggren and coworkers (64) report basal metabolism high in 13 obese women as compared with 16 women of normal weight. Large amounts of total body water, intracellular water and body potassium in the obese, suggested

that lean body mass and cell mass are also increased in obesity as well as fat mass. Ljunggren et al claim that metabolic activity of the cell mass is normal in the obese and that increased cell mass accounts for the higher basal oxygen consumption. Other factors which influence the rate of oxygen consumption under basal conditions are status of health, endocrine secretions, pregnancy, lactation, and growth (17,116). In the case of undernutrition or semi-starvation, the basal metabolic rate is lowered. This adaptation by the body to conserve energy appears to be true only over an extended period of time. Keys and coworkers report that the basal oxygen consumption of 32 young men was lowered approximately 10 per cent after 6 months semistarvation (54). Thyroxine is known to have an extremely important role in regulating metabolism. Patients suffering from hyperthyroidism may show an increase of from 15 to 75 per cent in basal metabolism. The pituitary and adrenal glands may also influence basal oxygen consumption, but to a lesser degree than the thyroid. Pregnancy demands additional energy for the growth of the foetus, placenta, and associated maternal tissues (17). The increase in basal metabolism in the last trimester of pregnancy is believed to be 20 per cent above normal (17,36). This would be met by an additional 500 Calories per day. As the calorie efficiency of human milk is assumed to be 60 per cent and the average daily milk production to be 850 ml., the FAO Committee on Calorie Require-

ments advises an increased Calorie intake of 500 to 1000 per day during lactation (36).

After the ingestion of foods, there is an increased total body heat production. This effect is known as the specific dynamic action or the calorigenic action of foods (22,122). The factors responsible for this mechanism are poorly understood. The type of food as well as the amount eaten, will determine the amount of heat produced and the length of the period of elevated heat production. Proteins have the greatest specific dynamic action, increasing the total heat production as much as 30 per cent above the basal value. Many individual amino acids have been shown to exert a marked specific dynamic effect when administered orally or intravenously, so that the production of heat can not be attributed to digestion or absorption (123). It has been further illustrated that this effect is not a result of the oxidation of the amino acids (112). Some authors believe the calorigenic action of amino acids is the result of the large amount of energy needed by the liver for oxidative deamination and the formation of urea (122). Additional energy is required to metabolize the carbon-containing residues of the amino acids if they are not immediately oxidized to carbon dioxide and water. The transamination of amino acids to form glucose, glycogen, or fat will also demand energy. When protein is used for growth, this specific dynamic action is not evident.

The relatively low specific dynamic action of carbohydrates is attributed to the synthesis of glycogen and glucose (47). When glucose is administered to rats along with thiamine, there is a greater production of heat than when glucose is given by itself (122). Since thiamine is involved in the transformation of glucose to fat, the extra heat is believed to be required for this reaction. A satisfactory explanation for the slight calorigenic effect of fat has not been given.

The overall specific dynamic action of the average Canadian mixed diet is considered to be about 10 per cent above the basal requirement (116). West and Todd describe an old but interesting theory to explain the calorigenic effect of foods (122). They recall the plethora theory of Lusk, which states that the absorbed digestive products pass from the blood into the tissues, and during the time that the rate of inflow exceeds the rate of utilization, a plethora develops in the tissues. This causes an accelerated rate of the specific dynamic action which diminishes as the flow of nutrients decreases.

To calculate the total Calorie requirements of any individual the added cost of work must be considered. Several standards have been devised to estimate the Calorie requirements of a population. The most recent standard was proposed by the Canadian Council on Nutrition. The Canadian Dietary

Standard, 1963 (17), divides the Calorie requirements for adults into two categories, maintenance activity, and work. Maintenance activity is described as "the activity of an unemployed person engaged only in waiting upon himself," or "sedentary idle living without reproduction or lactation." The daily maintenance requirement is considered to be 113 per cent of the basal figure, i.e., 93 ($Wt_{kg}^{0.75}$) Calories per day.

The Calorie requirement for physical activity is probably the most difficult to assess. This is due to the wide individual variation in energy expended in various activities (22). The FAO Committee on Calorie Requirements states that 75 per cent of the energy used in work is involved in moving the body, so the Calorie requirement for work becomes directly proportional to the metabolic body size (36). The Canadian Dietary Standard uses the formula $\underline{b}$ ($Wt_{kg}^{0.75}$) to calculate the work Calories, where the value of $\underline{b}$ depends on the severity of the activity. Values for work Calories include the effect of the specific dynamic action of foods. The four categories of activity, A,B,C and D, suggested in this standard, are applied to eight hours work performed by the reference man of 65 kilograms, and have been assigned values of 23, 35, 80, and 107 Calories respectively. The occupation of the majority of Canadians places them in the A category, representing the lightest form of activity.

As people grow older, their general activity decreases. FAO proposes reductions in total Calorie requirement (36), whereas the Canadian standard makes this correction in the maintenance fraction (17). The Canadian workers maintain that the energy needed for any activity must be in the same range among people of the same body size, regardless of age. Thus the activity requirement will not change. The maintenance requirement decreases by 3,5,9,13 and 17 per cent for every decade over the age of 25 years.

STUDIES ON ENERGY EXPENDITURE

Data has been accumulated on the energy expenditure of individuals performing various activities. The work of Passmore, Durnin, and others, has provided a significant contribution to this area of knowledge. Further research is needed, especially with regard to the cost of excessive adipose tissue on energy expenditure. In the majority of such studies, individuals have kept food and activity records. Food intake was estimated either by analysis of aliquot samples or from tables of food values, while energy expenditure was assessed by measurement of the major activities with a respirometer, or through the use of tables of average energy expenditure.

In 1955, Edholm, and Fletcher (31) measured the energy expenditure and food intake of 12 cadets over a period of 2 weeks. Foods eaten were weighed and daily activity

records kept. The energy cost of the major activities was measured with a respirometer. A great difference was found to exist in the efficiency with which any 2 men performed the same task. Calorie intake varied considerably from day to day. While there was no correlation between intake and expenditure on the same day, there was a significant correlation between the mean daily expenditure on one day and the mean daily intake two days later. Over the 2 week period, balance between expenditure and intake was close.

The energy expenditure of a group of miners and clerks was investigated by Garry, Passmore and Durnin (42) over a period of one week. Measurement of energy expenditure was made with the Kofranyi-Michaelis respirometer. While the miners were found to expend more Calories than the clerks during working hours, the off-duty energy expenditure was the same for both groups.

A study of 3 groups of elderly men, aged 60 years, 2 groups of whom were engaged in moderate work and 1 in heavy, revealed the energy expenditure of the latter group to be the highest (30). However, when Calories expended were expressed per unit of body weight, the energy expenditure was similar in all 3 groups.

A 7-day study of middle-aged housewives and their adult daughters was made by Durnin (26). The mean daily intake was 2100 Calories for the mothers and 2225 Calories

for the daughters. The Calorie expenditure was estimated to be 2090 for the mothers, and 2225 for the daughters. Both were considered to be engaged in sedentary activity. This study shows a remarkable balance between intake and expenditure.

Taggart made an interesting study of her own food intake and activity over a period of 36 days (114). She found little daily correlation between food intake and expenditure. Daily fluctuations in body weight were attributed to changes in fluid balance. She pointed out a significant relationship between activity on one day and intake on the following day. Taggart found that changes in weight, food intake and water balance were not related to the menstrual cycle or to the excretion of pregnandiol and oestriol in the urine. Over the total period, the trend of weight followed closely that expected by Calorie intake.

The energy needs of a group of women, aged 22 to 36 years, were studied by Frank and Johnston (40). Over a period of 112 days, the mean Calorie intake for the 8 subjects was estimated to be 2215, which compared favourably with the United States recommended allowances for persons of the same age, weight, and activity pattern. A study of 17 elderly women, aged 60 to 69 years is reported by Durnin and others (29). The mean daily expenditure of 1950 Calories closely approximated the values found by other workers for this age

group. In all the aforementioned studies, subjects maintained their weight by balancing intake to energy expenditure.

Passmore and others studied the energy expenditure of three overfed thin young men (85). After a control period of 5 days on a 2300 Calorie diet, they were given a 4000 Calorie diet for an 8 to 10 day period. The gain in weight was less than expected, and was principally attributed to a gain in body protein and fat. There was no evidence of a gain in body water. It was concluded that, under short periods of overeating, the body is able to concentrate its stores of fat and protein (86).

The effect of overfeeding two fat young women was reported recently by Passmore (90). He found that Calorie expenditure varied from 3035 in the control period to 3165 during overfeeding, and to 2785 during underfeeding. Calorie intake during these periods was 3390, 4475, and 350 Calories respectively. Both women gained weight more easily than the overfed thin young men reported earlier by Passmore (85). One woman required an excess of 6000 Calories to gain 2.5 kilograms, whereas the other required an excess of 14,000 Calories. Both gained body water as well as fat and protein. The composition of the excess weight was not the same for both women. The authors calculated that one woman laid down 500 grams of fat, 420 grams of carbohydrate, and 140 grams of protein, while the other laid down 520 grams

of fat, 110 grams of carbohydrate, and 230 grams of protein.

Rose (89) conducted a study of large and small eaters, using a group of male medical students. The large eaters consumed twice as much food as the small eaters while each maintained his weight. The amount of physical activity performed was the same for each group, but the large eaters performed most tasks at a faster rate, and so were presumed to expend more energy. This study is an excellent illustration of individual variation in energy expenditure.

The energy expended during various activities has received wide attention. Durnin's investigations have been mentioned earlier (27). Bratton (9) studied the energy expended by women of normal weight in various household duties. The energy cost of activities such as walking, sitting, standing, and bending, were reported by Richardson (97), for a group of nine women. She found a direct relationship between the cost of walking and the body weight and speed, as did Passmore (88). A more extensive study of the energy expenditure of women performing household tasks was undertaken by Elliot, Patton and Singer (34). In load-carrying, the heavier women spent more energy than the women of normal weight, but the difference was statistically significant only at the 16 per cent level. These workers attributed the major part of the increase in energy expenditure to an increase in basal expenditure.

The Calorie cost of an activity depends not only on the nature of the work, and the speed with which it is executed, but also on the skill of the individual (31). German workers observed a variation in Calorie expenditure of ± 10 per cent between persons performing the same task. The same person can be expected to show a variation of ± 5 per cent in Calories expended during the same activity (104).

As an index of activity level, a few workers have made use of the pedometer. Chirico and Stunkard (18), studying a group of obese men and women, discovered a significant difference between the level of activity of the obese and non-obese women, while no significant difference was observed between the obese and non-obese men. Stunkard (111) emphasizes the problems inherent in the use of the pedometer, namely the fragility of the instrument, and the uncertainty of the data it measures.

Pulse count has been used by Malhotia (65) to measure energy expenditure. He found it directly related to the rate of oxygen consumption. However, this is the only reference to the use of this technique found in the literature.

Most energy expenditure tables measure the cost of activities in Calories per kilogram per minute. This unit of time is considered most satisfactory, as the majority of activities occupy only a few minutes (87). Durnin (87) stresses the fact that, because exercise may affect the

resting level of metabolism, gross values including basal metabolic rate and specific dynamic action should be used, and allowances made for the subject's weight. Variation in basal expenditure are considered small as compared to total energy expenditure.

For most people, the time spent in different activities is about the same. One-third of the day is usually spent sleeping, using one-tenth to one-quarter of the daily energy expenditure. Metabolism falls only slightly below the basal rate during sleep, so that basal Calories are used to calculate Caloric expenditure during sleep (87). Personal necessities normally occupy 1 hour per day. As an example of time spent in various activities, a study of 17 elderly women showed that seventy-two per cent of the day was spent in such activities as lying in bed, sitting or performing personal necessities, 21 per cent of the time in standing, and only 6 per cent of the time spent in walking (29).

The cost of walking, climbing, and running is very difficult to estimate because of individual variation, but generally, the energy expenditure is directly proportional to speed and body weight (7 ,87). Passmore and Durnin (87) clearly demonstrated that over the range of 2 to 4 miles per hour, energy expenditure was linearly proportional to speed and body weight. Two formulas, $C = 0.8\ V \times 0.5$, (where C =

calories per minute and V the speed or Km/hour) and C = 0.047w + 1.02, where w = weight in kilograms, have been developed to demonstrate the relationship of these two factors (87). Bobbert (7) found good agreement between the observed and calculated values of energy expenditure in level and grade walking. His formula is log Ew = 1.4272 + 0.004591 V + 0.024487 α + 0.0002658 V α where Ew = energy expended in walking, V = speed, and α = gradient. Pollack (95) on the other hand, states that the energy expenditure in walking is proportional to body weight but not to speed. Descending stairs is estimated to require 1/3 of the energy used in climbing. The cost of recreational activities and domestic work is again very variable. Mental work does not in itself increase energy expenditure but usually involves some physical activity. In a study of male clerks, Durnin (42) showed the metabolism increased 50 to 70 per cent above the basal during clerical work.

Some of the inaccuracies of energy expenditure studies are discussed by Durnin (27). He feels the greatest error is in recording the duration of separate activities. Failure to define the activity accurately, errors in the technique of measuring energy expenditure, and atypical behaviour of the subject during the period of measurement, could all contribute variation. If the subject is impressed with the importance of accuracy in recording and defining activities,

a major part of the error can be eliminated. Individual variation is not of course, taken into consideration when tables of energy expenditure are used.

The measurement of Calorie intake is also subject to error especially if the intake is calculated from tables of food value (22, 46). It must be remembered that each figure represents an average of the analyses of a limited number of samples of each food. Obviously then, variations in the chemical composition of foods grown in different areas, the fat content in different meats, variation in moisture content or differences in methods of analyses, may alter the Calorie value (22, 23, 46). Calculated values for the protein and Calorie composition of foods have been found to closely approximate those obtained by chemical analysis (23, 91). The overall error attributed to the use of these tables has not been found to exceed 10 per cent, so for all practical purposes, they may be considered a useful estimate of Calorie intake (22). It would seem obvious that the use of food and activity records can provide only an approximate estimate of energy intake and expenditure. A fairly reliable measure of Calorie expenditure may be obtained from the Calorie intake of persons who are maintaining a steady normal weight.

ETIOLOGY OF OBESITY

The normal-weight person enjoys an appetite-regulating mechanism which balances his food intake and energy expenditure over a period of time with remarkable accuracy. Davidson (22) et al illustrates this feature by citing the example of a man who maintains his weight within 2 or 3 pounds over a period of 25 years, during which time he consumes approximately 12 tons of food. Although Caloric intake and expenditure may not balance on any one day, there is definite evidence of a long-term balance (71). The extremely fine accuracy of this adjustment explains how a very slight but prolonged disturbance could lead to overweight and obesity.

A complex number of factors are involved in the development of obesity. These are classified in a variety of ways by different authors.

Mayer (69) suggests obesity is the result of the interrelationship of factors which he terms genetic, traumatic and environmental. Several forms of hereditary obesity have been demonstrated in mice, for example, yellow obesity and the hereditary obese-hyperglycemic syndrome. In man, examples of true hereditary obesity are rare, but some forms such as congenital adipose macrosemia, monstrous infantile obesity and familial hypoglycemosis have been recognized (76).

Traumatic factors may be of hypothalmic or endocrine origin (69). Injury to the hypothalamus may result in the

Frohlich's syndrome. Damage to the central nervous system as in frontal lobotomy is also known to result in obesity (76). Endocrine disorders may produce obesity but again these are rare (1,22,56). Mayer (76) mentions tumour of the pancreas or pituary resulting from treatment with cortisone or adrenocoticotropic hormone, as well as disorders of the reproductive system such as male hypogonadism and ovarian disturbances.

Environmental factors suggested by Mayer (69) include inactivity, psychic disturbances, and social and cultural pressures. Nature of the diet and timing of food ingestion are also mentioned. Mayer points out that the proper genetic factors must be present before the nature of the diet becomes important. On the basis of mechanism of development, Mayer distinguishes between regulatory and metabolic obesity (76). Regulatory obesity is caused by a disturbance of the central food-regulating mechanism whereas in metabolic obesity, the primary lesion is an inherited or acquired disorder of metabolism. The differences between these two types has been demonstrated in mice. Mice made obese by destruction of the ventromedial nuclei of the hypothalamus, or damage to this area through administration of goldthioglucose, show marked hyperphagia, glucose is absorbed more rapidly in the intestine, and the rate of lipogenesis and cholesterogenesis increases with the amount of food overeaten.

