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Obesity and the Gordon Regimen: Experiences in the Obesity Clinic at
the University of Nebraska

by

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The College of Medicine in the University of Nebraska
In Partial Fulfillment of Requirements
For the Degree of Doctor of Medicine

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the University of Nebraska

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Introduction

Obesity has long been one of the most perplexing and common of medical problems. It is estimated that 25% of the general population of the United States is overweight, making this the most prevalent disease in America. (2) Mayer suggests that at least 16% of the present population under 30 years of age is obese. (16)

Despite the frequency of this disease a consistently successful mode of treatment has yet to be developed. In 1963 Edgar S. Gordon, M.D., Marshall Golberg, M.D., and Grace J. Chosy, B.S. advanced a new program of controlled weight loss - a program which has since become known as the Gordon Regimen. (11) Gordon et al originally proposed a program of diet control consisting of a 1320 calorie high protein low carbohydrate diet divided into six daily feedings. This was combined with the daily use of Cytomel and the use of a diuretic once each 10-14 days. The initiation of the diet was preceded by a 48 hour absolute fast. X

Since the first publication of the Gordon Regimen modifications of the Gordon diet along with many of its principles have been used rather extensively at the University of Nebraska Obesity Clinic. The purpose of this paper is to discuss the Gordon Regimen and present some preliminary observations as to its effectiveness in the University Clinic.

Method and Results

The Obesity Clinic at the University of Nebraska was organized in 1963 by Drs. Mary J. Henn, Robert B. Muffly and Vernon G. Ward. At the time of this writing we have some data available on the treatment of 119 females in the University of Nebraska Obesity Clinic. Also available is some limited information on nine male patients but because of this small number they will not be included in the following discussion.

The average age of these 119 females was 35.3 with a range of 13 to 72 years. Of these 119 females, 78 were originally begun on a modification of the Gordon diet and their average age was 37.4 years with a range of 14 to 72 years. The average height of the female patients was 5'4½". The weight as recorded on the initial visit for 62 female patients beginning the modified Gordon Regimen averaged 253 pounds with a range of 150 to 400 pounds. The average weight for 53 non-Gordon patients as recorded on the initial visit was 233 pounds with a range from 157 to 391 pounds. (Table 1) The modified Gordon patients were instructed in a 1230 calorie six feeding diet composed of 100 gms. protein, 50 gms. carbohydrate and 70 gms. fat. This modification of the basic 1320 calorie Gordon diet was done by Mrs. Berta Barnett, Director of the Dietary Department at the University of Nebraska. In addition to this diet, 41 of these patients were given Cytomel, 25 mcg. once to four times

per day and in no instance exceeding 125 mcg. per day. Forty-four of the modified Gordon patients were treated with diuretics principally Diuril and Hydrodiuril, in doses of 500 mg. and 50 mg. * respectively. Diuretics were given from once a day to once a week. Nineteen of the modified Gordon patients were also given appetite suppressants including Tenuate dospan and Presate. * The non-Gordon patients were also given instruction in a variety of different diets more suited to the apparent needs of the patient than to serve as a control group. These diets were therefore quite diversified and included 800 to 1000 calorie diabetic diets, low cholesterol diets, and 4, 5, and 6 feeding diets with moderate caloric restriction incorporating a 1-day fast each week. These patients were also treated with a variety of medications again tailored to individual needs and including diuretics, oral hypoglycemic agents, antihypertensive medications and a variety of appetite depressants as well as Cytomel on occasion. Both groups were treated with uricosuric agents when indicated.

An attempt was made to screen the metabolic status of the patients by determinations of serum PBI, uric acid, cholesterol, total lipids, and 24-hour urinary steroid excretion during their initial visits but because of time, monetary factors, patient response and cooperation this data is somewhat scanty. (Table 2) Information at present indicates that the first recorded PBI for 53 patients on

the modified Gordon Regimen averaged 5.8 mg.%, with a range of 3.0 to 11.3 mg.%. It is to be noted that a few of these values represent levels measured after the patient had begun treatment and may have been taking exogenous thyroid medications. First recorded uric acid levels on 45 modified Gordon patients averaged 6.6 mg.% with a range of 3.1 to 10.1 mg.%. Cholesterol levels on 49 modified Gordon patients averaged 238 mg.% with a range of 100 to 440 mg.%. Total lipid levels for 43 modified Gordon patients averaged 838 mg.% with a range of 450 to 1290 mg.%. Adequate data is not available for precise comparison of the patients on other dietary programs but the information at hand seems to be more or less in line with values obtained for the Gordon patients.

