



# *Treatment of OBESITY with Calorically UNRESTRICTED DIETS*

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IT is well known that weight reduction requires a limitation of the caloric intake to a level below that of the caloric expenditure. This limitation is usually effected by conscious restraint of the appetite but there appears to be reason for believing that it can also be accomplished by physiological forces which, being brought to bear upon the appetite, regulate it so that weight is lost without the necessity for enforcing caloric restriction. In normal individuals, the appetite appears to be limited by regulatory mechanisms; and though these are disturbed in the obese, they continue to operate at the higher level of body weight. It seems reasonable, therefore, to expect that, if the cause of the disturbance can be removed, these still-intact mechanisms should adjust the caloric intake to output at a normal weight level.<sup>1</sup>

Evidence has been presented for a metabolic block in the oxidative pathway of pyruvic acid as a factor which, by inducing excessive fat storage, disturbs the balance between caloric intake and output; and restriction of carbohydrate has been suggested as a treatment in a calorically unrestricted diet composed, essentially, of protein and fat. Restriction of carbohydrate, it is believed, by removing much of the source of pyruvic acid, alleviates the inhibiting influence of this substance on the oxidation of fat, with the result that the energy needs of the tissues, being more fully supplied from the body's own re-

serve stores, dictate a correspondingly smaller intake of food.<sup>1</sup>

The strategic advantage of such a plan of treatment has been pointed out by Dole *et al.*<sup>2</sup> There appears, however, to be an even greater advantage to this method of treatment, in contrast to general restriction of the whole dietary pattern; for, when carbohydrate, alone, is restricted, there is no decline in the basal caloric expenditure.<sup>1</sup> When, however, the total caloric intake is restricted, a decline in basal caloric expenditure is to be expected.

## BASAL CALORIC EXPENDITURE OF THE OBESE ON LOW CALORIE DIETS

This subject has been reviewed by Ryncarson and Gastineau,<sup>3</sup> who refer to the work of Erown and Ohlson<sup>4</sup> and of Strang and Evans<sup>5</sup> as showing a decrease in basal caloric expenditure of the obese on low calorie diets, and to the work of Evans and Strang,<sup>6</sup> Moller,<sup>7</sup> Mulier and Topper,<sup>8</sup> and Rony<sup>9</sup> as showing no such decrease. Rony's conclusions were based on the experiments of Evans and Strang<sup>6</sup> and of Keeton and Bone.<sup>10</sup> Ryncarson observes that the question of the fall of the basal metabolic rate in the reduction of weight of obese persons is of some importance; but he finds the reports contradictory, and he feels that insufficient studies have been made to permit the formation of any definite conclusion.

Brown and Ohlson's studies<sup>4</sup> showed an average decline of 17 per cent in basal calories among eight young women of college age; and

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Strang and Evans, in their five cases, showed a decline of 14 per cent, which was greater than the decline in either the weight or surface area. The reference to the work of the latter investigators as showing, also, that no decline occurs, stems from their introduction of a special formula for calculating metabolic rates from the ideal, rather than from the actual weight—a method based on the assumption that fatty tissue is metabolically inert and that, therefore, its weight should not be taken into account when metabolic calculations are made. The discovery that fatty tissue is metabolically active, however,<sup>11</sup> seems to rule out the validity of metabolic calculations based on ideal weights, a method of calculation which has been used to make the metabolism of the obese appear hypernormal and its decline on low calorie diets advantageous.<sup>3</sup>

Examination of the basic data of those who reported no decline in metabolism reveals that, actually, there was a decline which was not considered significant. The one case studied by Moller<sup>7</sup> showed a decline of 12.5 per cent in basal metabolic rate (B.M.R.) (calculated from the graph). Mulier<sup>8</sup> found a decline of only 3.8 per cent in the B.M.R. of 25 children, but pointed out that the pelidisi of Pirquet\* is a better standard in this age group than is the usual surface area rule. Calculations from the graphs of the eight cases studied by Keeton and Bone<sup>10</sup> show that there was an average decline of 12.2 per cent in the B.M.R. They did not consider this significant because the rates did not fall below the arbitrary limit of normal, customarily used in interpreting clinical tests of the metabolism. It seems, however, that in physiological experiments such as this it is more appropriate to take note of the actual changes in the significant variables. The basic data of the various investigators seem to give overwhelming evidence that, in the obese adult at least, there is a fall in metabolic rate attendant on the use of low calorie diets.