With fasting lipogenesis returns to normal. If these animals are reduced, their body composition returns to normal proportions.

In the case of metabolic obesity, the mice have a much less pronounced hyperphagia and their inactivity is especially marked. They have a high blood cholesterol level and exhibit atypical responses to various hormones. Mice with metabolic obesity show hypertrophied islets of Langerhans and an increase in the number of both alpha and beta cells. There is also evidence of hyperinsulinism and elevated glucagon content. In addition, a marked increase in hepatic glycogen turnover and in hepatic phosphorylase activity is observed. The increase of lipogenesis during fasting is a typical feature of metabolic obesity. There is no evidence of hyperketonemia and after reducing, the body composition is found to contain a higher fat content than normal. Mice with regulatory or metabolic obesity have been shown to react differently to diets of different composition, and to differ in the association with various pathological conditions. In man, psychogenic obesity may be considered evidence of regulatory obesity, while endocrine obesity is of the metabolic type.

A new type of obesity, differing from the hereditary obese-hyperglycemic syndrome, discovered by workers in New Zealand, is discussed by Mayer (76). The NZO mice, as they

are called, show a different reaction to fasting. The usually high glucose values, typical of this kind of obesity, rise even higher during this time, rather than declining as is the case with the other types. During pregnancy and parturition extremely low glucose values are observed. Like the hereditary obese-hyperglycemic mice, they show a marked resistance to insulin.

Other authors classify obesity according to the localization of body fat. Here we find obesity of the gynoid or android type as described by Vague (119).

Although it has been demonstrated that obesity may be hereditary (106), the actual genes responsible have not been identified. Studies with identical twins have emphasized the close relationship between genetic constitution and body weight (69). Children of obese parents appear to have a greater tendency to become obese than do children of non-obese parents (5,77). However, it is difficult to separate the effects of heredity and environment. The general opinion of most workers indicates the inheritance of a tendency toward obesity (22,74), so that children of obese parents need to take special precautions to avoid becoming overweight. Some authors have associated hereditary obesity with inheritance of diabetes (52).

Actual cases of endocrine obesity are rare (22,52). Joliffe (52) points out that most obesity believed due to

faulty hormonal balance will respond to diet in the same manner as ordinary obesity. He also states that, although hyperinsulinism resulting in hypoglycemia may lead to obesity, most obese patients show an elevated blood sugar level. Nervous hypoglycemia might be a factor in the development of obesity. However, this is not usually a cause of obesity. According to Joliffe, sex hormones influence the distribution of body fat, this distribution becoming apparent only when the subject becomes obese. Obesity as a result of the physiological changes arising during puberty, menopause and pregnancy are not considered by Joliffe to be due to the hormonal changes, as each of these periods involve a different shift in hormonal balance. Another argument in favour of this statement is that if hormonal imbalance were responsible for obesity, then more individuals would become obese at such times. Again, these patients respond to a reducing diet in a similar way to other obese subjects. It may be that persons who have a tendency to become obese are more susceptible at these times.

Hilde Bruch (13) in a study of the psychological factors related to obesity distinguishes between developmental and reactive obesity. The former type is an integral part of the growth and development of the person and is not actually caused by emotional problems, whereas the latter is an expression of an individual's emotional response to stress. Bruch

feels that the discouraging prognosis for reducing supports the idea that psychological factors are involved in many ways. Reactive obesity is more common in adults. Such persons should not attempt to reduce without psychological or psychiatric assistance. Developmental obesity usually occurs in a child whose living pattern centers around eating and avoidance of social activities and sports. But obese persons do not share the same psychiatric problems. Bruch feels that for some persons, overweight is a natural state, while for others it represents a necessary adjustment to life, without which the subject would suffer severe psychological disturbances.

Hamburger (45) discusses reactive obesity as a "substitute adaptive mechanism" which permits a person to deal with, and yet avoid difficult emotional problems. He classifies the emotional factors involved into overeating as a response to non-specific emotional tensions, overeating to compensate for intolerable life situations, as a syndrome of underlying emotional illness or as an addiction to food. Young (129) stresses that all obese subjects cannot be considered emotionally unstable. Many different feelings, drives, or conflicts might lead an individual to seek satisfaction in overeating, depression being one of the most common causes.

In discussing factors related to overeating, a distinction must be made between the terms appetite and hunger. Hunger

refers to a physiological regulation while appetite includes a psychological response. The center of hunger is believed to be in the hypothalamus, whereas appetite involves the cerebral cortex. The cerebral cortex may influence the hypothalamus to increase or decrease hunger. Appetite refers to an expression of mind which is related to hunger and the behaviour which causes a person to seek food. Hamburger (45) mentions Engel who describes the ability of man to permit a delay between the instinctive forces of hunger and the act of seeking food as "the most important determinant of his total psychologic behaviour." The cerebral cortex is the factor which "allows hunger, memory of relief of hunger by eating, planning to find food and then eating." It is also the function of the brain to allow a person to restrict his food intake. Because appetite is a function of the brain, it can be influenced by experience and a number of factors, both physiologic and psychologic. To understand the regulation of food intake, Hamburger (45) points out that the complex nature of man must also be understood. Because of man's highly developed brain he can subconsciously allow food to serve as a replacement for unsatisfied emotional needs.

It is readily apparent from the above discussion that the complex mechanism which regulates energy balance is not fully understood. It is now accepted that the center of this regulation is in the hypothalamus (3,75). With experi-

ments on mice, two areas of the hypothalamus, namely the lateral and the ventromedial areas, have been shown to be involved. Mayer (71) refers to Carlson who postulated a theory to explain the mechanism of the regulation of food intake. He noticed that when the empty stomach contracted hunger was present. He associated the cause of hunger with these contractions and the impulses of the vagus nerve. This theory received wide acceptance for a time, until it was demonstrated that, after vagotomy, patients still experienced hunger sensations.

Mayer (71) describes an explanation by Brobeck, who felt that animals eat to keep warm and stop eating to prevent hyperthermia. This theory, although it does apply in some cases, is not a plausible explanation for the decreased appetite found in hyperthyroidism (52).

The explanation proposed by Mayer (75) is referred to as the glucostatic theory. According to this theory, the hypothalamus is particularly sensitive to carbohydrate metabolism, not to blood glucose level per se, but to the rate of effective utilization by the tissues. The difference between the venous and the capillary blood sugar level is taken to be an indication of the effective utilization by the tissues. The rate of utilization is expressed as Δ glucose values. When this difference is small (zero or small Δ glucose values) the subject is hungry, and conversely, when it is large, the

subject experiences satiety. It is further believed that glucoreceptors in the central nervous system carry impulses to the hypothalamus and the cerebral cortex, influencing the appetite-regulating centre to increase or decrease food intake.

The above theory offers an explanation for the hunger typical of diabetics because, although the blood sugar level is elevated, the rate of glucose transfer into the cell is decreased, so the cell is actually not using glucose effectively. It is believed that the passage of potassium ions into glucoreceptor cells along with glucose phosphate may represent the point at which the effective glucose level is translated to electrical or neural mechanisms. This may explain why cortisone is associated with increased appetite, as following its administration Δ glucose values are decreased in spite of an elevated blood sugar levels. Mayer (71) reports that Stunkard and Wolfe found good correlation with small Δ glucose values and hunger. This theory is probably the most widely accepted explanation of the appetite regulating mechanism. However, Jolliffe (52) and Davidson et al (22), point out that this cannot be the complete explanation, as many obese persons have normal or large Δ glucose values along with an elevated appetite.

Davidson et al (22) suggests that the appetite-regulating mechanism, with its location on the brain, is probably subject to various stimuli, in much the same manner as the respiratory

mechanism. He feels that nervous, chemical and external stimuli all play a role. He also postulates that total body mass, factors determining chemical pathways of foods such as hormones, the role of the liver, and the effect of exercise are involved (22).

Jolliffe (52) believes that "appestat" will be understood when the physiological or chemical basis for a conditioned reflex is found. He classifies the functional causes of an elevated "appestat" into three categories, habitual, cortical, and psychosomatic. The appetite-regulating mechanism is subject to habit, and repeated overeating beyond satiety can "set the appestat" at a higher level. The obese person may be completely unaware of overeating because he does not experience satiety with a normal intake of food. Habitual overeating may also occur in a family situation where the importance of food is magnified beyond proportion, when family members eat high calorie meals, by the thrifty housewife who would rather eat than discard leftover food, or through the frequent or habitual use of alcohol (52).

Cortical or purposeful overeating is believed by Jolliffe(52) to be true of children who overeat to avoid parental nagging. It would also apply to persons who believe that overeating will make them healthier and stronger.

Psychosomatic overeating may express a reaction to emotional stress, an outlet for boredom, or an escape from

the interests of the other sex. In all these cases, the result is an elevated "appestat" which cannot be returned to normal purely through psychological treatment. It must be retrained to a normal level, and the proper dietary measures enforced with discipline. Jolliffe further warns against overemphasis on the psychological aspects of reducing, which he feels may be more harmful than beneficial.

A factor of major importance, often overlooked, is the effect of exercise on body weight and obesity. Mayer (69,72, 74) firmly believes that inactivity may be the key to the increasing overweight in today's society. He aptly describes the significance of exercise when he says, "An inactive life for man is as recent and abnormal a development as caging is for the animal." The proper functioning of the appetite-regulating mechanism has been demonstrated to be dependent on a certain minimum exercise level (72).

The relationship between activity and obesity has been illustrated with obese mice where inactivity is a characteristic feature (71,76). Upon overfeeding, mice with the gene for obese-hyperglycemic syndrome gained 200 to 300 per cent more than non-obese controls, while mice with the waltzing gene gained only 20 per cent more than non-obese littermates. When rats were exercised for a period of 1 to 6 hours, food intake was automatically adjusted in direct proportion to the amount of exercise and weight did not change (77). When exer-

cised more than 6 hours appetite was lost and weight decreased. The interesting point in this experiment was that when exercise was less than 1 hour, appetite did not decrease proportionately and obesity resulted.

With a group of 213 male workers in West Bengal, India, Jean Mayer and associates (72) studied the relationship between Calorie intake, body weight, and physical activity. Increased food intake followed increased activity but only within a certain limit, which was referred to as the "normal activity range". Below this level, a decrease in activity was followed by an increase and not a decrease in food intake. From these findings the authors concluded that there is a certain interval, the "sedentary zone", where food intake does not correspond to energy output.

Chirico and Stunkard (18) studied a group of 25 obese men and 15 obese women and compared them to an equal number of normal weight individuals. When physical activity was measured by means of a pedometer, it was discovered that obese women were much less active than the non-obese controls. They found a lesser difference in the activity of the obese and non-obese men. These workers postulated that obesity in men might be due to excess Calorie intake rather than to lessened physical activity. Studying another group of obese women, Stunkard and Dorris (110) found similar results. In this study the women considered themselves to be quite active,although in realit

they were not.

Bruch (15) was one of the first to notice the inactivity associated with obesity of children. Wilkes (126) studying a group of 300 obese girls aged 10 to 14 years, found they were very inactive as compared to children of normal weight. Bullen (16) studied the activity pattern of 113 overweight girls aged 12 to 19, and compared it to that of 39 controls. A questionnaire, designed to reveal the subjects perception of his behaviour and feelings, showed that most of the girls were unaware of their degree of inactivity and attributed their overweight to excessive eating. The obese girls did not eat more than the controls, but were much less active. Projective psychological tests indicated the obese girls were quite passive and tended to avoid difficult situations. Poor eating habits were also discovered to be a feature of the obese group.

Wilkes (125) conducted a survey of 300 obese girls aged 10 to 14 years, members of the "Chubby Club". A questionnaire revealed that they spent less time in sports than their non-obese siblings. They ate a great deal of foods rich in carbohydrate and fat between meals and while watching television. Sixty per cent of the obese girls did not belong to a social club and were very dissatisfied with their appearance.

Another study made by Stefanik et al (105) of 65 obese adolescent boys showed that the obese boys did not overeat but energy

expenditure was depressed below a level considered typical of their sex and age group.

Bullen, Monello and others (16), investigated the Calorie intake and expenditure of 2 groups of high school girls attending a summer camp. The obese group had a significantly lower Calorie intake than the non-obese group, while attending camp. But a questionnaire revealed that the obese girls spent less time than the other group in active sports when not at camp. Both groups lost weight in spite of their increased food intake. Studying 65 obese adolescent boys, Stefanik et al (105) found the obese boys ate less than a control group but their activity index was much lower. These findings were further supported by a study of 28 obese girls conducted by Johnson and Mayer (49). Johnson postulated that for the age group decreased activity rather than increased food was the contributing factor to the development of obesity.

It appears from the evidence to date that inactivity is often characteristic of obese persons. It is difficult to know whether inactivity is a cause or effect. Stunkard (110) suggests three factors which may lead to decreased activity. These may be biological, resulting from physical illness or injury, or as a result of the requirements of an individual's social pattern, or of an emotional nature, where inactivity is the response to a situation of stress. Thus activity or exercise can be assumed to play a significant role in the development

and maintenance of many cases of obesity and it becomes obvious that exercise must be considered an essential part of a reducing regimen.

REDUCING PROGRAMS

The prognosis for success in reducing is poor (5,37,43,48, 52,113). Few obese persons lose weight successfully, and fewer are able to maintain a weight loss. There have been many different approaches to problems of low Calorie diets. In order to lose weight, there must be a Calorie deficit, but the question arises as to which Calorie level is most effective, and what rate of loss may be considered advisable. The proportion of fat, protein, and carbohydrate in the diet is believed to be significant by some workers (21,38,92,93,130) while others maintain the frequency of food intake plays an important role (4,20).

The Calorie levels suggested range from zero to 2000 Calories. Fasting regimes are a relatively new approach to dieting and appear to be attracting a considerable number of followers. Bloom (6) placed 9 obese patients on a fasting program for a period of 4 to 9 days, and found weight loss averaged 2.6 to 2.7 pounds per day. He felt that fasting had considerable merit in that it altered the patient's satiety level. A great part of this weight loss was probably

due to shifts in fluid balance (127). The possible hazards of fasting are pointed out by the American Medical Association (127).

Intermittent periods of fast were suggested by Duncan, and coworkers (25), followed by diets of 1300 to 1900 Calories. Wishnofsky (127) points out, in reference to a study on fasting that 63 per cent of total weight loss was body protein. Since body protein retains 3 parts of water, as soon as the patient resumes eating, replacement of body protein will cause retention of water and a rapid weight gain. The physiologic dangers of prolonged negative nitrogen balance in fasting have been questioned (51,61,84,130).

Diets of 400 Calories, combined with exercise, were used by Strong, Passmore and Ritchie (108), and found to effect an average weekly weight loss of 4.7 to 6 pounds. The patients were hospitalized for a period of 40 to 45 days. No adverse effects on health were noted and the patients did not suffer from excessive hunger. The composition of the weight lost was calculated to be 73 to 83 per cent fat, 4 to 7 per cent protein, and 10 to 23 per cent water. Strong and others (107) have also reported success on diets of this Calorie level.

The low Calorie diet most often advocated is one of high protein, moderate fat and low carbohydrate. This pattern has been recommended by Young et al (128) and used with considerable success. It most nearly meets the protein needs

of the patient, provides a sense of satiety and prevents excessive fatigue. In a study of college women placed on a 1400 Calorie diet, the average weight loss per week amounted to 2 pounds; there was a slight fall in basal metabolism with weight loss and a lowered retention of phosphorous and calcium. Some subjects were in negative nitrogen balance, even with a high protein intake (61,62).

The feasibility of low protein diets has also received some attention. Dole et al (24) claims that a high protein diet is not of any particular benefit to the patient. His findings suggest that high protein actually increases appetite. A study with 42 obese hospitalized patients provided no definite proof that the weight loss was the result of the restricted protein. It may have been as easily due to a change in the patient's eating habits. Unfortunately, no measurement of fluid losses were recorded. A low protein diet is frowned upon by most authorities as considerable damage may be caused to vital body organs if such a program is carried out for an extended period or without proper medical supervision (51,130).