The average duration of treatment for the modified Gordon patients was 23.9 months with a range of 1 to 76 months while the non Gordon patients had an average of 20.2 months with a range of 1 to 66 months up to this time. (Table 1) As of now 65 patients on the modified Gordon diet had a total weight loss of 407 pounds (863 pounds lost, 456 pounds gained), an average loss of 6.26 pounds per patient. Individual performances for these patients ranged from a loss of 94 pounds for one patient to a gain of 86 pounds. Only 10 of the patients on the modified Gordon diet had a weight loss of over 30 pounds. Four of these patients lost between 30 and 40 pounds, one patient lost 41 pounds, one patient lost 56 pounds, two patients

lost between 60 and 70 pounds and two patients lost between 70 and 80 pounds. One patient lost 94 pounds. The results for 35 patients not on the modified Gordon Regimen shows an aggregate weight loss of 237 pounds (410 pounds lost, 180 pounds gained), an average loss of 6.77 pounds per patient. The range for these individuals was from a loss of 78 pounds to a gain of 36 pounds. (Table 1) It is interesting to note that where comment about individual adherence to the program has been made these have in the great majority of instances mentioned poor adherence to the specific plan of therapy.

Discussion

In 1963 Gordon, Golberg, and Chosy published an article entitled "A New Concept in the Treatment of Obesity," outlining an entire program designed to achieve weight loss even in patients with previous negative responses to other weight loss programs. (11)

This regimen, which was discussed by Gordon in a later monograph, consists of a 1320 calorie diet (100 gm. protein, 80 gm. fat supplemented with 10 to 20% of polyunsaturated fatty acids, and 50 gm. carbohydrate) divided into 6 meals per day. (12) Triiodothyronine is prescribed to correct hypometabolism and a diuretic is administered once every 10 to 14 days. Treatment is begun with a 48 hour total fast.

The cornerstone of the Gordon Regimen is the 6 feeding low carbohydrate diet. It has long been suggested that eating only one or

two meals per day may promote fat storage. Hollifield and Parsons demonstrated an increase in lipogenesis with hypertrophy of liver and adipose enzymes concerned with lipogenesis in rats on an adequate caloric diet but limited to feeding only during a single two hour period each day. (15) After a 10-week period these rats were 30% heavier than a controlled group allowed free access to the same diet throughout the day. Cohn, Shargo and Joseph showed marked differences in the carcasses of "pair fed" rats eating qualitatively and quantitatively identical diets. (6) The carcasses of the rats forced to take the prescribed amount of food as a single large daily feeding contained approximately twice as much fat and proportionately less protein and water than did the carcasses of the rats who were allowed to eat the same amount freely throughout the day. Cohn and Joseph also demonstrated a decreased conversion of carbon-14 labeled acetate to lipid in rats given restricted amounts of food every hour when compared with tissue of control rats with free access to food. (5) This was noted regardless of whether the amount of food eaten was 50%, 65% or 80% of that consumed by the animals eating ad libitum. They also showed that the amount of conversion of carbon-14 labeled acetate into lipid increased as the daily amount of food was increased. On the other hand, the rate of conversion in animals fed only 50% of the amount given to controls and allowed to eat only in 1-2 hours out of 24 was four times that

of controls with free access to food. Cohn and Joseph suggested that subnormal food intake will stimulate lipogenesis only if the rate of ingestion exceeds the pace of energy expenditure. An interesting study which tends to support the relationship between frequency of feeding and obesity was conducted in Prague in 1964. (7) This study conducted on a random sample of men between 60-64 years of age showed a direct correlation between obesity, elevation of serum cholesterol and decreases in glucose tolerance with decreasing frequency of meals.

Since there appears to be a large body of evidence linking infrequent large meals with the development of obesity, the Gordon Regimen proposes multiple small feedings to break the cycle of enzyme hypertrophy and increased lipogenesis following meals. It will also hopefully raise the expenditure of exogenous caloric intake used for immediate energy demands. To further this goal the diet is initiated by a 48 hour fast not only to accomplish some atrophy of the assumed hypertrophied enzyme systems but also to break the established pattern of gorging. Rats who have been forced to condense their entire 24-hour food intake into a 1 to 2 hour period by gorging do not return to a normal nibbling type of eating pattern when again allowed free access to food but continue to gorge. If a 48-hour fast is imposed on these animals before resumption of free access to food the pattern of nibbling small amounts throughout the day is

rapidly reestablished.