\* According to Pirquet, the cube of the sitting height in centimeters is approximately the weight in grams of a normal person.

#### SIGNIFICANCE OF THE DECLINE IN BASAL ENERGY EXPENDITURE

It was found that obese individuals, who had lost weight after treatment by low calorie diets, maintained a constant weight on a food intake considerably lower than that of other people of similar age and dimensions.<sup>4</sup> This would seem to indicate that, between the two groups, there exists a metabolic difference which would require that the formerly obese person must subsist on a subcaloric intake of food the rest of his life if he chooses to control his weight by this means. Continuance of subcaloric diets after weight reduction has, in fact, become a standard recommendation.<sup>3</sup> It would seem that the situation with formerly obese persons is very similar to that of normal individuals who have accustomed themselves to a caloric intake below their requirement. In both there would seem to have occurred what Lusk referred to as a "specific reduction in metabolism coincident with undernutrition."<sup>12</sup>

The question of greatest significance in connection with the use of low calorie diets is whether it is true, as is generally believed, that the reserve stores of fat are drawn upon in an amount sufficient to meet the metabolic needs of the organism. It might be reasoned that a fall in basal metabolic rate means only that the requirement of the tissues for energy has declined, and that their metabolic needs are fulfilled in any case. Another interpretation, however, could be that there is an optimal metabolic rate for each individual, and that a decline below this rate indicates that less than an optimal amount of energy is being made available for the metabolic work of the tissues. This interpretation would be in accord with Benedict's view that the basal metabolism is "a very good index of the general state or level of vital activities."<sup>13</sup> The basal metabolism would appear to be an index of caloric nutrition at the cellular level. As customarily interpreted, however, basal metabolism tests are rarely of great value except in the diagnosis and treatment of diseases of the thyroid gland;<sup>14</sup> and it may very well be that in ordinary clinical practice the range of error

is too wide for uses which require greater precision.

The answer to the question whether the decline in metabolic rate of the obese on low calorie diets merely reflects a lessened requirement of the tissues, or, on the other hand, whether it signifies that the tissue requirements are not being fulfilled, would seem to necessitate an inquiry into some of the most fundamental matters in metabolic theory. Metabolic theory, in its broadest scope, attempts to answer the question: what causes the body to oxidize the amount of nutrient materials that it does? Current thought on the matter has been largely colored by Rubner's concept of a rigidly fixed caloric expenditure, determined by the requirement; this in turn is determined by the surface area of the body. This concept was opposed vigorously by Rubner's teacher, Voit, who insisted that, *while the tissues have a certain maximal capacity for metabolizing foodstuffs, the amount they actually metabolize is influenced by the quantity and the quality of the nutrient materials brought to them by the blood.*<sup>12</sup> "The requirement for energy," Voit said, "cannot possibly be the cause of metabolism any more than the requirement for gold will put it into one's pocket." Voit's concept of the metabolism would seem to find support in studies which show that the utilization of glucose,<sup>15</sup> fatty acids,<sup>16</sup> and ketones<sup>17</sup> by the tissues is influenced by the concentrations of these substances in the blood. The decline in metabolism of the obese during weight reduction by low calorie diets, therefore, might reasonably be taken to indicate that the reserve stores of body fat are not being mobilized rapidly enough to meet the metabolic needs of the tissues.

#### STIMULATION OF FAT UTILIZATION DURING WEIGHT REDUCTION

It would seem desirable in the treatment of the obese to direct measures primarily toward an *increased* mobilization and utilization of fat, instead of relying upon the dubious ability of caloric restriction to draw adequately upon the adipose deposits. If fat mobilization can be stimulated to a sufficient degree, and inhibition of fat oxidation can be reduced, it

should be possible for the tissues to utilize this nutrient material to the maximum extent of which they are capable. There would then be no question of a shortage of calories for performing the metabolic work of the tissues, and no decline in metabolic rate would be expected. This, it seems, is the situation produced when obesity is treated by calorically unrestricted diets in which carbohydrate, alone, is limited.