Again some authors feel that carbohydrate should be severely restricted (118) but the evidence to date suggests that as long as minimum protein needs are met, the balance of the Calories may be chosen to suit the individuals food preferences (94).

One of the first to suggest that a high fat diet was an effective means of reducing was A.W. Pennington (92,93). He postulated the theory that obesity was due to a defect in the intermediary metabolism of carbohydrate resulting in an excess accumulation of pyruvate which in turn depresses fat oxidation and increases lipogenesis. This leaves less fat free for energy and, consequently, appetite is increased. Miller and Thomas (80) examined blood pyruvate levels of 16 obese persons and found that these levels were elevated, only after moderate exercise. This increase was considered a result of circulatory inadequacy rather than defective carbohydrate metabolism. Taller (115) has emphasized Pennington's theory in the book "Calories Don't Count." He quotes amazing success with 93 patients, although data are presented for only 7. He has also used the findings of Kekwick and Pawan (53). These workers conducted a study with 14 obese patients placed on three types of 1000 Calorie diets for a period of 7 days. The diets consisted of 90 per cent fat, 90 per cent protein, and 90 per cent carbohydrate respectively. The greatest weight loss occurred with the high fat diet, and the least with the high carbohydrate diet. The weight loss was not associated with a significant loss of body protein. A remarkable resistance to ketosis was observed in all patients. The idea that a high fat diet might be useful in reducing stimulated further

research by other workers.

Kinsell (58) placed an obese girl on an 800 Calorie diet. An initial weight loss occurred, but then it levelled off. She was then put on a 600 followed by a 400 Calorie diet. Kinsell found that, at the lower level, there was a minimal weight loss when all the Calories were from protein and a rapid weight loss when Calories were provided by carbohydrate or fat. A peculiar finding of this study in the case was the positive nitrogen balance on high protein, 400 Calorie diet. This was interpreted to mean that she possessed unusual ability to conserve protein.

Pilkington et al (94) believed that the length of the diet in Kekwick's study was much too short. He conducted an experiment for a total of 54 days, varying the composition of the diet every 18 days, from high fat to high carbohydrate. Analyzing the weight loss, he found no significant difference related to composition of the diet. Weight loss during the first few days on each diet was attributed to changes in fluid balance. Since the weight loss levelled off within each period, he concluded that it was the Calorie level <u>per se</u>, rather than the diet composition, that was effective in achieving weight reduction. Findings of Fletcher et al (38) support Pilkington's conclusions. Ohlson and coworkers (84) found that initial weight loss was higher with a high fat diet, but after a 3 week period the total amount of weight lost was

the same as that for a high carbohydrate diet. However Ohlson (84) explained the slower loss of weight associated with a low fat diet as a result of a decrease in energy expenditure, a high fat diet providing a greater sense of well being, increased activity, and subsequently a more rapid loss of weight. However, Fletcher reports that Weiner (38) found no significant difference in weight loss between high carbohydrate and fat diets.

Taller's diet instructs the patient to eat as much fat as desired but to avoid carbohydrate foods. By restricting carbohydrate foods, this diet in effect becomes a low Calorie regime as most foods containing fat also contain an appreciable amount of carbohydrate. Yudkin and Carey (133) tested this approach to dieting with 6 obese adults. Rather than increase the fat and protein, the subjects reduced their carbohydrate intake to a level of 40 to 50 grams. The resultant weight loss was thus due to a low carbohydrate, low Calorie diet rather than a high fat diet.

Formula diets providing approximately 900 to 1000 Calories have been used successfully in the initial period of reducing. Roberts (98) studied a group of 57 patients on a Metrecal formula diet, that contained 30.5 per cent protein, 19.5 per cent fat and 50 per cent carbohydrate. He felt that product could be used to start a patient on a reducing diet and to provide an opportunity to re-educate

the patient with respect to food habits and dietary control. He also felt it might be used intermittently with a low Calorie diet to speed up weight loss and so offer encouragement to the patient. The main objection to formula diets is that lay persons may use them as a means of reducing quickly and thus fail to learn proper eating habits.

Many obese individuals consume the bulk of their Calories at night (109). This pattern is defined as the "Night-Eating Syndrome." Women have been found to be especially guilty of this and they are completely unaware of the amount of food consumed. Jolliffe (52) emphasizes that when such persons are reducing, Calories allowed in the evening must be severely restricted.

Cohn (20), in work with rats, demonstrated that the frequency of food intake may be of significance in the development of obesity. Rats, given meals rather than allowed to nibble ad libitum, showed an increase in body fat stores, decreased body protein, a change in enzyme activity, altered thyroid activity, and an increased incidence of diabetes. As a result of these findings, he postulated that when too much food is ingested at one time, the pathways of metabolism are affected, so that amino acids, instead of being used for synthesis of body protein, are diverted to form glycogen and fat. Before this theory can be applied to man, more research is needed.

A reducing diet will never be successful unless the therapist gains the full co-operation of the patient (10, 37, 44). This co-operation will depend on a number of factors: the diet itself, the therapist-patient relationship, and the emotional stability of the individual (37). The diet should be low enough in calories to ensure an adequate and gradual weight loss, and nutritionally balanced to maintain proper health. It should be one which the patient is able to understand, afford, obtain, vary, and follow for a long time. The patient should not be excessively hungry or experience undue fatigue. The literature suggests that some persons may feel better on diets of different composition and that eating smaller meals at more frequent intervals may be beneficial for some. Eating slowly may also have its advantages.

The relationship between the therapist and the patient is considered to be a crucial factor influencing the success of a reducing program (44). At the very outset of this relationship, the patient should examine his motives and goals. If these goals are unrealistic, dieting will prove an added source of discouragement and frustration. The therapist should not over-emphasize the inherent dangers of obesity nor the rewards of dieting. Reducing must be approached from a rational point of view. It must not become the means by which a person achieves beauty, success, or self-confidence. This is a period of re-education for the patient, a time to

learn good food habits, the Calorie value of foods, the value of moderate exercise, and the principles of energy balance. The therapist should attempt to remain objective in his approach, and should continue to follow the patient's progress for a considerable period of time. This also implies that he be alert to the symptoms of emotional distress as described by Hamburger (44). Depression is frequently associated with reducing and complaints of fatigue, loss of appetite, or crying spells may be a signal to counsel the patient and perhaps discontinue dieting (44).

The individual who is emotionally stable and decides to reduce for the sake of health, or appearance, will probably meet with success on a reducing program (101). For persons whose obesity is associated with severe emotional or psychological disturbances, reducing may only exaggerate their problems, especially if they fail to achieve the weight loss desired (12,44). A drastic change in eating habits may represent for some persons a severe disturbance in emotional security. The maintenance of the obese state for these individuals may be, as Bruch suggests (14), a protection against more severe emotional distress.

The obese person on a reducing program is facing a very difficult period in his life. Even if he is emotionally well balanced, a new food and activity pattern must be established. A great deal of encouragement is needed to achieve success.

A number of psychological tests have been used to determine the emotional stability of obese persons. Shipman (101) has devised a combined anxiety and depression test which, he claims, will enable the physician to assess the probability of success on a reducing diet. This test was administered to a group of 124 obese persons, 72 of whom were attending an obesity clinic, the remainder being private patients. All levels of socio-economic status were represented. The anxiety scores were found to be related to dieting success, being low for the successful dieters, and high for those who failed to lose weight. The initial depression scores appeared to be more closely related to the success of the clinic group, than to the success of the private patients. Other factors considered relevant to successful reducing were age, socio-economic level, degree of obesity, and marital status. A favourable emotional state was considered to be essential to successful dieting. It was further noticed that psychological factors had a more pronounced effect after one month of dieting. Until this time, weight loss was not believed to greatly influence physical or psychological stress. To learn the true diagnostic value of Shipman's test, more data must be collected. However, it may serve as an aid to physicians and nutritionists in directing individual and group weight reduction programs.

Because the individual treatment of obesity has met with such little success, a new method has been suggested, namely group therapy. Simmons (102) describes this method as a somewhat undefined procedure, being neither psychotherapy nor a class in nutrition, but rather a social grouping of persons sharing the same problem and trying to do something about it. It affords the opportunity to each member to have his problem recognized and,at the same time, receive support from other sympathetic members. The group determination may provide enough incentive to enable the individual to follow a diet and lose weight.

A four year study conducted by Simmons investigated the benefit of the group weight reduction program (102). Four hundred and fifty over-weight persons volunteered for the study. A physical examination, a health questionnaire, and nutrition interviews as well as numerous psychological tests were involved. The subjects were divided into two groups, those below and those above age 40. Sixteen weekly meetings were held. This program met with a fair degree of success as 40 per cent lost 15 pounds or more during the study period. A follow-up after 1, 2 and 3 years showed that 37 per cent could be considered successful after 1 year, while 47 per cent had not gained after 2 and 3 years.

Suczek (113), on the other hand, believes that only those

who are not emotionally maladjusted can make use of the group method. He stressed the importance of the psychological attitude of the obese person. The Herrick control study (102) of 100 obese women identified 6 distinct psychological groups, each with its own level of anxiety, interpersonal behaviour, and security operations which can be distinguished clinically as well as with psychological tests. There is general agreement in the literature about the importance of the symbolic value of food and a large body size to the obese individual (112,113). It is also agreed that these attitudes must change before effective weight reduction can occur (101,113). Suczek claims that the results of the group method are similar to those achieved by individual treatment. Generally more than half of the members lose weight while in the group but only a small proportion are able to maintain this weight loss.

Brosin (10) suggests that those who depend on food to allay disquieting feelings can alter their eating pattern when circumstances change so that "satisfactions" are provided by other means. This helps to explain "the success of the social clubs formed by obese persons, modelled on Alcoholics Anonymous because these organizations offer much companionship and realistic support." Such groups do provide "supplies" for some, but once an individual leaves the group he no longer has the comfort, support or sympathy of the

other members, and so resorts to former eating habits. Those who are unable to make use of these "supplies" cannot lose weight. The members who lose weight and maintain their weight loss probably represent the individuals whose obesity is not related to emotional maladjustment. This successful group would include the constitutionally obese, whose goals are realistic, and who are able to change their attitudes to eating, fairly easily. Suczek (113), using the "Interpersonal Dimensions of Personality System" to assess psychological attitudes, found no changes in the attitude of 100 obese women after group therapy.

On the positive side, group programs do afford recognition of the human aspects of dieting. Simmons (102) feels that its greatest merit may be as a preventive approach to overweight. The method has great potentialities. Present group programs could be immensely improved by the combined efforts of physicians, psychiatrists, nutritionists, and social workers.

METHOD

A group of 25 women, members of the Winnipeg Branch of the Streamliners Club, was selected for a study of food intake, energy expenditure, and response to a reducing diet. The Streamliners Club is a social organization whose specific purpose is to assist overweight women with reducing. To qualify for membership, the woman must be at least 20 pounds above the ideal weight and have approval of her physician to embark on a reducing program. Immediately after joining, each member is given a 1200 Calorie diet. At each weekly meeting, the women are weighed, and then participate in one hour of supervised physical exercise. Those chosen for this study had expressed interest when approached by an executive member of the club.

On the basis of previous weight loss, women were arbitrarily divided into 2 groups. Members of Group 1 were considered to be resistant to weight loss, i.e., non-successful dieters. Those in Group 2 were maintaining a steady weight loss and so were classified as successful dieters. A group of 8 women composed of professional students served as controls. The control group was similar in age but not paired with respect to occupation.

General information concerning weight record, food habits, and activity pattern was obtained through a questionnaire (See Appendix A).

To determine the body build of each subject, wrist measures and height were used. The ideal weight for this frame was taken from the Metropolitan Life Insurance Company's Table of Desirable Weights for women (79), (See Appendix C). The percentage above ideal weight was then estimated for each subject.

A seven day record of food intake and activities was obtained for the 34 subjects. Most workers consider the 7-day record to be more representative of usual food intake than records of a shorter duration (29,39,78,100,117,120,132). Widdowson and McCance (123) states that while a week is the shortest time for which a dietary study should be made, results for one week are probably fairly representative of the person's accustomed food intake. While some authors have found no significant difference between the 3- and 7-day averages (131), 3-day records are reliable only when studying large groups. Each woman was interviewed and instructed as to the proper technique of recording food intake and activities. The instructions and sample food record are found in Appendix B. It was originally intended that all women be visited during the 7-day period, but this proved to be impossible and contact was kept with the subjects by telephone.

Food records were analysed using the "Table of Food Values Recommended for Use in Canada," (82) and "Food Values

of Portions Commonly Used," prepared by Bowes and Church (19). The mean daily Calorie intake, and percentage distribution of Calories in terms of protein, fat, and carbohydrate was calculated. The Calorie value for foods not found in either of the two sources, was calculated from the recipes provided by each subject. Approximate serving sizes had to be estimated when meals were eaten away from home.

From the food records the number of breakfasts eaten and the frequency of between meal and bed-time snacks were estimated. Activity records were analysed and each activity grouped into one of 3 categories, namely Maintenance, A, or B, as designated by the Canadian Dietary Standard (See Appendix E, Table 2). Energy expenditure was estimated by multiplying the Calorie expenditure per kilogram of body weight by the number of minutes spent in each activity. Tables used were those prepared by Durnin (87)(See Appendix E, Table 1). Some of the records were kept in considerable detail and provided an accurate approximation of energy expenditure. The per cent of time spent in each category was also noted.

It is generally accepted that obese persons have a higher energy expenditure than persons of normal weight. However, the energy expended in any activity by excessively obese individuals is not directly proportional to their body weight. The Calorie expenditure when based on actual weight gave extremely high values which did not relate to the weight change

observed during the 7 day period. However, using the ideal weight as a reference, the predicted weight change more closely approximated the actual. As a further means of comparison, energy expenditure was calculated from the Canadian Dietary Standard, with both ideal and actual weight as a reference. From the metabolic body size, the Calorie cost of maintenance activity and the cost of 8 hours spent in A category activities was calculated. The approach suggested by Jolliffe (52) to assess Calorie requirements was also calculated (See Appendix E, Table 3) and compared to the figures derived from the other methods. This method makes an allowance of 4 Calories for each pound of excess weight over the requirement for women of a specified age and height (52).

As a measure of activity level, some of the women wore a pedometer for a period of 3 to 7 days. The total mileage as recorded by the pedometer reading was adjusted for the individual's stride to arrive at the average number of miles walked per day. As an added item of interest to the study the psychological quiz developed by Dr. Shipman (See Appendix G) to assess the potential success on a reducing sequence was given and the results compared with the actual progress of the individual.

Following the food and activity records, a 1000 Calorie diet was given to 23 subjects to be followed for a period of 4 weeks. The diet was calculated to provide 60 grams protein,

35 grams fat, and 110 grams carbohydrate. Based on the Exchange system , two diet patterns were offered (See Appendix H), along with instructions for following the diet. Dietary scales were also provided to insure the proper measurement of food. Weights were recorded at the beginning and end of the reducing program. The predicted weight loss was compared to the actual using Calorie requirements as determined by the Jolliffe method.

A three month period elapsed between the time of recording food intake and activities, and the beginning of the 1000 Calorie reducing diet. A record of the weights of the women in Groups 1 and 2 during this period made it possible to compare the weight lost by each group. It was also possible to trace the long range pattern of weight reduction for those members who had belonged to the club for a number of years.