Although the small frequent feeding theory has gained some popularity it has not been enthusiastically received by all groups. In a study designed to test whether frequency of feeding per se is a critical factor in the rate of weight loss on a hypocaloric diet six obese females were placed on 600 calorie liquid diets given either as a single meal or divided into 9 equal feedings per day. (4) Both groups showed a rapid initial weight loss but following this the weight losses were, in effect, linear with time and independent of the frequency of feedings. The mean daily weight loss for the 9 feeding subjects was 0.24 kg. while that for the single feeding group was 0.23 kg. This suggested to the authors that the rate of loss was determined by the degree of calorie restriction and independent of the frequency of feeding.

In addition to dividing the daily calorie intake into multiple small meals, the Gordon Regimen requires a low daily carbohydrate intake. This is based on the currently accepted interrelationship of lipid and carbohydrate metabolism. Lipogenesis and the storage of neutral fat as triglyceride are linked to glucose utilization by at least three well established pathways. Glycolysis by the Emden-Meyerhof cycle provides pyruvic acids, an important source of acetyl COA for condensation into the carbon skeleton of fatty acids. Glycolysis serves as the principle source of glycerophosphate

required for the esterification of free fatty acids. Oxidation of glucose by the hexose-monophosphate shunt provides reduced TPN, important if not obligatory for the reductive biosynthesis of fatty acids. Because of these considerations a diet low in carbohydrate should decrease lipogenesis and promote fat mobilization to meet energy requirements. Bloom and Azar studied two groups of obese patients by supplying calories in a mixture of constituents similar to the food composition of the body during fasting. (3) Two diets were used. One supplied 1500 calories as 39% protein, 61% fat calories, the other supplied 2000 calories with 25% protein and 75% fat calories. They showed an increase in plasma and urine ketones, serum FFA, total cholesterol and urinary nitrogen excretion in all subjects as would be seen under fasting conditions. They could show no consistent trends in blood sugar levels, total serum lipids or creatinine excretion. All the subjects showed a weight loss in the range of 4.5 to 8 pounds over the 3-day test. With the addition of carbohydrate to the diet a prompt decline in plasma and urine ketones, FFA, and urinary nitrogen excretion was noted. The similarity of values found on the carbohydrate free diet and those seen in fasting suggest that the metabolism of fat and protein is similar regardless of whether this is supplied endogenously as a result of fasting or exogenously in conjunction with carbohydrate restriction. The increase in FFA was attributed to the deficiency

of carbohydrate in the diet mixture with subsequent fat mobilization. The authors suggested that fat mobilization occurs with adequate calorie intake if the carbohydrate content of the diet is deficient. Consequent to this type of interpretation of lipid-carbohydrate interaction, the Gordon diet allows no more than 50 gm. of carbohydrate intake per day.

The Gordon Regimen makes use of two medications in addition to diet control. These are triiodothyronine and a diuretic, usually Diuril or Hydrodiuril. Gordon states that many or most obese individuals show one or more abnormalities indicative of hypometabolism such as low protein-bound iodine, a low I^{-131} uptake by the thyroid, or a prolonged relaxation of the Achilles tendon reflex. (11) Studies measuring the in vivo oxidation of palmitate- $1-C^{14}$ have demonstrated an adequate fatty acid oxidation in obese patients but its rate is generally lower than that in normal controls so that the actual metabolic rate in such persons must be low. (13) With this in mind triiodothyronine is a suggested part of the Gordon Regimen. The apparent indications for the use of thyroid medications have not, however, been agreed upon by all investigators. Glennon and Brech studied 330 obese subjects and compared them to 50 non-obese controls. They could demonstrate no significant differences in PBI levels in the two groups (10). On the other hand there is support for the use of triiodothyronine in the treatment of obesity. Gelvin, Kemigs-

berg, and Boyd in a sophisticated double-blind study compared the efficiency of a capsule with d-amphetamine and amobarbital with a combination of this capsule and liothyronine for the management of obesity. (8) Fifty-seven obese males and females were placed on a 1000 calorie diet of 75 gm. protein, 40 gm. fat, and 100 gm. carbohydrate. One-half of the patients were given d-amphetamine and amobarbital while the other half were given this plus liothyronine. At the end of 8 weeks the medications of the two groups were reversed. During the first 8 weeks both regimens produced equal weight losses indicating that the addition of liothyronine added nothing to the program. However, when the combined therapy was given during the second 8 week period, weight loss continued at the same rate but when the liothyronine stopped at 8 weeks few patients continued to lose weight while some began to gain. The authors concluded that liothyronine may help patients who fail to lose weight while on a reducing program.