A diet consisting essentially of protein and fat is ketogenic. Ketogenesis, it appears, is the normal mechanism by which the organism is enabled to utilize fat in much larger quantities than it otherwise could.<sup>18</sup> Ketonemia, furthermore, is followed by increased mobilization of fatty acids from the adipose tissues.<sup>19</sup> Consequently, the blood concentration of both ketones and fatty acids becomes increased, causing the tissues to oxidize them in larger amounts.<sup>16,17</sup>

Ketogenesis, therefore, would seem to be the key to the possibility of weight reduction on calorically unrestricted diets; and this would have special applicability to the obese, in whom the ketogenic response to fat feeding is greater than it is in the lean.<sup>20</sup> A greater than ordinary quota of the energy requirements would be urged upon the tissues by the increased mobilization of the body's fat deposits, and the appetite would decline to a corresponding extent. Animal experiments in which nutrient materials are introduced into the drinking water indicate a very precise adjustment in the voluntary caloric intake<sup>21</sup> and it seems that the effect would be the same whether the nutrients were added to the metabolic pool from without or from the body's own reserve stores. Mobilization of an increased quantity of utilizable fat, then, would be the limiting factor on the appetite, effecting the disproportion between caloric intake and expenditure which is necessary for weight reduction.

When such a plan of treatment is used, the actual caloric intake would vary according to the needs of each individual from day to day. This appears to be a great advantage, for daily variations in physical activities and other factors affect the energy requirements;



and weight loss would proceed in any case, for under these circumstances the adipose tissues, first, furnish a considerable quota of the nutriment required by the organism, leaving the appetite to make up the remainder. The large caloric requirements of the obese for maintaining constant weight have often been emphasized. Evans found that they range up to 4500 calories a day.<sup>3</sup> There is, therefore, nothing remarkable in the observation that, when this method of treating obesity is used, some obese individuals must, of necessity, lose weight on an intake of 3000 calories or more per day.

#### PRACTICAL APPLICATION OF THIS METHOD OF TREATMENT

In the practical use of this method a minimum of 8 ounces of meat has been recommended for each of the three meals of the day; and to emphasize that fat, as well as lean, is to be eaten, one part of fat to three parts of lean meat has been suggested as the proper proportion. This is the general proportion adopted by choice when an exclusive meat diet has been followed.<sup>22</sup>

Carbohydrate has been allowed in an amount calculated not to interfere with ketogenesis. Peters found that 100 Gm. of carbohydrate would reduce ketogenesis,<sup>18</sup> but the amount seems to vary in different individuals.<sup>23</sup> The very low calorie diets of Strang and Evans, containing only 40 Gm. of carbohydrate, were ketogenic,<sup>24</sup> and these diets showed a very favorable protein-sparing action. In most of the patients on a calorically unrestricted diet, 60 Gm. of carbohydrate per day have been allowed, although in a few cases a more drastic reduction has seemed necessary. Since most patients, though they are familiar with calories, are not familiar with the quantity of carbohydrate, in grams, in various foods, it has seemed helpful to provide a list of a few foods containing an average of about 20 Gm. of carbohydrate in an ordinary serving.

Liberal amounts of water have been allowed. Salt has been restricted, both for the value of this in the treatment of certain diseases often associated with obesity, and also

because there is at least one report which suggests that the metabolism may be increased by this means.<sup>25</sup> Salt, as is well known, often causes fluid retention, and this may exist in a subclinical degree more often than is realized. The clinical impression is gained that, with some individuals at least, salt interferes with weight loss on calorically unrestricted diets to an extent not explainable by the weight of the water which may be retained.

A general hygienic regimen has been advised, including regular rest, without oversleeping. A half-hour walk, or the equivalent exercise, before breakfast, also has been recommended. The reason for this is that, while 60 per cent of the energy needs of the body are supplied by fat after the usual overnight fast, the proportion can be increased by exercise in the post-absorptive state.<sup>18</sup> The entire success of treatment by calorically unrestricted diets, it seems, depends upon effectively stimulating the use of fat by the organism.

Since the obese patient must have a concise, readily understandable guide to go by, the following sheet of instructions, embodying the matters set forth above, has been prepared and has proved satisfactory during the past four years. Like most sheets of dietary instructions, its form is didactic; otherwise the patient is likely to become indecisive on many points. Although some may find reason to question certain details, it has seemed best to present it in its entirety, in the form in which it has been effectively used. The essential principle on which a calorically unrestricted diet appears to work—that of sufficiently stimulating the oxidation of fat—is quite different from that of low calorie diets; and one of the chief tasks in applying it is to establish the new orientation.