DISCUSSION OF RESULTS

A study involving human beings is never perfectly controlled. A researcher in the physical sciences can control all the variables in an experiment and achieve reliability and reproducibility of results. In animal studies, the genetic factors may be controlled, and the animals given exactly the same treatment, i.e., the same ration, and raised under the same conditions. However the results may be affected by unforseen factors or constitutional differences of the animals. For the nutritionist studying human beings, the problem is far more complex. In addition to the variables involved in animal experiments, such studies are subject to the inconsistencies typical of human behaviour. Any random sample of individuals will present differences in genetic makeup, as well as biochemical individuality, and varied nutritional background resulting from diverse cultural, social and psychological environment. Although the individuals participating in a study may undertake the project with the most sincere intentions, personality problems, emotional crises, illness, unexpected pregnancy, and pressing social demands, may interfere with the degree of cooperation. A certain amount of control may be exercised over the environmental factors, in specific types of studies, for example, facilities may permit the hospitalization or confinement of the individuals in question. But in many cases this is neither possible nor

practical. In fact, the abnormal aspects of such controlled conditions may result in findings not applicable to normal living. This study was conducted within the home situation and as such was influenced by various environmental factors. However the limitations presented by the absence of control do not, in any way detract from the significance of the results, for the information gained by this research can only enhance the present understanding of the problem of energy balance and obesity.

DESCRIPTION OF SUBJECTS

Thirty-three women participating in the study were divided into 3 groups: Group I, 14 unsuccessful reducers; Group II, 11 successful reducers; and Group III, 8 control subjects selected from among the staff and students in the School of Home Economics. Characteristics of the 3 groups are summarized in Table 1. Eight of the women in Group I had been members of the Streamliners for 8 years, whereas the majority of those in Group II had belonged to the club less than 1 year. The extended length of membership of those in Group I indicates a longstanding and obviously unsuccessful attempt to lose weight.

The three groups were similar with respect to age and height. The mean weight was 190, 173 and 140 pounds for Groups I, II, and III respectively. The percentage above

TABLE I. Characteristics of three groups of women participating in the study.

Characteristic		Group Designation I	II	III
Number in group		14	11	8
Age	Range	23-60	20-50	20-51
	Mean	40	31	33
Weight (lbs)	Range	148.5-2605	140-204.5	114-163
	Mean	190	173	140
Above Ideal Wt. (%)	Range	12-80	11-64	
	Mean	39	35	
Had previously reduced (%)		99	99	25
Gained weight during pregnancy (%)		64	58	
History of overweight (%)		29	45	38
Taking appetite depressants (%)		14	27	0
Taking thyroid preparations (%)		21	0	0
Occupation (%):	Homemakers	86	73	0
	Employed or students	14	27	100
Participating in Active Sports (%)		29	36	25
Daily Exercise Program (%)		0	45	0

ideal weight ranged from 12 to 80 per cent in Group I, and from 11 to 64 per cent in Group II. The controls were considered to be within the normal weight range for their age and height.

The age of onset of obesity ranged from 11 to 35 years in the first group, and from 6 to 25 years in the second group. More than half of the women in both Groups I and II reported added weight gained as a result of pregnancy. Fewer members in Group II had made previous attempts at dieting as compared to those in Group I. Some of the women in the first group had reduced as many as 8 times. This repeated effort at reducing was reported by Maretzki and Dodds (66), who found 77 per cent of their subjects had dieted many times. All of the dieters had regained weight after a reducing program while 36 per cent of the unsuccessful reducers, and 54 per cent of those in Group II had regained more weight than was previously lost. Other workers have found obese persons to show a gradual weight gain after dieting is discontinued. This appears to be an insidious process which few escape.

More women in the second group reported a family history of overweight than did the other 2 groups. Questions regarding the use of anorexants and thyroid preparations revealed that twice as many of the successful reducers were taking appetite depressants as compared to the unsuccessful reducers, whereas

21 per cent of Group I were taking thyroid preparations as compared to none in the second group.

Only 14 per cent of the women in Group I worked outside the home whereas this figure was doubled in Group II. This may in part account for the better success of the second group as there could be less opportunity to become preoccupied with food and perhaps greater motivation due to more frequent contact with other people.

The questionnaire attempted to discover the subjects attitude toward food, to find whether overeating was a response to emotional problems, and if the groups differed with respect to food habits. Seventy-one per cent of Group I, 54 per cent of Group II, and 50 per cent of Group III reported that they ate more when they were bored. Fifty-seven per cent of Group I, 36 per cent of Group II and 12 per cent of Group III ate more when they were lonely. Seventy-eight per cent of Group I, 45 per cent of Group II and 12 per cent of Group III ate more when depressed and 85 per cent of Group I, 18 per cent of Group II and 25 per cent of Group III ate more when annoyed. Thus it appears that the eating pattern of the unsuccessful dieters showed a greater relation to emotional stress than did that of either of the other groups.

CALORIE INTAKE

A summary of the mean daily calorie intake is presented in

Table 2. For Groups I, II and III the mean daily Calorie intake as calculated from the 7 day food records was 1434,1259 and 2007. Although Group II appeared to be consuming fewer Calories per day than Group I, by *t* test the difference was not statistically significant. An analysis of variance did discover a significant difference between the Calorie intake of the 2 groups. A difference of even 200 Calories per day over an extended period of time could account for a considerable difference in rate of weight loss. Polack (45) points the fact out dramatically when he states that an extra 10 to 15 Calories per day over a period of 10 to 15 years may result in a gain of 10 pounds. The mean Calorie intake for Groups I and II were considerably lower than that of the controls.

There was wide individual variation in the Calorie intake of both Groups I and II, ranging from a level of 645 Calories to 2102 Calories per day. This represents a significant finding as all the women in both groups had been given a 1200 Calorie diet when joining the club and the majority believed they were following it fairly closely. Many reasons could probably account for the extremely low levels, the most obvious being excessive zeal in reducing, but omitting breakfast, lack of appetite or use of anorexants may also be contributory factors. At the other extreme, poor food habits such as omission of breakfasts, with between meal and bedtime

TABLE II. The mean daily Calorie intake and expenditure for three groups of women calculated from seven-day food and activity records.

Group	No	Calorie Intake				Calorie Expenditure				
		Mean Daily Intake	Percentage Distribution			Mean Daily Expenditure *	Percentage Time			
			Prot.	Fat	CHO		Maint.	A	B	Sleep
I	14	1434	18	38	44	2419	36	30	2	32
	SD	346	2.9	4.4	3.0	206	8.1	8.9	1.4	6.2
II	11	1259	21	41	39	2314	37	26	4	34
	SD	429	5.6	7.2	4.5	193	7.9	6.5	4.0	6.0
I and II	25	1347	20	40	42	2373	37	28	3	33
	SD	387	4.4	6.1	4.6	203	7.1	8.1	3.0	6.1
III	8	2007	14	43	43	2231	54	11	1	34
	SD	400	1.7	3.0	4.1	293	2.2	6.2	0.1	7.5

* Calculated from tables of energy expenditure by Durnin (87) and based on ideal weight.

snacks, ignorance of serving sizes, lack of knowledge concerning calorie values of food, poor adherence to diet, and social and family obligations, could account for the extremely high values.

Calculation of the percentage composition of the diet showed the percentage protein to be similar for all 3 groups. The average daily protein intake ranged from 40 to 79 grams in the first group and from 35 to 108 grams in the second group. The range for the controls was from 48 to 91 grams. The mean daily intake for each group was very similar being 63, 62 and 64 grams of protein per day. A comparison of the protein intake with the Canadian Dietary Standard for minimum (0.4 gm/Kg body weight), and recommended daily allowance (0.7 gms per kilogram of body weight) showed that the protein intake of 7 subjects in Group I, and 3 in Group II, fell below the recommended level. One subject in Group II, with an average daily intake of 645 Calories was consuming only 0.38 gms of protein per kilogram of body weight, indicating a sub-minimal protein intake. It is alarming to think that in their efforts to reduce quickly such a large percentage of both groups were consuming precariously low levels of protein. The possible dangers of prolonged low protein intake have been stressed by many authors (11,128), and it has been repeatedly found that, in such instances, body protein is being sacrificed to meet

energy needs. Low protein diets have been shown to be associated with a considerable loss of body water. Since the replacement of 1 pound of body protein involves the uptake of 3 pounds of body water, the relative ease with which some of the women gain weight may be the result of a loss of body protein stores rather than fat. The erratic weight loss pattern of Subject #20 appears to confirm this hypothesis. She loses weight very quickly, but as soon as her intake increases slightly she shows a rapid increase in weight. There also appears to be some difference between the groups with respect to the mean percentage of Calories contributed by fat and carbohydrate. Groups I had a higher intake of carbohydrate foods, than Group II. Many workers have advocated severe restriction of carbohydrate foods on a reducing diet, as they appear to stimulate appetite and provide less satiety than foods composed largely of protein or fat. It would be interesting to see if the bulk of these carbohydrate Calories were consumed in the evening, as this has been observed with many obese women (109). Group II had a higher mean fat intake than Group I. It is possible that the higher fat content provided enough satiety to enable the individuals in this group to maintain a lower Calorie intake. These findings are different from those of Maretzki and Dodd (66) who reported successful losers having a signifi-

cantly lower mean intake of fat and protein than unsuccessful losers.

An analysis of variance on the individual daily Calorie intake throughout the seven-day period for 25 obese subjects may be found in Table III. It shows a significant difference in the day-to-day variation in Calorie intake of each individual, as well as a significant difference in the daily intake between subjects. This lends support to the observations made at the beginning of the study, as it points out the fluctuations in daily intake of unsupervised persons during reducing regimes. It further emphasizes the need for more strict control over the reducing diet and for better instructions. The daily fluctuations may explain, in part at least, individual differences in rate of weight loss as well as the irregular patternof loss observed in some subjects. An analysis of variance with regard to differences between weekly and weekend Calorie intake would undoubtedly be revealing. Another point, which is well illustrated by these records, is the unreliability of food records of shorter duration than one week.

TABLE III. Analysis of variance for day and person to person variation in individual Calorie intake over a 7-day period.

Source	df	SS	MS	F
People	24	252,247,957	10,510,331	4.13**
Days	6	324,889,218	54,148,203	21.26**
Error	144	366,854,172	2,547.598	

** Significant at 1 per cent level.

The food habits of each group with regard to the number of breakfasts eaten and between-meals snacks during the 7-day food record were compared. The results, given in Table IV, show that 14 per cent of the unsuccessful dieters ate fewer than 3 breakfasts per week, whereas all the members of Group II and III ate more than 4 breakfasts. More between-meal and bedtime snacks were characteristic of Group I, as compared with the other two groups. In the questionnaire, 64 per cent of Group I, 36 per cent of Group II, and 12 per cent of Group III reported eating between meals. Eating at bedtime was reported by 64, 63 and 62 per cent respectively of the three groups. Examination of the food records showed that, although between-meal and bedtime snacks were common in all groups, they occured with greater frequency among the unsuccessful reducers. The "night-eating syndrome" common to obese subjects, has received a great deal of attention, for it is believed that this is the time of day when the bulk of Calories are consumed, and that the individuals concerned are unaware of this eating pattern. From this study, it appears that most of the subjects ate at night. All of the women in the control group were found to eat at bedtime, and this may be considered a typical eating pattern of this occupational group.

TABLE IV. Comparison of food habits characteristic of the three groups.

Group	No. of Subjects	No. of Breakfasts Eaten Per Week			No. of Between Meal Snacks Per Week			No. of Evening Snacks Per Week		
		None-3 %	4-6 %	7 %	None-5 %	6-10 %	11-14 %	None %	1-4 %	5-7 %
I	14	14	14	72	58	21	21	0	21	79
II	11	0	27	73	91	9	0	9	54	37
III	8	0	25	75	63	37	0	0	38	62

ENERGY EXPENDITURE

The mean daily Calorie expenditure was estimated from 7-day activity records for 33 subjects. Most of the activity records were carefully kept and are considered a reliable measure of activity. The records of subjects 9 and 16 were not recorded in sufficient detail, so only an estimate of Calorie expenditure was made in these cases. The time spent in each activity was multiplied by the Calorie cost of the activity per kilogram of body weight, as taken from tables of energy expenditure prepared by Durnin (see Appendix E, Table 1). For persons of normal weight, a reasonably close balance between intake and expenditure is to be expected, so that for all practical purposes, the Calories consumed should approximately equal those expended. It was found that using actual weight in the calculations, energy expenditure of the control subjects was very close to Calorie intake. When ideal weight was used, both values were surprisingly close (mean of 2007 and 2076 respectively). A similarly close balance between Calorie intake and expenditure over one week has been shown by Durnin and others (124).

However, when the Calorie expenditure for the obese subjects was calculated on the basis of actual weight, extremely high values were obtained, ranging from 2508 Calories per day to 4775 Calories per day. When the Calorie expenditure was

calculated from ideal weight, the predicted weight change came closer to that observed for most subjects (see Table V). This suggests that ideal weight is a better basis upon which to estimate calorie needs.

If energy requirement is more closely related to ideal than actual weight, then two contradictory explanations are possible. Either fatty tissue is metabolically inert or the obese are able to perform activities with much greater efficiency than the non-obese. Evidence that basal metabolism is higher in the obese contradicts the concept of completely inert fatty tissue. However it is also clear from observing the obese women that many have adapted to a heavy body size by eliminating needless movements. Based on ideal weight, and using Durnin's figures, the mean daily Calorie expenditure was similar for all three groups.

Calorie allowances proposed were also calculated using the formula for metabolic body size of the Canadian Dietary Standard from both ideal and actual weight. Another method suggested by Jolliffe (52) was also used. The mean daily energy expenditure for each group, as determined by five methods is presented in Table VI while the same data for each subject may be found in Appendix F, Table 3.

There was very little difference in the means of values for mean daily expenditure of the control group, as determined by the five different methods. This was because their weight

TABLE V. Weekly Calorie expenditure and intake and difference between predicted and actual weight loss for thirty-three women.

Subject No.	Actual Wt. (lbs)	Ideal Wt. (lbs)	Weekly Calorie Expend-iture**	Weekly Calorie Intake	Deficit	Weight Change (lbs) Predicted ***	Weight Change (lbs) Actual	Difference between Predicted and Actual
Group I								
1	161	125	14,830	9,229	5,601	-1.6	-1.0	0.6
2	229.5	153	18,387	9,119	9,268	-2.6	-1.0	1.6
3	158	127	14,999	10,785	4,214	-1.2	0	1.2
4	148.5	122	14,543	4,495	10,048	-2.9	*	
5	165.5	143	18,495	9,334	9,161	-2.6	-0.5	2.1
6	260.5	149	19,199	12,849	6,350	-1.8	+3.0	4.8
7	239	133	16,215	10,181	6,034	-1.7	+1.0	2.7
8	172	153	17,799	11,440	6,359	-1.8	-3.0	1.2
9	198	135	16,888	10,369	6,519	-1.9	*	
10	202	149	18,273	7,680	10,593	-3.0	-2.0	1.0
11	170	122	16,898	12,005	4,893	-1.4	-1.0	0.4
12	172	127	16,764	9,427	7,337	-2.1	+1.0	3.1
13	170	135	16,436	8,926	7,510	-2.1	-0.5	1.6
14	173	137	17,306	14,715	2,590	-0.7	-3.0	2.3
Mean	187		16,931	10,039		2.0	0.6	1.9
Group II								
15	154.5	133	16,355	6,209	10,146	-2.9	+1.0	1.9
16	190	133	15,335	8,402	6,933	-2.0	-2.0	0
17	175.5	143	16,548	12,285	4,263	-1.2	*	
18	190	115	13,185	11,732	1,453	-0.4	-4.0	3.6
19	204.5	125	15,303	6,422	8,881	-2.5	-3.0	0.5
20	199	139	17,675	4,512	13,163	-3.8	-3.5	0.3
21	176	131	16,928	14,357	2,571	-0.7	-1.5	0.8
22	170	118	18,162	9,963	8,199	-2.3	0	2.3
23	140	126	15,904	6,822	9,082	-2.6	-3.0	0.4

TABLE V CONTINUED

24	155	123	15,801	7,240	8,561	-2.4	-3.0	0.6
25	153	135	16,967	8,981	7,986	-2.3	-2.5	0.2
Mean	173		16,197	8,812		2.1	2.2	1.1
Mean for I and II			16,608	9,499		2.0	1.3	1.5
Group III								
27	126	126	14,059	9,091	-4,968	-1.4	-0.5	0.9
28	151.5	130	17,579	12,859	-4,720	-1.3	+0.8	2.1
29	129.5	127	13,593	14,874	+1,281	+0.3	0	0.3
30	143	126	16,444	17,662	+1,218	+0.3	0	0.3
31	144	135	17,157	15,720	-1,437	-0.4	0	0.4
32	114	126	12,371	15,896	+3,525	+1.0	0	1.0
33	163	143	17,937	11,218	-6,719	-1.9	0	1.9
34	147	130	15,786	15,083	- 703	-0.2	0	0.2
Mean	140		45,615	14,050		-0.5	+0.04	0.9

* Weight loss not obtained for these subjects.