The use of thyroid medications as an aid to weight reduction as compared to a placebo was studied by Gwinup and Poucher. (14) Nine patients on levothyroxin and eight patients on liothyronine were compared with four patients on a placebo. All medicines were given in increasing doses until weight loss occurred. At the end of six months 15 of the 17 patients had shown steady progressive weight loss of slightly more than one pound per week. Two patients dropped

out because of significant side effects while the others continued a full six months with no significant difficulties. This would tend to suggest that thyroid medications when used in large doses do play a valuable role in weight reduction.

The other medication recommended on the Gordon Regimen is a diuretic once every 10 to 14 days. The complete oxidation of 100 gm. of palmitate fatty acid will produce 112 gm. of metabolic water. This has been suggested as one reason obese patients have difficulty losing weight. But this is not the entire story since in a normal lean individual this excess water would be rapidly excreted via the kidneys. Obese patients, on the other hand, may be unable to excrete this extra water load. Bansi and Olsen showed that renal blood flow, glomerular filtration rate, and the filtration fraction were all significantly decreased in obese individuals as compared to normal controls. (1) These were returned toward normal by exogenous liothyronine. They also demonstrated a higher level of antidiuretic hormone in the plasma of obese patients than in normal individuals. Posture also seems to have an exaggerated effect on water excretion in the obese patient. Standard water load tests in obese subjects often show only about a 10% urinary excretion of the total load while in the upright position. This figure usually rises to well over 100% when recumbent. Because of these and other similar observations the routine use of a diuretic is also incorporated in the Gordon

Regimen.

Although the Gordon Regimen represents a new and integrated approach to the treatment of obesity and originally showed great promise, it has not always been completely successful even in the hands of those involved in its development. Joseph A. Glennon, a colleague of E.S. Gordon at the University of Wisconsin, reported on a weight reduction program consisting of a short initial period of hospitalization followed by home diet. (9) All the patients had been at least 50% over their ideal weight and were followed for at least one year. All had initially lost weight in the hospital. As outpatients they were continued on diets begun in the hospital, either 800-1200 calorie diets or the complete 1,320 calorie 6 feeding Gordon Regimen. Of the 199 patients followed for one year only 12% were able to maintain or attain a 20 pound weight loss. Only 6% were able to maintain or attain a 40 pound weight loss. Only 2% of the total lost sufficient weight to be less than 50% over their ideal weight. Glennon stated that these results support the proposal that obesity is at present incurable.

Conclusion

The Obesity Clinic at the University of Nebraska has had long experience with the basic formulation of the Gordon Regimen. As can be seen in the Table 1 the results thus far are anything but spectacular. The average weight loss of 6.26 pounds per patient

while being followed for an average of 23.9 months is disappointing and actually not significantly different from the weight loss for patients on other diet control programs. (Table 1) Even though these results are discouraging they are in accord with the results obtained by Glennon at the University of Wisconsin. (9)

The Gordon type of diet with its 6 feedings and low carbohydrate content does seem to be excellent. It is generally well accepted by the patient and its high protein and its fat content seem to give it high satiety value. It is the impression of those associated with the Obesity Clinic at the University of Nebraska that patients should be treated with diet alone for a suitable period before the addition of thyroid medication or diuretics is considered. It is felt that either the Gordon type of diet alone or the complete Gordon Regimen can result in significant weight loss. This probably can be said of any well-planned weight reduction program provided there is optimal patient cooperation. The difficulty is not with the programs but with patient adherence to the programs. Until a method of instilling a genuine desire to lose weight is developed, obesity will probably remain, as Glennon says, the incurable disease.

Table 1

Initial weight, Duration of Treatment and
Weight Loss of Obesity Clinic Patients.

	Gordon Program (No.)	Non-Gordon (No.)
Initial weight		
Average	253 pounds (62)	233 pounds (53)
Range	150-400 pounds	157-391 pounds
Duration		
Average	23.9 months (65)	20.2 months (35)
Range	1-76 months	1-66 months
Total loss	-407 pounds	-237 pounds
Average loss	-6.26 pounds (65)	-6.77 pounds (35)

Table 2

Initial Lab Values of Gordon Diet Patients (No.)

Lab Test	Number of patients	Results
PBI		
Average	53	5.8 mcg%
Range		3.0-11.3 mcg%
Uric Acid		
Average	45	6.6 mcg%
Range		3.1 to 10.1 mcg%
Cholesterol		
Average	49	238 mg%
Range		100-440 mg%
Total Lipid		
Average	43	838 mg%
Range		450-1250 mg%

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