Reasoning associated with the use of low calorie diets has been so ingrained that matters applicable to such diets can quite inadvertently be carried over into the use of a calorically unrestricted diet, impairing its effectiveness. Such, it seems, was the fate of the calorically unrestricted diet based on a concept of obesity as a defect of carbohydrate metabolism, devised by the physician, W.

Harvey, from reflections upon the lectures of Claude Bernard, which he attended in 1856.<sup>26</sup> Harvey's diet, which attempted to avoid sweet and starchy foods, specifically, while allowing meat in *ad libitum* amounts, met with widespread success<sup>27</sup> and had a permanent influence on the treatment of obesity. However, since certain details of the diet could not find a rationale in the prevailing physiology of

Liebig, the diet underwent a succession of modifications, retaining only those features which conformed to current theory. Finally, as the "modified Banting" diets, it lost its identity among the many low calorie diets of the nineteenth century.

The sheet of instructions for the calorically unrestricted diet which has been in use during the past four years<sup>28</sup> is as follows:

#### A DIET FOR OBESITY

With this diet you follow a definite routine which is as important as the diet itself. Have a regular hour for going to bed. Set your alarm clock for eight hours sleep, never a minute more than that, and allow time for a thirty-minute walk before breakfast. It is not necessary to walk fast, but it is necessary to walk the full thirty minutes regularly.

Breakfast, lunch, and dinner are all the same type. You eat three big meals a day and lose seven pounds of excess weight a month.

*First course of each meal:* One-half pound or more of fresh meat with the fat. This part of the diet is unlimited. You can eat as much as you want. The proper proportion is three parts of lean to one part fat. Most of the meat you buy is not fat enough, so get extra beef kidney fat, slice and fry it to make up the proper proportion. Good meats are roast beef, steak, roast lamb, lamb chops, stewed beef, fresh pork, and pork chops. Hamburger is all right if you grind it yourself just before it is cooked. Season the meat with black pepper before it is cooked or use paprika, celery seed, lemon, chopped parsley, or celery tops, or use other flavoring which does not contain salt.

Do not use the least particle of salt. Do not use foods which contain salt, such as soup, bacon, smoked ham, canned chicken, or fish containing salt, frankfurters, bologna, canned or spiced meat, or salted butter.

*Second course of each meal:* This part of the diet is strictly limited. At each meal you have a choice of an ordinary portion of any one of the following: white potatoes, sweet potatoes, boiled rice, half grapefruit, grapes, slice of melon, a banana, a pear, raspberries or blueberries.

At the end of each meal have a cup of black coffee or tea without sugar. Do not use saccharine.

Be sure to drink six glasses of water every day before five o'clock. Your only other beverage is half a lemon in a glass of water if you desire it.

This diet contains *no* bread, flour, salt, sugar, alcohol, or anything else not mentioned.

#### SUMMARY

Restriction of carbohydrate, alone, appears to make possible the treatment of obesity on a calorically unrestricted diet composed chiefly of protein and fat. The limiting factor on appetite, necessary to any treatment of obesity, appears to be provided by increased mobilization and utilization of fat, in conjunction with

the homeostatic forces which normally regulate the appetite. Ketogenesis appears to be a key factor in the increased utilization of fat. Treatment of obesity by this method appears to avoid the decline in the metabolism encountered in treatment by caloric restriction. Details of diet and regimen are given.

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## RESUMEN

*Tratamiento dietético de la obesidad sin restricción calórica*

Restricción de los solos hidratos de carbono parece hacer posible el tratamiento de la obesidad con una dieta libre cuanto a las calorías y compuesta principalmente de proteína y grasas. El factor limitador del apetito que requiere cualquier tratamiento de la obesidad lo parece proveer la aumentada movilización y utilización de las grasas, en conjunto con las fuerzas homeostáticas que normalmente arreglan el apetito. La ketogénesis parece ser un factor importante en la aumentada utilización de las grasas. El tratamiento de la obesidad por este método parece evitar el descenso del metabolismo que se encuentra en el tratamiento por restricción calórica. Detalles del régimen se presentan.