** Based on Durnin's figures for ideal weight.

*** Assuming that a deficit of 3500 Calories is equal to 1 lb. weight loss.

closely approximated ideal. For the obese subjects, the figures derived from Durnin's tables gave values which were very close to those using the Canadian Dietary Standard for metabolic body size with ideal weight. When actual weight was used, the Calorie requirements calculated from the method of the Canadian Dietary Standard gave slightly lower figures than Durnin. Mean Calorie expenditures as estimated by Jolliffe's method was much lower than that obtained by either of the other methods. Durnin claims that Jolliffe's figures underestimate actual energy expenditure (26).

TABLE VI. Mean daily Calorie expenditure for three groups of women calculated by five methods

Method	Mean Daily Calorie Expenditure		
	I	II	III
Durnin (ideal wt.) mean	2419	2314	2076
Durnin (actual wt.) mean	3330	3123	2231
Can.Dietary Stand.(ideal wt.) mean	2480	2378	2408
Can.Dietary Stand. (actual wt.) mean	3090	3013	2540
Jolliffe (58) (actual wt.)	2294	2295	2238

It is apparent that estimating the energy needs of obese persons is a difficult task. Even with people of normal weight, individual variation permits only an approximate estimate of actual energy expenditure. The method of calculating

Calorie requirement by the time spent in different activities may, as Elliot, Patton and Singer (34) suggest, be unsuitable for use with housewives, as they may be doing several tasks at the same time. Individual variation may be even further exaggerated in the obese. Because of this, more accurate measuring devices are necessary.

It had been hoped that basal metabolism tests could have been performed on the obese women, in order to examine individual variation in basal requirement, at least. However, due to the time of year and difficulty in making arrangements, it was not possible to carry this out. The results of this study suggest that the energy expenditure of obese persons lies somewhere between the values for ideal and actual weight. Other workers have indicated a relationship between energy expenditure and body weight, but the exact nature of this relationship has not been defined (26, 87).

A comparison of the three groups with respect to the per cent of time spent in various activities is presented in Table II. A description of the categories designated as maintenance, A, B, and C, as outlined in the Canadian Dietary Standard, is provided in Appendix E, Table 2. The time devoted to maintenance activity was similar for both Groups I and II. The only significant difference between the two groups was in the B category of activity. Group II spent 4 per cent of their time in this category as compared with 2 per cent for

Group I. There was no significant difference between the two groups for calculated mean energy expenditure. The successful reducers spent slightly more time in maintenance and sleep and less in the A category. Although the difference in time spent in B category activities is small for both groups, it could, as with food intake, account for the greater weight loss of the successful reducers if continued over an extended period.

As previously mentioned, the control group was not paired with respect to occupation, and they spent the most time in maintenance activity and the least in the B category of all 3 groups. It would have been helpful to have included housewives and mothers of young children in the control group. The 3 groups spent one-third of the day in sleep, which is considered to be average for most people.

The level of Calorie expenditure of each group, as well as the time spent in various activities, agrees with the suggestion of the Canadian Council on Nutrition that the majority of Canadians belong in the A category of activities. Previous standards have overestimated the energy expenditure of housewives. Durnin, on the basis of various studies, classifies housework as sedentary and points out that, although it may be mentally taxing, the time spent in heavy work is relatively small, and so does not increase the overall daily energy expenditure (28).

The pedometer has often been employed to assess the activity level of individuals. The range of distance walked per day by subjects in Group I and II are given in Table VII. The distance walked by each subject may be found in Appendix F, Table 4. One subject in Group I walked a record 8 miles per day. The average distance walked by members of Group II was 2.5 miles per day, ranging from 0.6 to 5.3 miles. It was unfortunate that more subjects were not able to participate in this part of the program, for a more accurate estimate could then have been made for the level of activity characteristic of each group. The only observation which may be made is that there appears to be a wide individual variation in the distance walked per day.

TABLE VII. Distance walked per day by ten subjects as measured by pedometer.

Group	Number	Distance Walked Per Day (miles)	
		Mean	Range
I	3	*	0.3 - 8.0
II	6	2.5	0.6 - 5.3

* Due to small number of subjects participating, and the one extreme case who walked 8 miles, the mean value is considered meaningless.

PATTERN OF WEIGHT REDUCTION

A record of the weight loss for Groups I and II was kept for the period of October to February. The pattern of weight loss for the 2 groups during this period is presented in Table VIII. Only 3 women in Group I lost weight during this period as compared with 9 in Group II. Eleven of the unsuccessful reducers gained weight. One woman in this group gained 20 pounds. Only one subject in Group II gained weight while one remained the same. A weight gain over a holiday period frequently occurs with many reducers, and is probably a result of social and family obligations.

Figure 1 illustrates the pattern of weight loss for 2 unsuccessful reducers over a period of 8 years. Both of these subjects are extremely overweight, and both show extreme fluctuations in weight. It appears that each weight loss is followed by a gain which brings total body weight to a higher level than that previous to the weight loss. Figure 2 illustrates the pattern of weight loss for some of the other subjects in Group I. It will be noted that many of these women weigh more now than when they joined the club. For those subjects who have been members for only 1 year, the pattern of weight reduction is exemplified in Figure 3. It may be observed that some of the successful reducers have been maintaining a steady, yet gradual, weight loss, while others,

TABLE VIII. Percentage of each group showing weight loss and gain over a three month period.

Group	No.	Weight Loss			No Change	Weight Gain		
		0-9 lbs.	10-19 lbs.	Over 20 lbs		0-9 lbs.	10-19 lbs.	Over 20 lbs
I	14	22	0	0	0	57	14	7
II	11	45	36	0	9.5	9.5	0	0

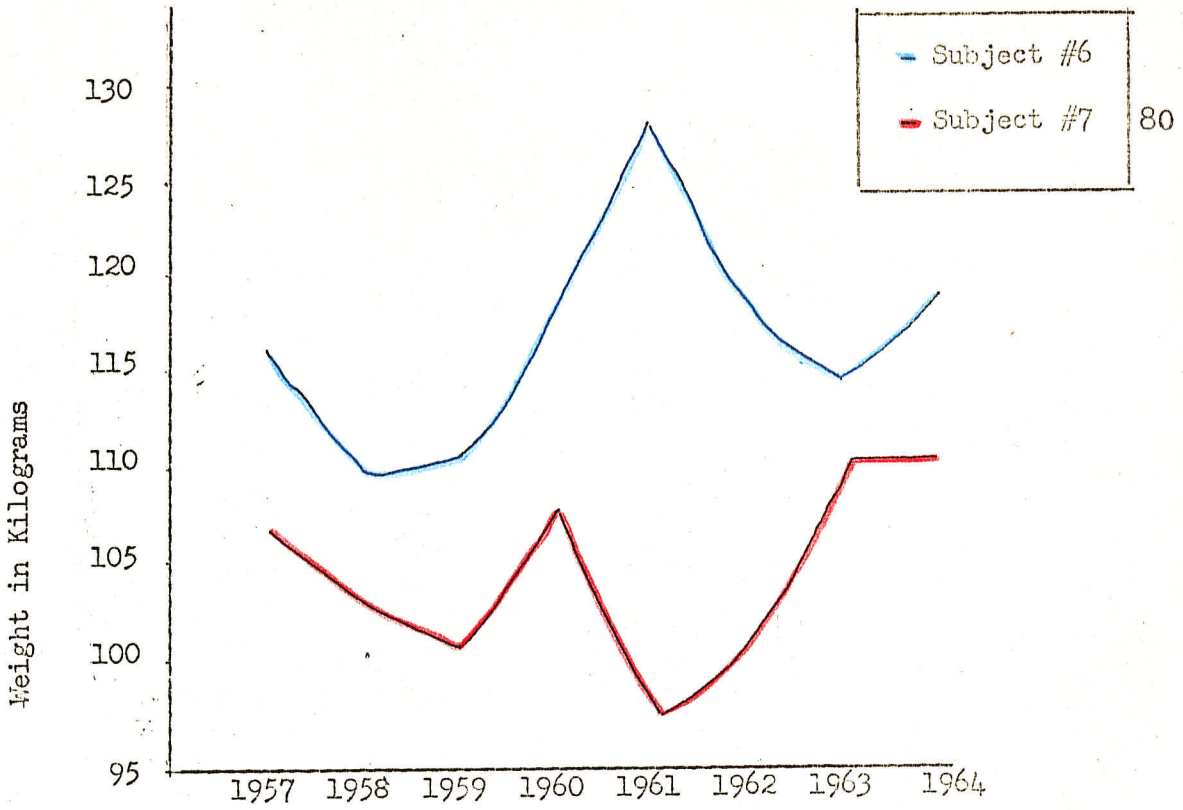

Figure 1. Pattern of Weight Loss for 2 Obese Women

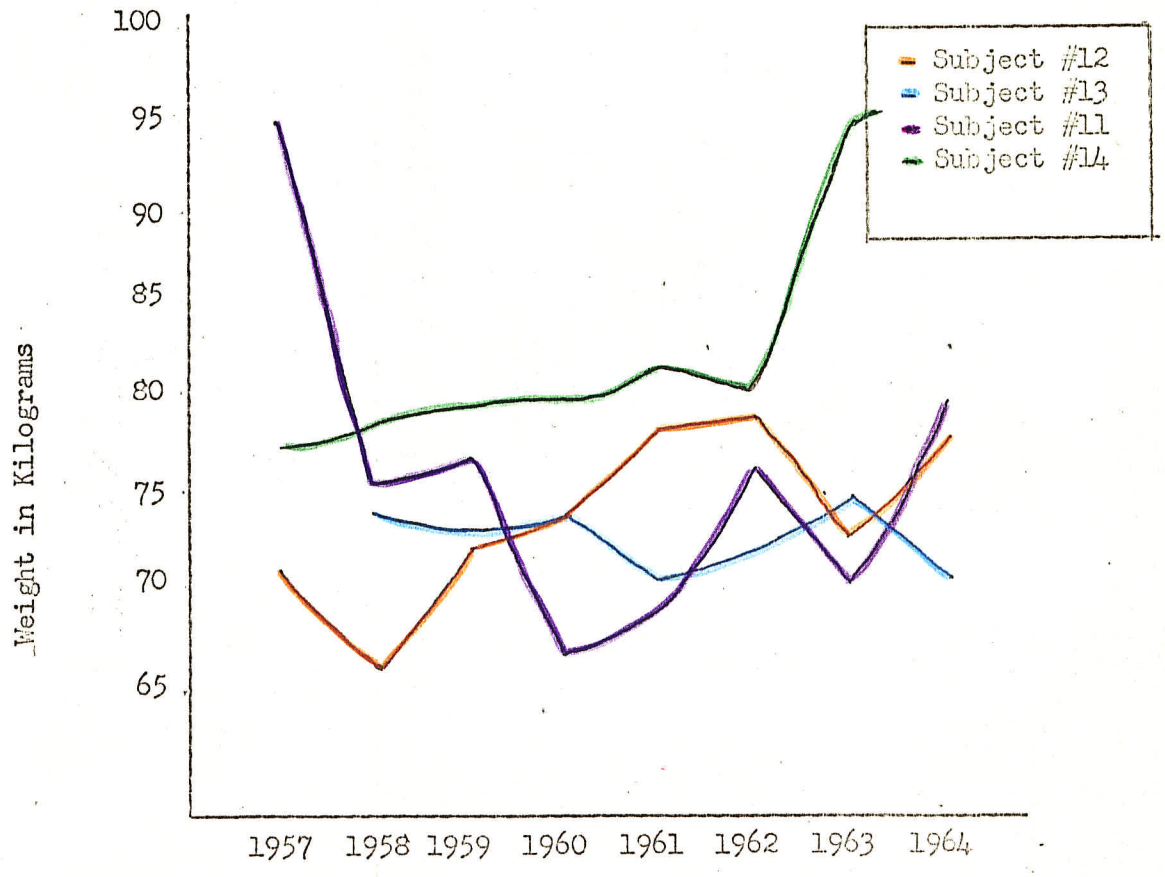

Figure 2. Pattern of Weight Loss for 4 Obese Women

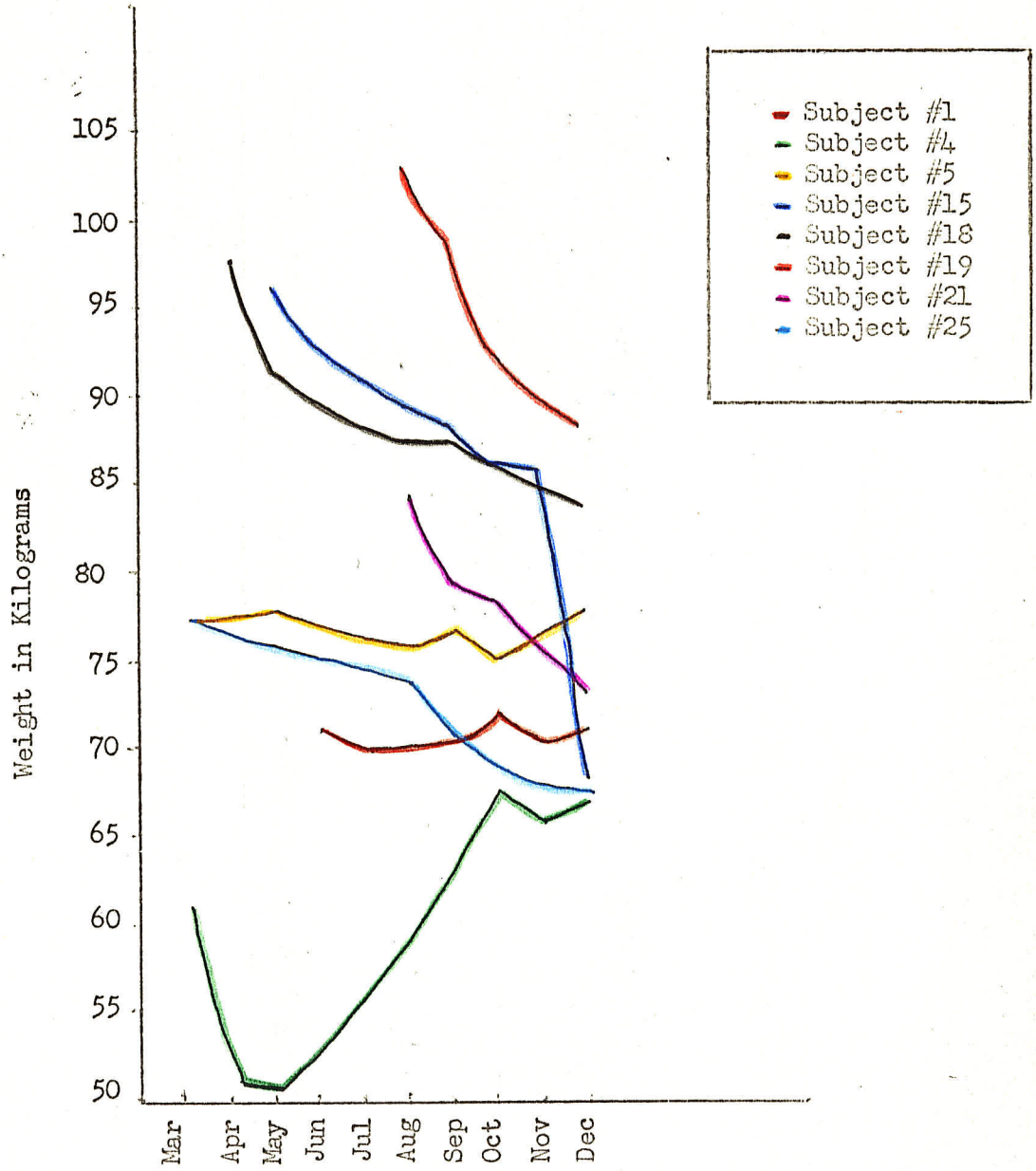

Figure 3. Pattern of Weight Loss for 8 Subjects Over 8 Month Period.

such as Subject #15, show a sharp decline in weight. All of the unsuccessful reducers have, in spite of some weight loss, gained weight since joining the Streamliners.

ANXIETY-DEPRESSION SCALE

The mean scores made on Shipman's Anxiety-Depression test by the three groups are given in Table IX.

TABLE IX. Mean anxiety and depression scores on Shipman test for three groups of subjects.

Group	Score	
	Anxiety	Depression
I	7.6 ± 5.1*	11.4 ± 2.5
II	8.9 ± 4.5	10.6 ± 1.8
I and II	8.2 ± 4.6	11.1 ± 2.2
III	2.6 ± 2.5	9.3 ± 1.4

* Standard deviation

(Individual scores are seen in Appendix G, Table 1). The successful reducers appeared to have a higher score for anxiety than the unsuccessful reducers, whereas the score for depression was slightly lower. However, this difference was not statistically significant. Both Groups I and II had higher scores for anxiety and depression than the control group. The mean scores do not appear to indicate any difference in

the probability of success between the 2 overweight groups. This may be due to the small number of subjects in each group. Some of the individual scores appeared to be related to success in dieting. Subject #7, who weighs 247 pounds, scored 16 on anxiety and 15 on depression. She has been overweight for a number of years, and repeated attempts at reducing have met with little success. Subject #2, on the other hand, has also lost very little weight since she joined the club in 1961 and yet she scored very low for both anxiety and depression.

The usefulness of such a test to predict the dieting success of any individual may be open to question. To be considered both valid and reliable, a test should measure what it is supposed to measure, and the results should be reproducible. It is difficult to believe that a single test can measure the degree of anxiety and depression, for many factors may influence the way the subjects answer the questions. Some of the women could not understand some of the questions or found them ambiguous. In addition, it is quite possible for someone to give false answers. One subject, considered to be an extremely anxious person scored zero for anxiety. Obviously this individual's state of anxiety was not reflected by the test. The use of true or false questions in any test reduces reliability, for the chances of guessing the expected answer cannot be overlooked.

REDUCING DIET

A 1000 Calorie diet was planned to contain 60 grams protein, 35 grams of fat and 110 grams of carbohydrate (see Appendix H). This high protein, moderate fat regime has received the support of many nutritionists and dietitians. It is high enough in protein and fat to provide satiety, and meets the nutritional requirements for minerals and vitamins of most persons.

The reducing program was planned to cover a period of 4 weeks. For a variety of reasons, some of which will be discussed later, 6 of the women were unable to continue for the full period. The record of weight loss is summarized in Table X. The daily Calorie expenditure was estimated by the method suggested by Jolliffe, and the predicted weight loss calculated. To assess the relative adherence of each subject to the diet, the performance index was determined (52).

The mean weight loss was similar for both groups, although the performance index was higher for Group II. Other workers have reported actual weight losses which more closely approximated the predicted (11, 128). However, in all of these studies individual food intake was controlled. If this index is considered to be an accurate estimate of performance, then the response to the reducing diet was poor. On the other hand, a total loss of 10.1 to 10.5 pounds in 4 weeks appears to be somewhat higher than the usual recommended weight loss of 1 to 2 pounds

TABLE X. Weight loss of eighteen subjects after four weeks on a reducing diet of 1000 Calories.

Subject Number	Initial Wt. (lbs)	Estimated Daily Requirement*	Predicted Wt.Loss** (lbs)	Actual Wt.Loss	Performance Index ***
Group I					
1	156.2	2066	8.5	3.0	35
2	239.5	2246	10.0	5.5	55
3	162.5	2182	9.5	1.5	16
5	175	2558	12.5	10.0	80
7	247	2456	11.6	3.0	26
8	175	2308	10.5	7.0	67
10	209	2400	11.2	3.5	31
11	171.5	2338	10.7	6.5	61
13	169	2326	10.6	6.5	61
Mean	189.4	2320	10.5	5.1	48
Group II					
15	148	2060	8.5	3.0	35
16	192	2186	9.5	2.0	21
17	175.5	2080	8.6	4.0	47
18	186.5	2636	13.1	9.5	73
19	192.5	2210	9.7	6.5	67
20	185.5	2486	11.9	12.0	101
21	161	2320	10.6	6.0	57
22	165	2268	10.1	5.0	50
24	137.5	2088	8.7	2.5	29
Mean	171.5	2259	10.1	5.5	53

* Estimated from methods suggested by Jolliffe

** Assuming 3500 Calories equals 1 pound weight loss.

*** Actual weight loss expressed as a percentage of the expected weight loss (52).

per week. Sixty-one per cent of both groups lost at least 4 pounds, while 16 per cent lost more than 8 pounds.

Although the performance index was low for most subjects, 7 women attained an index above 60, so the predicted weight loss in these cases did not greatly overestimate the actual loss. Only 6 of the 18 subjects rigidly followed the diet, and five of these were relatively successful. Subject #7 was extremely co-operative, and conscientiously followed the diet. However, during this time, she missed her regular menstrual cycle. This may have resulted in some fluid retention. Subject #19, who lost a total of $6\frac{1}{2}$ pounds, followed the diet for the first week. During this time she lost one half a pound, and reducing her intake to 800 Calories the second week, gained one half pound. The third week, she reduced her intake still further, to a level of 530 Calories, and lost $7\frac{1}{2}$ pounds. The last week, following an 800 Calorie diet, she experienced no weight change. This woman appears to require less than 800 Calories to lose a significant amount of weight. Kinsell has postulated that for some persons to lose weight, the Calorie intake must be very much below energy requirement (58).

The general reaction to the diet was favourable. Everyone felt it offered too much food. No one reported hunger or fatigue. Most of the subjects reporting feeling much better while they were on this diet. This reaction was especially true of Subject #7, who looked brighter, and reported feeling more

alert. This may have indicated a previous diet of poor nutritional quality. Most of the women preferred the rigid pattern to the exchange system, as many reported a tendency to overeat when allowed to choose from a selection of foods. However, some enjoyed the variety of foods provided by the exchange list, and the greater freedom it gave them in meal planning.

It was unfortunate that more of the subjects were unable to follow the diet. Subject #6 had planned to participate, but suffered a gallbladder attack and was placed on a bland low fat diet by her physician. Particularly concerned about the possibility of an impending operation, she was extremely careful to follow the diet closely. Over the 4 weeks period she lost a total of 21 pounds. The Calorie value of this diet was found to be approximately 1400 Calories. This seemingly large weight loss is difficult to explain, but it would appear to indicate that her previous intake was much higher than this level. Subject #9 had been under severe emotional strain for 6 months, as a result of her husband's death and family illnesses. She followed the diet for 1 week, but was forced to discontinue because the added strain of dieting proved too upsetting. Subject #23 began the diet without mentioning that she was pregnant. After the first week she suffered a miscarriage, and discontinued the diet.

Subject #14, a member of the club for 8 years, found the diet too difficult to follow. This subject appears to lack the incentive necessary to continue a diet for any length of time. She is involved with the social functions of the club, and appears to have forgotten the underlying aims of weight reduction.

She expresses an intense desire to lose weight, but obviously cannot adhere to a reducing diet. It is interesting to note that she was a member of the weight reduction group advised by this Department in 1957.

Subject #11 has made repeated attempts to lose weight, but has been unable to maintain a stable weight loss. She explains the gain or loss of as much as 4 pounds per week as a fluid retention problem, and claims to be unable to lose weight on more than 800 Calories. This woman appears to have emotional conflicts which will need to be resolved if she is to achieve successful weight reduction.

Subject #5 who lost 10 pounds, during the 4 weeks, reported eating less than the amount of food recommended on the diet, so her weight loss cannot be attributed solely to the 1000 Calorie regime. Her major problem is an economic one. She has 3 children and very little money, the club providing the only social activity she can afford. Her food record showed a low intake of protein, and a high carbohydrate intake.

If reducing did not involve so many difficulties, the prognosis would surely be more encouraging. Successful weight reduction can only be achieved if the individual is sufficiently motivated and has the determination and resolution to carry through. As Feinstein (37) states, successful weight reduction depends on the interaction of 3 factors, the patient himself, the therapeutic relationship, and the dietary program. The status of the patient is influenced by the degree of obesity, the pattern by which the excess weight has been achieved, the age, the conscious and sub-conscious motivation,

the home and work environment, and "the entire panorama of factors which create, alter and gratify the human psyche". The various psychological responses to food and the act of eating must also be considered. The patient-therapist relationship should be one which provides the necessary motivation and encouragement required to attain success. The diet must satisfy both the emotional and social needs of the patient and be one which can serve as a future eating pattern.

Some authors suggest that a less rigid devotion to the concept of a nutritionally balanced diet might result in better success (37). The majority of workers do not agree with this approach, for the maintenance of normal weight can only be achieved on a lower calorie intake. As Barryman states "Long term weight reduction is almost impossible without deliberately pitching Calorie intake at a lower level than social custom and unconscious motivation often demand" (5).

GROUP WEIGHT REDUCTION

It is apparent that a group such as the Streamliners provides an effective method of treatment for some individuals. As Brosin (10) states, such individuals are able to make use of the "supplies" offered. There are others, however, who do not appear to benefit from such a program. Why this type of

treatment should be successful for some, and not for others, reflects the multiple causes of obesity as well as individual differences.

A number of factors were discovered which might account for the failure of some members to lose weight. For some of the women, the club has become a social outlet rather than a means of reducing, and a shelter where they receive the sympathy of others who have experienced the same failure. A few consider themselves to be somewhat rare medical phenomena for whom successful weight reduction is an impossible goal. Others are afraid to lose too much weight for then they would be different, and no longer have the sympathy and companionship of their friends. It appears that there are some who do not really want to lose weight.

Bruch has suggested the body may have a "preferred" weight and that overweight cannot always be considered harmful (14). Perhaps this may explain why some women, in spite of repeated attempts to reduce, return to the same weight.

No single factor could possibly explain the development of obesity or the difficulties experienced in reducing. Family food habits, social pressures, inactivity, lack of other interests, boredom and frustration, all appear to contribute to overweight. Undoubtedly, individual treatment would be more helpful for some, but for the majority of obese people this is

impractical over a long range period. A club, such as the Streamliners, does indicate awareness of the problem and, as such, offers great potentialities. But such organizations could be greatly improved if they were to employ the services of physicians, nutritionists, and social workers. Moreover, a time limit should be set, within which members are required to achieve a certain weight loss.

Most of the subjects greatly benefitted from the individual attention and encouragement provided by this study. A better knowledge of good nutrition habits was most definitely gained by some, and a few women are still following the reducing diet. Thus, the potential value to the subjects concerned may not be realized for some time.

SUMMARY

Twenty-five obese women, members of the Streamliners Club, volunteered to participate in the study. They were divided into two groups, unsuccessful and successful reducers, depending on the previous pattern of weight loss. A third group of 8 subjects of normal weight served as controls.

The three groups were similar with respect to age and height. The mean weight was 190, 173 and 140 pounds, for Groups I, II and III respectively. The percentage above ideal weight ranged from 12 to 80 per cent in Group I, and from 11 to 64 per cent in Group II. The controls were within the normal weight range. The onset of obesity ranged from 11 to 35 years in the first group, and from 6 to 25 years in the second group. Half of the women in both Groups I and II reported weight gained after pregnancy. More of the unsuccessful reducers had previously attempted to reduce, and all subjects had regained the weight lost. The women in Group I reported a greater tendency to eat when bored, lonely, depressed, or annoyed.

The mean daily Calorie intake was 1434 Calories for the unsuccessful reducers, 1259 Calories for the successful reducers, and 2007 Calories for the control group. There was a wide individual variation in the Calorie intake of both Groups I and II. The percentage protein intake was similar for all groups. Group I consumed a higher percentage of carbohydrate

and a lower percentage of fat than Group II. Ten of the obese women were consuming less than the recommended allowance for protein, while one subject was consuming less than the minimum requirement according to the Canadian Dietary Standard. The unsuccessful reducers ate fewer breakfasts, and more frequent between-meal snacks than the successful reducers.

The individual daily expenditure was calculated using both ideal and actual weight as a reference. The values for the energy expenditure of the obese subjects more closely approximated the observed weight change when calculated from ideal weight. The mean daily expenditure was 2419 Calories for the unsuccessful reducers, 2314 Calories for the successful reducers, and 2231 Calories for the control group.

The percentage time spent in maintenance activity as defined in the Canadian Dietary Standard was similar for both Group I and II, whereas as Group II spend a significantly greater percentage of time in the B category of activity. There appeared to be a wide variation in the number of miles walked per day, as measured by a pedometer for 10 subjects.

The results of Shipman's Anxiety-Depression Scale showed no significant difference in anxiety or depression scores between Groups I and II. Both groups scored higher than the control group. Some individual scores appeared to be related to success in reducing, while others were not. Most of the unsuccessful reducers gained weight during the study.

A 1000 Calorie reducing diet, containing 60 grams protein, 35 grams fat, and 110 grams of carbohydrate, was given to 24 obese women to be followed for a 4 week period. Only 18 women continued the diet for the full period. The mean weight lost was similar for both groups, although the performance index was higher for the successful reducers. Weight loss ranged from 1.5 to 10 pounds in Group I, and from 2.0 to 12 pounds in Group II, with a mean loss of 5 pounds for each group.

The results of the study confirm that activity pattern, food habits, and personality factors are related to weight reduction. A group program of the type seen in the study may be helpful for some obese persons but its overall effectiveness appears questionable.

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APPENDIX A

UNIVERSITY OF MANITOBA

SCHOOL OF HOME ECONOMICS

Weight Control Study

Personal History

I General

Name:_____, Address _____, Tel._____

Age:(check one) below 25 yrs._____,25 to 45 yrs._____45 - 65 yrs._____,over 65_____

Marital Status _____; Number of children _____; Ages_____

Occupation _____

State of Health: (check one) good _____; fair _____; poor _____.

Have you had any serious illness in past five years? _____ If so, list _____

_____

Are you presently under physician's care? _____For how long? _____

Are you taking appetite depressant drugs? _____.

Are other members of family overweight? _____.

II Weight Record

Amount overweight _____; Age at which you became overweight _____

Was any weight gained after first or second pregnancy? _____

Have you reduced weight before? _____. How many times? _____

What type of diet was followed? _____. Amount of weight lost? _____

How long was a reducing regimen followed? _____

Did you follow diet carefully? _____. Have you regained this weight? _____

How much? (check one) a little _____; as much _____; more _____.

How often do you weigh yourself when dieting? _____.

III. Food Preferences

Do you like a variety of foods _____; or a simple pattern? _____

Do you like baking _____. List five favourite foods _____

_____

Do your eating habits vary from day to day? _____

Do you eat between meals? _____; Before going to bed? _____

Do you eat meals at regular hours? (check) _____; on Saturdays _____;

on Sundays _____; on holidays _____; when you are bored _____;

lonely _____; depressed _____; annoyed _____.

Do you consume alcoholic beverages? _____. Are you a light or

heavy smoker _____.

IV. Activity Pattern

Do you follow a daily exercise program? _____.

Do you actively participate in any sports? _____; List _____

_____. How frequently? _____

Do you drive a car? _____; Watch television? _____

Do you engage in a fair amount of walking? _____.

APPENDIX B
SCHOOL OF HOME ECONOMICS
FOODS AND NUTRITION DEPARTMENT

Study on Energy Intake and Expenditure

Directions:

The purpose of this study is to investigate the eating and activity pattern of persons on a reducing regimen. If the study is to point out problems related to loss of weight with reduced calorie intake, it is most important that records kept be accurate and complete. The food intake record and activity record must be typical of the subjects' normal routine; therefore, do not change eating habits or activities from your everyday pattern. Please record your weight the first and last day of this study. It is best to weigh yourself before breakfast each time.

Food Intake Record

What is it?

A detailed and accurate account of all food and beverages eaten for a period of seven (7) days.

How is it kept?

A small food record book will be provided where you can conveniently jot down all the food eaten each day. (Clear coffee, tea or water may be omitted.) For accuracy in amounts, foods may be weighed on a dietetic scale or measured with standard measuring equipment. To find weight of food actually consumed, any food left on the plate must be weighed and deducted from the original amount. Foods such as butter, sugar, etc. may be measured at one time and used from one container throughout the week if this is more convenient.

Complete details about the kind of food and method of preparation (e.g. fried, boiled, etc.) should be recorded and whether it is home baked or purchased. Ingredients of home made recipes may be included on a separate sheet or in the notebook provided for activity record, along with size of total recipe and individual serving size. If meals are eaten in a restaurant try to judge the amounts as closely as possible (e.g. 1/4 cup peas, frozen).

Directions for Use of Dietetic Scales

1. Place a paper plate or other container on pan of scale, adjust to zero.
2. Place food on paper container. Record weight.
3. Pointer may be again returned to zero and another food added to plate or container.

Activity Record.

The small ring notebook is for recording the activities of each day. Beginning with rising in the morning, the time of commencing each new activity should be recorded as accurately as possible. (For example 7:00 a.m. - washed and dressed, 7:15 a.m. - made beds, etc.). If any strenuous activity occurs such as walking, scrubbing floors or gardening, be sure to include it, regardless of how brief the period of time involved.

CALORIC INTAKE RECORD SUBJECT NO._____

DAY 1

Food & description	Amount	Wt. gms.	Cal.	Pro.	Fat	CHO
Total						
Per Cent Composition						

DAY 2

Food & description	Amount	Wt. gms.	Cal.	Pro.	Fat	CHO
Total						
Per Cent Composition						

APPENDIX B (Page 2)

APPENDIX C

METROPOLITAN LIFE INSURANCE TABLE OF DESIRABLE WEIGHTS FOR WOMEN OF SMALL, MEDIUM, AND LARGE FRAME WEIGHT IN POUNDS AS ORDINARILY DRESSED BUT WITHOUT SHOES AND HEAVY OUTER CLOTHING SUCH AS SUIT JACKETS (79)

Height		Small Frame	Medium Frame	Large Frame
Feet	Inches			
4	8	94	101	111
4	9	97	103	113
4	10	99	106	116
5	11	102	109	119
5	0	105	112	122
5	1	108	115	125
5	2	111	119	129
5	3	114	123	133
5	4	118	127	137
5	5	122	131	141
5	6	126	135	145
5	7	130	139	149
5	8	134	143	153
5	9	138	147	158
5	10	142	151	162

APPENDIX D

PERTINENT DATA FOR TWENTY-FIVE OBESE SUBJECTS AND EIGHT CONTROLS

Subject No	Age	Ht. (m)	Wt. (lbs)	Wrist Size	Frame	Ideal Wt. (lbs)	% Above Ideal Wt.
Group I							
1	35	61	161	6¼	L	125	29
2	60	68	229.5	7	L	153	50
3	41	64	158	6	M	127	24
4	26	60	148.5	6	L	122	22
5	23	68	165.5	6¼	M	143	16
6	43	67	260.5	7	L	149	75
7	41	63	239	7 1/8	L	133	80
8	46	68	172	6 3/4	L	153	12
9	48	66	198	6½	M	135	47
10	43	67	202	6 3/4	L	149	35
11	35	645	170	6	S	122	39
12	42	64	172	6 3/8	M	127	35
13	34	66	170	6 3/8	M	135	26
14	48	64	214	6½	L	137	56
Mean	40	65	190				39
Group II							
15	47	63	154.5	6½	L	133	17
16	50	63	190	6½	L	133	42
17	27	67.5	175.5	6½	L	153	15
18	23	60.5	190	6	L	125	52
19	36	60.5	204.5	6 3/4	L	125	64
20	23	66.5	199	6¼	M	139	43
21	33	65	176	6½	M	131	34
22	33	63.5	170	6	M	127	34
23	20	66	140	6	S	126	11
24	34	62.5	155	6 1/8	M	123	17
25	23	66	153	6½	M	135	13
Mean	31	64	173				32
Mean for I and II	37	64.6	182				

APPENDIX D CONTINUED

Group III							
27	32	66	126	5½	S	126	-
28	51	67	151.5	6	S	130	16
29	20	64	129.5	6	M	127	-
30	20	66	143	6 1/8	S	126	13
31	32	66	144	6⅛	M	135	7
32	20	66	114	5 3/4	S	126	-
33	45	67.5	163	6¼	M	143	14
34	44	66.5	147	6 1/8	S	130	13
Mean	33	66	140				7.8

APPENDIX E

TABLE 1. VALUES FOR ENERGY EXPENDITURE FOR VARIOUS ACTIVITIES ADAPTED FROM DURNIN (87)

Activity	Energy Cost Cal./Kg./Min.
Dress	.024
Sit	.024
Drive	.043
Sew	.029
Stand	.026
Household Chores	.045
Houseclean	.052
Laundry	.05
Walk	.05
Run	1.17
Bowl	.06
Curl	.06
Garden	.08
Play with child	.054
Dance	.08
Paint	.04
Cook	.03
Type	.035
Scrub Floors	.057
Bicycle	.012
Sleep	.015
Gym	.075
Play cards.	.025
Piano	.04
File	.026

APPENDIX E

TABLE 2. DESCRIPTION OF CATEGORIES OF ENERGY EXPENDITURE (CANADIAN DIETARY STANDARD) 1963

Category	Maintenance	A	B	C	D
Home or Household	Ablutions, dressing, brushing hair, etc; washing dishes, knitting, mending	Most household chores, repairing appliances, mowing the lawn, wiping windows, laundering, cooking, normal housecleaning	Digging or spading in garden, rolling lawn, moving furniture within house, scrubbing floors and walls, polishing floors by hand	Farm chores, spading heavy clay, moving clay or stones in wheelbarrow	
Office	Work at desk requiring little movement	Office work involving typing, filing, computing, drafting, working on ledgers, walking from desk to desk, etc; salesclerk, barbering, hairdressing, nursing, laboratory work	Moving files, furniture, heavy packages, etc; stooping and lifting		

APPENDIX E TABLE 2 CONTINUED

Industry	Supervising, monitoring	operating dragline, most mechanical trades and crafts, cooking for restaur- hotel, or short order; sewing Shop and mill work, operating lathe, assembly line work, driving truck, tractor or bull-dozer,	Masonry, carpentry, loading and unloading trucks, power-equipped mining, commercial cooking and baking, military marching and drilling, commercial laundering, maid service such as making beds and cleaning rooms	Felling trees in lumbering, mining without power equipment, harvesting and haying by manual methods, manual handling of wheel barrow in construction work, military marching with full pack	Hand felling trees, shoveling gravel, coal, etc.
Recreation	Spectator at games, theatre, etc; playing cards, chess, billiards, etc; reading, driving car.	Golf, walking, bowling, fishing, hunting, most hobbies and crafts, (e.g., woodworking, metal work, leather work, photography, painting), ballroom dancing, ping pong.	Sports such as hockey, football, basketball, field and track, fast ping pong or tennis, dancing with much action or movement, gymnastics, swimming or skiing for pleasure	Training for professional athletics or Olympic sports vigorous activities in football, etc; difficult mountain climbing	Training for weight lifting, marathon sports such as cross-country running or skiing, long bicycle races, rowing races, marathon swimming races.

APPENDIX E

TABLE 3. PREDICTED DAILY CALORIE NEEDS FOR WOMEN OF NORMAL WEIGHT

Height	15-19	20-29	30-39	40-49	50-59	60-69
4' 9"	2080	1890	1810	1760	1710	1480
4' 10"	2110	1920	1840	1790	1740	1510
4' 11"	2140	1950	1870	1820	1770	1530
5' 0"	2190	1980	1900	1850	1800	1550
5' 1"	2240	2020	1940	1890	1850	1590
5' 2"	2290	2060	1980	1950	1900	1640
5' 3"	2350	2100	2030	2000	1950	1690
5' 4"	2400	2150	2080	2040	2000	1740
5' 5"	2460	2200	2140	2080	2050	1780
5' 6"	2520	2250	2190	2120	2100	1820
5' 7"	2570	2300	2240	2160	2150	1860
5' 8"	2620	2350	2290	2220	2200	1910
5' 9"	2680	2400	2340	2260	2250	1950
5' 10"	2740	2450	2400	2310	2300	1990
5' 11"	2800	2500	2450	2360	2350	2040
6' 0"	2860	2550	2500	2410	2400	2090

NOTE: If you are overweight, add 4 calories for each pound over your desirable weight.
These figures are calculated from the normal basal energy requirements with an allowance for activity of 60% for the 15-19 age group, 50% for ages 20-59, and 40% for ages 60 and over. These figures apply for most overweight housewives who do their own housework, for clerical and office workers, machinery operators, domestic workers, and those in similar occupations. People engaging in heavier occupations need 10%-20% more, and people who are retired or engaged in little or no activity need about 10% less.

From Jolliffe (50).

APPENDIX F

TABLE 1. DAILY CALORIE INTAKE OF TWENTY-FIVE OBESE WOMEN AS CALCULATED FROM SEVEN-DAY FOOD RECORDS

Subject No	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.	Total
1	557	1391	932	1590	1827	1968	1456	9,229
2	1220	1516	1712	1533	928	1222	988	9,119
3	1482	1602	1759	1424	1692	1486	1340	10,785
4	456	694	658	804	804	564	657	4,495
5	591	1367	1222	1820	1795	1058	1481	9,334
6	2212	1570	1474	1849	2002	2114	1628	12,849
7	1068	1256	1683	1904	1268	1418	1584	10,181
8	1077	2085	1834	1984	1246	1567	1647	11,440
9	2058	1129	1497	1076	1590	1477	1542	10,369
10	642	1017	850	1575	1268	1177	1200	7,680
11	1818	1536	1213	1983	2616	1616	1223	12,005
12	626	1617	1133	1314	1763	1393	1581	9,427
13	1532	1137	1293	1658	1129	1415	958	8,926
14	1337	2677	1716	2310	2926	2027	1722	14,715
15	1203	910	530	912	827	872	1005	6,209
16	1156	1003	1225	1178	1141	1248	1451	8,402
17	1412	1651	1716	1540	2083	2669	1214	12,285
18	1910	1968	1308	2672	1636	1234	1004	11,732
19	677	745	985	996	1016	1053	950	6,422
20	532	370	627	878	755	503	847	4,512
21	1691	1490	2558	1929	3468	1737	1484	14,357
22	937	627	970	968	1080	1255	985	9,963
23	512	1235	1855	1285	1562	1911	1603	6,822
24	1113	945	1452	914	888	991	937	7,240
25	1254	1069	1070	1404	1023	1806	1355	8,981
Total	29073	32607	33272	37360	38334	35781	31842	

APPENDIX F

TABLE 2. MEAN DAILY CALORIE INTAKE AND EXPENDITURE FOR TWENTY-FIVE OBESE AND EIGHT NORMAL WEIGHT SUBJECTS

Subject	Mean Daily Calorie Intake*	Percentage Distribution			Mean Daily Expenditure**	Percent Time			
		Protein	Fat	Carbohydrate		Maintenance	A	B	Sleep
Group I									
1	1318	22	32	46	2119	37	23	1	39
2	1303	22	39	39	2627	29	44	0	27
3	1541	18	37	45	2143	46	22	2	30
4	642	25	29	46	2079	26	38	.01	36
5	1333	18	44	38	2642	52	24	1	23
6	1836	15	44	41	2743	30	35	2	33
7	1454	17	38	45	2316	41	13	1	45
8	1634	18	36	46	2543	25	40	1	33
9	1481	16	40	44	2413	37	42	0	21
10	1097	17	40	43	2610	45	23	2	30
11	1715	18	33	49	2414	33	32	4	31
12	1347	16	38	46	2395	30	30	4	36
13	1275	18	39	43	2348	36	30	1	33
14	2102	15	43	42	2472	42	28	2	28
Mean	1434	18	38	44	2419	36	30	2	32
SD	346	2.8	4.4	3.0	205.8	8.1	8.9	1.4	6.2
Group II									
15	887	23	34	43	2336	36	25	4	35
16	1200	16	49	35	2191	47	21	2	30
17	1755	14	42	43	2364	37	24	0	39
18	1676	15	45	40	1884	52	11	4	33
19	917	33	23	44	2186	28	33	1	38
20	645	22	44	34	2525	32	34	0	34

APPENDIX F TABLE 2 CONTINUED

21	2051	21	46	33	2418	44	27	2	27
22	1423	18	38	44	2595	29	26	14	31
23	975	16	45	39	2272	39	32	7	22
24	1034	24	43	33	2257	28	29	3	43
25	1283	25	39	36	2424	38	23	5	38
Mean	1259	21	41	39	2314	37	26	4	34
SD	429	5.6	7.2	4.5	192.6	7.9	6.5	4.0	6.0
Mean for Groups I and II	1347	20	40	42	2373	37	28	3	33
SD	387	4.44	6.1	4.6	203	7.1	8.1	3.0	6.1
Group III									
27	1299	15	48	37	2008	62	7	1	30
28	1837	15	45	40	2511	45	16	0	39
29	2125	12	40	48	1942	54	7	2	37
30	2523	15	46	39	2349	48	14	2	36
31	2246	16	41	43	2451	47	19	1	33
32	2271	14	42	44	1767	54	1	1	44
33	1603	12	40	48	2562	54	15	0	31
34	2155	13	42	45	2255	65	6	0	19
Mean	2007	14	4.3	43	2231	54	11	1	34
SD	400	1.7	3.0	4.1	293	2.2	6.2	0.1	7.5

* Estimated from seven day food records.

** Based on ideal weight and derived from tables of energy expenditure prepared by Durnin (87).

APPENDIX F

TABLE 3. DAILY CALORIE EXPENDITURE OF THIRTY-THREE SUBJECTS CALCULATED BY FIVE METHODS

Subject No.	Actual Wt. (Kg)	Ideal Wt. (Kg)	Daily Calorie Expenditure: Activity Record (Durnin) Actual Wt.	Activity Record (Durnin) Ideal Wt.	Canadian Dietary Standard Actual Wt.	Canadian Dietary Standard Ideal Wt.	Jolliffe
Group I							
1	72.7	56.8	2731	2119	2772	2325	2084
2	105.0	69.5	3965	2627	3407	2740	2206
3	72.7	57.7	2699	2143	2773	2375	2164
4	67.5	55.4	2508	2079	2661	2280	2086
5	75.4	65.0	2948	2642	2970	2555	2440
6	118.2	67.7	4775	2743	3986	2680	2606
7	108.2	60.4	4133	2316	3781	2430	2424
8	79.5	69.5	3082	2543	2863	2740	2296
9	90.0	61.3	3542	2413	3144	2380	2372
10	91.8	67.7	3539	2610	3307	2680	2372
11	77.7	55.4	3344	2414	2918	2280	2332
12	78.2	57.7	3250	2395	2929	2375	2220
13	77.3	61.3	2961	2348	2954	2380	2330
14	78.6	62.2	3164	2472	2841	2493	2184
Mean			3330	2419	3090	2480	2294
Group II							
15	72.7	60.4	2813	2336	2681	2430	2086
16	86.8	60.4	3198	2191	3056	2430	2178
17	79.5	65.0	2809	2364	3012	2555	2080

TABLE 3 APPENDIX F CONTINUED

18	85.9	56.8	3102	1884	3272	2195	2650
19	96.8	56.8	3751	2186	3441	2325	2258
20	92.0	63.1	3543	2525	3362	2530	2540
21	80.2	59.5	3253	2418	3108	2430	2380
22	76.8	53.6	3606	2595	2933	2250	2288
23	65.7	57.2	2610	2272	2679	2325	2306
24	72.3	55.9	2919	2257	2807	2310	2158
25	69.5	61.3	2748	2424	2795	2380	2322
Mean			3123	2314	3013	2378	2295
Group Mean (I & II)			3239	2373	3058	2435	2294
Group III							
27	57.3	57.3	2008	2008	2354	2354	2190
28	68.9	59.1	2511	2159	2573	2295	2238
29	58.9	58.9	1942	1942	2471	2471	2150
30	65.0	57.2	2349	2067	2657	2412	2318
31	65.3	61.3	2451	2301	2604	2481	2226
32	51.8	57.3	1767	1884	2239	2412	2250
33	74.1	65.0	2562	2248	2817	2465	2300
34	66.8	59.1	2255	1995	2605	2374	2228
Mean			2231	2076	2540	2408	2238

APPENDIX F

TABLE 4. LEVEL OF ACTIVITY OF TEN OBESE WOMEN AS MEASURED BY PEDOMETER

Subject No	Total Mileage	No. of days	Stride	Miles per Day
Group I				
4	4	7	17½"	0.3
7	15½	7	20"	2.2
9	72	6	24"	8
14	57¼	6	24"	6.4
Group II				
17	7	7	21"	1.0
18	26½	5	10"	5.3
19	44	6	10"	2.0
21	27 3/4	6	17"	2.2
22	16½	4	16"	4.1
23	12	6	11"	0.6

APPENDIX G

INSTRUCTION SHEET FOR THE ANXIETY-DEPRESSION SCALE

by William G. Shipman
Michael Reese Hospital, P.P.I.
Chicago 16, Illinois

Scoring

The anxiety score is the total of the following item-answers that have been marked by the subject: 3F, 5T, 7T, 9T, 11T, 13F, 15F, 17T, 19T, 21T, 23T, 25F, 27T, 29T, 31T, 33T, 35T, 37T, 39T, 44T.

The depression score is the total of the following answers that have been marked by the subject: 1F, 2T, 4F, 6F, 8F, 10F, 12F, 14F, 16F, 18F, 20F, 22F, 24T, 26T, 28F, 30F, 32F, 34F, 36T, 38F, 40F, 41F, 42F, 43F.

Scoring is most simply done by taking two of your blank questionnaires and making one your scoring key for Anxiety and one for Depression. Cut holes in the sheet where the answers above are located. Then scoring is simply done by placing your key over each answer sheet and counting the number of black marks that show through the holes. Remember to check each answer sheet first to see if all the statements were answered and if the answering was done by blackening the letters. Sometimes a patient will circle the answer and this will not show through the holes of your key.

When the two scores have been obtained and recorded at the top of the patient's answer sheet, then you can compare them with the general population norms. The normative statistics based on 113 general population adults are: Anxiety Mean 6.8, SD 4.2; Depression Mean 10.5, SD 2.9.

Anxiety	Depression	Percentile
15	16	98%
13	15	93%
11	13	84%
9	12	69%
7	11	50%
5	9	32%
3	8	16%
0	6	7%
0	5	3%

Use these columns of numbers to interpret your scores in the following way. An anxiety score of ... or a depression score of ..... is higher than that obtained by .....% of the population.

Our findings to date indicate that dieters with low initial scores (Anx. 3, Depr. 8, or lower) will be the very successful dieters, if they keep at it. Those with high scores, (Anx. 13, Depr. 15, or higher) will probably lose little or nothing. Those with an Anxiety score of 15 or a Depression score of 16 are very upset and should seek professional help about it.

IF YOU PREFER, WE WILL SCORE YOUR ANSWER SHEETS FOR YOU AND SEND YOU THE SCORES

Name: _____ Date: _____ Weight _____

This questionnaire consists of numbered statements. Read each statement and decide whether it is true as applied to you or false as applied to you. If it is TRUE or MOSTLY TRUE, blacken the T to the left of the statement you are answering. If the statement is NOT USUALLY TRUE or is NOT TRUE AT ALL, blacken the F. Give your own opinion of yourself. Do not leave any blank spaces if you can avoid it. Try to make some answer to every statement.

T	F	1.	My daily life is full of things that keep me interested.
T	F	2.	I am easily awakened by noise.
T	F	3.	I believe I am no more nervous than most others.
T	F	4.	At times I feel like smashing things.
T	F	5.	I work under a great deal of tension.
T	F	6.	My judgment is better than it ever was.
T	F	7.	I cannot keep my mind on one thing.
T	F	8.	I am a good mixer.
T	F	9.	I am more sensitive than most other people.
T	F	10.	Everything is turning out just like the prophets in the Bible said it would.
T	F	11.	I frequently find myself worrying about something.
T	F	12.	I sometimes keep on at a thing until others lose their patience with me.
T	F	13.	I am usually calm and not easily upset.
T	F	14.	I sometimes tease animals.
T	F	15.	I am happy most of the time.
T	F	16.	I usually feel that life is worthwhile.
T	F	17.	I have periods of such great restlessness that I cannot sit long in a chair.
T	F	18.	I go to church almost every week.
T	F	19.	I have sometimes felt that difficulties were piling up so high that I could not overcome them.
T	F	20.	I believe in the second coming of Christ.
T	F	21.	I certainly feel useless at times.
T	F	22.	I do not worry about catching diseases.
T	F	23.	I find it hard to keep my mind on a task or job.
T	F	24.	Criticism or scolding hurts me terribly.
T	F	25.	I am not unusually self-conscious.
T	F	26.	I certainly feel useless at times.
T	F	27.	I am inclined to take things hard.
T	F	28.	At times I feel like picking a fist fight with someone.
T	F	29.	I am high-strung person.
T	F	30.	Sometimes, when embarrassed, I break out in a sweat which annoys me greatly.
T	F	31.	Life is a strain for me much of the time.
T	F	32.	I enjoy many different kinds of play and recreation.
T	F	33.	At times I think I am no good at all.
T	F	34.	I like to flirt.
T	F	35.	I am certainly lacking in self-confidence.
T	F	36.	I brood a great deal.
T	F	37.	I sometimes feel that I am about to go to pieces.
T	F	38.	I sweat very easily even on cool days.
T	F	39.	I shrink from facing a crisis or difficulty.
T	F	40.	When I leave home I do not worry about whether the door is locked and the windows closed.
T	F	41.	I do not blame a person for taking advantage of someone who lays himself open to it.
T	F	42.	At times I am all full of energy.
T	F	43.	Once in a while I laugh at a dirty joke.
T	F	44.	I feel anxiety about something or someone almost all the time.

APPENDIX G.

TABLE 1. SCORES ON THE SHIPMAN ANXIETY-DEPRESSION SCALE FOR THIRTY-THREE SUBJECTS

Group I			Group II			Group III		
Subject No.	Anxiety Score	Depression Score	Subject No.	Anxiety Score	Depression Score	Subject No.	Anxiety Score	Depression Score
1	0	15	15	6	12	27	4	9
2	2	8	16	12	10	28	0	12
3	8	10	17	16	12	29	4	8
4	10	13	18	6	7	30	3	9
5	14	12	19	6	10	31	0	10
6	11	10	20	7	9	32	7	8
7	16	15	21	12	11	33	3	10
8	8	12	22	6	13	34	0	8
9	9	13	23	9	9			
10	5	10	24	2	12			
11	0	8	25	16	12			
12	11	14						
13	8	8						
14	5	12						
Mean	7.6	11.4		8.9	10.6		2.6	9.3
50	5.1	2.5		4.5	1.8		2.5	1.4
Mean for Groups I and II								
	8.2	11.1						
	4.6	2.2						

APPENDIX H
SCHOOL OF HOME ECONOMICS

WEIGHT CONTROL STUDY

Directions for Following Reducing Program.

1. GENERAL INFORMATION.

This diet has been planned to provide 1000 calories per day. It is balanced in protein, fat and carbohydrate, and follows Canada's Food Guide. To ensure weight loss this diet must be followed closely. If there should be anything about the diet which is not clear, please telephone J. Strang (Gr 5-5175). All foods, except meat, may be measured in a standard measuring cup. Meats should be weighed. (1 ounce = 30 grams).

2. WEIGHT RECORD.

Please record your weight the day you begin the diet, and at the end of each week Weigh yourself at the same time in the morning, preferably before breakfast, in the same state of dress.

3. DIET PATTERNS.

Diet pattern #1 is based on the exchange system. Foods allowed are grouped in exchange lists, and a sample menu is given. You may choose any food within an exchange list, but you cannot substitute one food in one exchange list for a food in another exchange list. This plan should provide you with a reasonable variety of foods from which you can plan your menu.

Diet pattern #2 is also based on the exchange system, but has been worked out in the form of three menus. This plan provides a more limited choice of foods for those who prefer a definite pattern.

4. IMPORTANT CONSIDERATIONS.

It is very important to eat all the protein foods suggested. It is not necessary to eat all the food at any one meal. You can eat part of a meal at some other time of day. Do not carry over foods not eaten to the next day.

If you would like to have a sandwich for lunch, you may do so if you use two slices of thin sandwich bread instead of one regular slice of bread. If you do not drink milk, replace one cup of milk with four tablespoons skim milk powder. This may be taken in tea or coffee, or used in cooking. If you prefer 2% milk to skim milk, omit the daily allowance for butter or margarene. One teaspoon of boiled dressing, or low-calorie dressing may be used at each meal. Mayonnaise or French dressing is not permitted. Low calorie beverages, clear tea or coffee, may be taken at any time. All meats should be broiled, roasted or stewed - never fried. As this diet may be low in iron, one serving of liver per week is recommended.

5. FOR THOSE EATING IN RESTAURANTS. - The following selections are suggested:

1. Soups - bouillon or consomme
2. Meats - plain, lean meat, fish or poultry (no gravy)
   poached or boiled eggs
   cottage cheese
3. Vegetables - plain vegatables - as outlined in exchange list
4. Fruits or dessert - plain jello or fresh fruit
5. Bread - plain rolls or white bread
6. Beverages - tomato juice may replace vegetable
   clear tea or coffee
   skim milk

		SAMPLE MENU
BREAKFAST	1 Fruit exchange	½ cup unsweetened orange juice
	1 Meat exchange	1 egg, poached or boiled
	1 Bread exchange	1 slice toast
	1 Fat exchange	1 teaspoon butter
	½ Milk exchange	½ cup skim milk
	Beverage	Clear tea or coffee
10 A.M.	Clear tea or coffee	Clear tea or coffee
LUNCH	2 Meat exchanges	Consomme ½ cup cottage cheese
	1 vegetable exchange	½ cup asparagus tips lettuce 1 medium tomato
	1 bread exchange	1 slice bread
	1 fat exchange	1 tsp. butter
	1 fruit exchange	1 small orange
	½ milk exchange	½ cup skim milk
	Beverage	Clear tea or coffee
3 P.M.	Beverage	Clear tea or coffee
DINNER	2 Meat exchanges 1 vegetable exchange 1 bread exchange 1 fruit exchange	Consomme or broth 2 ounces Roast beef ½ cup peas 1 small baked potato 1 small apple
BEDTIME	1 milk exchange	1 cup skim milk

FOODS TO AVOID

sugar, candy, jam, honey, jellies, marmalade, puddings, gravy, pastry, cakes, cookies, fried foods, fruits canned in sugar, fat meats, (ham, pork, sausage, bologna, spareribs, sardines, duck, goose, condensed milk, chewing gum, carbonated beverages, alcoholic beverages, chocolate and cocoa, coconut, mayonnaise, French dressing.

FOODS ALLOWED

clear tea and coffee, clear broth, bouillon or consomme, unsweetened pickles, low calorie beverages.

1000 CALORIE DIET PATTERN #1

EXCHANGE LIST

MILK	VEGETABLE	FRUIT	BREAD	MEAT
1 Exchange contains: 8 grams protein 12 grams carbohydrate 80 calories	1 Exchange contains: 2 grams protein 7 grams carbohydrate 36 calories	1 Exchange contains: 10 grams carbohydrate 40 calories	1 Exchange contains: 2 grams protein 15 grams carbohydrate 68 calories	1 Exchange contains: 7 grams protein 5 grams fat 73 calories
1 Exchange =	1 Exchange =	1 Exchange =	1 Exchange =	1 Exchange =
1 cup fluid skim 1 cup buttermilk (made from skim milk) ¼ cup powdered skim milk	1 cup of the following Asparagus Broccoli Brussel Sprouts Cabbage Celery Chicory Cucumbers Cauliflower Lettuce Mushrooms Pepper Radishes Eggplant String beans Tomatoes ½ cup of following Beets Carrots Onions Green Peas Pumpkin Winter Squash Turnip	Apple - small Applesauce - unsweetened or dietetic - ½ cup Apple juice, unsweetened - ½ cup Blended Juice, unsweetened - ½ cup Apricots, dietetic - 2 med. Banana - ½ small Raspberries, unsweetened - 1 cup Strawberries, unsweetened - 1 cup Blueberries, unsweetened - 2/3 cup Cantaloupe - ¼ Grapefruit - ½ small Grapefruit juice, unsweetened - ½ cup Grapes - 14 Orange - small Pineapple, unsweetened - ½ cup Prunes - 2 medium Tangerine - 1 large Watermelon - 1 cup	Bread - 1 slice Cereals, cooked, no sugar - ½ cup Shredded Wheat - ¾ cup Graham crackers - 2 Saltines 2" square-5 Sodas 2½" square - 3 Arrowroots - 4 Flour - 2½ tbsp. Vegetables - peas - ½ cup corn - 1/ 3 cup parsnips - 2/3 cup potatoes, white - 1 small potatoes, sweet - ¼ cup	Lean Beef - 1 ounce Lamb - 1 ounce Veal - 1 ounce Chicken - 1 ounce Turkey - 1 ounce Luncheon meat - 1 oz. Egg - one Cod, haddock, sole whitefish, pickeral, - 1 ounce salmon, crab, tuna, lobster - ¼ cup shrimp, clam, oyster- - 5 small Cheese - cheddar - 1 ounce cottage - ¼ cup

1000 CALORIE DIET PATTERN #2

DAY 1	DAY 2	DAY 3
BREAKFAST Unsweetened orange juice 1 egg, poached 1 slice toast 1 tsp. butter or margarine 4 ounces skim milk clear tea or coffee	**BREAKFAST** ½ grapefruit 1 egg, boiled 1 slice toast 1 tsp. butter or margarine 4 ounces skim milk clear tea or coffee	**BREAKFAST** 3 ounces apple juice 1 ounce lean, broiled back bacon 1 slice toast 1 tsp.butter or margarine 4 ounces skim milk clear tea or coffee
LUNCH Broth ½ cup cottage cheese sliced cucumbers lettuce, celery sticks 1 medium tomato 1 slice bread or 3 sodas 1 tsp.butter or margarine ½ banana 4 ounces skim milk	**LUNCH** Consomme 2 ounces luncheon meat or 2 ounces hamburger,broiled 1 cup cooked cabbage or cabbage salad - boiled dressing 1 slice bread 1 tsp.butter or margarine 1 medium orange 4 ounces skim milk	**LUNCH** Bouillon 2 ounces lean roast beef or 2 ounces cheddar cheese 1 tomato or lettuce or 1 cup string beans 1 slice bread or 3 sodas 1 tsp.butter or margarine ½ cup dietetic fruit 4 ounces skim milk
DINNER Broth 2 ounces lean roast beef or 2 ounces steak,lean ½ cup cauliflower and ¼ cup carrots or ½ cup carrots 1 slice bread or 1 small baked potato 1 small apple	**DINNER** Bouillon 2 ounces baked or broiled fish or 2 ounces roast veal ½ cup green peas or 2½ tbsp. corn 1 slice bread or ½ cup boiled potato 14 grapes	**DINNER** Consomme 2 ounces broiled liver or 2 ounces roast or broiled chicken ½ cup beets or ½ cup turnips 1 slice bread or 2 graham wafers ½ banana
BEDTIME 8 ounces skim milk	**BEDTIME** 8 ounces skim milk	**BEDTIME** 8 ounces skim milk

FOODS TO AVOID: sugar, candy, jam, honey, jellies, marmalade, puddings, gravy, mayonnaise, French dressing, pastry, cake, cookies, fried foods, fruits canned in sugar, fat meats such as ham, pork, sausage, bologna, spareribs, sardines, duck, goose, condensed milk, chewing gum, carbonated beverages, alcoholic beverages, chocolate and cocoa, coconut.

FOODS ALLOWED: clear tea, coffee, clear broth, consomme, unsweetened pickle, low calorie beverages.