Breakfast.—One egg and 1 oz. of bread.

Lunch.—One egg and 4 oz. of vegetables as below.

Dinner.—One cup of bouillon and 3 oz. of lean meat; 4 oz. of vegetables as below.

Vegetables Allowed.—Lettuce, cucumber, spinach, asparagus, endive, celery, mushrooms, tomatoes, sprouts, watercress, cauliflower, radish, cabbage.

Water, as much as needed. No fried foods. A teaspoonful of sodium bicarbonate daily.

It is essential that all the foods mentioned in this diet should be taken. Once a week the patient may have one meal of any food he wants. This is not so generous as it sounds, because after a few days of strict dieting the capacity for eating a large meal is lost. However, a "red-letter day" is something to look forward to, and encourages the victim in his perseverance. The reason for putting him to bed is that virtual starvation is more easily borne when at rest. Furthermore, he can be strictly controlled—a point of importance in children. In adults it is permissible to allow work to be continued on this diet, provided, of course, that there is no evidence of cardiac weakness.

Half to one pound a day is lost on this diet. It is apt to produce constipation and pimples if continued too long. As a rule a month is quite long enough, and during this time five drops of halibut-liver oil should be taken daily. An initial loss of weight of one to two stone having been achieved the following less drastic diet should be prescribed:

Breakfast.—One portion of fruit. One egg and white of one egg. Coffee, tea, bread substitute (for example, Heudebert's breadsticks).

Luncheon.—3 oz. lean meat, fish, or fowl. Half pint 5 per cent. vegetables.* One portion fruit.

Tea.—Tea.

Dinner.—3 oz. of meat, fish, or fowl, and vegetables as at lunch.

9.30 p.m.—Half a cup of orange juice. One oz. bemax.

In addition one and a half glasses skimmed milk daily (for calcium content). One capsule haliverol t.i.d. (for vitamin content).

A fruit portion = one orange; half grape-fruit; one medium apple; two medium peaches; one small pear; one cup strawberries; one cup blackberries.

When the desired weight is attained the diet should be slowly increased by adding butter, bread, and other vegetables. With a little care it is surprisingly easy to avoid return of obesity.

Dangers of Treatment

With the measures outlined above there are no dangers of vitamin deficiency, acidosis, or thyroid poisoning. There remains one fear, however, and that is for the heart. A rapid reduction of weight in the very fat patient of 50 or more may induce myocardial failure. For such persons only the first diet in this paper should be used, and even then a watch should be kept for a rising pulse rate, shortness of breath, and faintness, as signs of too rapid withdrawal of fat. As a useful precaution I regard the prescription of 10 minims of the *B.P.* tincture of digitalis thrice daily as helpful. Should signs of heart weakness appear, a tablespoonful of glucose should be given twice daily for three days, the diet raised to full normal, and the patient kept in bed for a week. Dieting may then be recommenced, but on a modified scale. Such eventualities are very rare, and indeed the plethoric, panting, corpulent caricature is far more likely to regain liveliness and slender lines from dieting than to suffer from a cardiac catastrophe.

*Lettuce, cabbage, cucumbers, spinach, asparagus, marrow, celery, tomatoes, brussels sprouts, cauliflower, radishes, mushrooms, rhubarb, scarlet runners, French beans, grape-fruit.

OBESITY: ITS CLASSIFICATION AND CAUSATION*

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Obesity is a disease which has been known to man from time immemorial, but it has not been until the past twenty or thirty years that a proper realization of the importance of the disease has been reached. The meaning of the word itself, which first appeared in the English language in the early seventeenth century, is not without interest. It takes its origin from the word "obesus," which is the past participle of the Latin word "obedere." The meaning of "obesus" passed through several stages in Roman times and signified, in turn, "that which has eaten itself away," "that which has eaten itself fat," and finally it was occasionally used to indicate fatness, laziness, or slothfulness. It can be deduced that overeating, fatness, and laziness have been associated together from Roman times, and the fact that some English writers of two hundred years ago were aware of the disadvantages of overweight is shown by the following quotation from Pope's *Dunciad*: "He might truly be called a martyr to obesity." This dates back as far as 1728, but the word obesity was rarely used in any writings before the nineteenth century. During the present century, however, the public have taken the keenest interest in the subject and this has helped to stimulate the medical profession to give the disease the most careful consideration.

Definition of Obesity

It is not an easy matter to give a rigid definition of obesity. While gross forms of the disease are easily recognized, mild degrees are less readily appreciated. Indeed it is a matter of some difficulty to ascertain the ideal weight of any individual. We are all familiar with the average tables of weight, but there is some considerable difference between the figures given by the various authorities. A woman of 20 who is 65 inches in height should have a weight of 125 lb. according to Wood,¹ 127 lb. by the tables given by Lawrence,² and 129 lb. by the tables of the Metropolitan Life Insurance Company.

A somewhat different standard is adopted by some writers which is called the optimum or ideal weight. Lawrence and other authors compute this for diabetics by subtracting 10 per cent. from the average weight. While this rule may be excellent for the great bulk of diabetics who are past the third decade of life, exception should be made for young diabetics as they are especially liable to fall victims to tuberculosis. It is universally recognized³ that individuals under 35 years are much better insurance risks if slightly above the average weight. A small reserve of fat seems to protect the individual against the infectious diseases such as tuberculosis, pneumonia, etc., which are the chief causes of death in the first decades of life. After taking various factors into consideration the Life Extension Institute¹ has issued tables by which the woman mentioned above should have an ideal weight of 134 lb. Even with the above large variations only the sex, age, and height have been taken into account. No allowance is made for any difference in the size of the bony skeleton from individual to individual, whereas it is a matter of everyday experience that two men of the same age and height may vary by a stone in weight and both be perfect specimens. To overcome these difficulties various calculations to give ideal weights have been suggested which are based on

* Part of an address given to the Birmingham Branch of the British Medical Association.

several measurements of the body, but the involved nature of the measurements and calculations has limited their use.

In practice the assessment of optimum weights, like so many other problems, should really be an individual matter and should rest on the clinical experience of the medical adviser. A complete physical examination should be undertaken in which particular attention should be paid to the amount of abdominal and other adipose tissue and also the size of the bony frame. This examination, together with a consideration of average tables, will serve as a basis of judgement for determining the ideal weight, but the advantage of slight overweight in youth, and the marked advantage of a weight less than the average after middle life when infectious diseases give way to degenerative diseases as the prime cause of death, should be carefully borne in mind.

Classification of Obesity

Many classifications of the various forms of obesity have been suggested and the following is that put forward by Zondek⁴:—

- A. *Alimentary obesity* (overfeeding obesity), due to exogenous causes; fat distributed diffusely and uniformly over the whole body.
- B. *Endocrine obesity*, due to endogenous causes; the adipose tissue shows regional predilection. The glands in question are: the thyroid gland, the pituitary body, the sex glands, the pineal body, the islet system of the pancreas, and the suprarenal cortex.
- C. *Localized accumulation of fat* (lipomatosis).

It may be mentioned that the above classification, like all others, is not very satisfactory. The vast majority of cases fall within groups A and B, but it is often difficult to place any individual case strictly within one group or the other. Moreover, even within group B it is often impossible to say to what extent the different glands are responsible for the obesity. Perhaps these uncertainties are due to the fact that many factors are involved in the production of obesity, and these will be discussed later in this paper.

Importance of Obesity

Appearance.—Having arrived at the conclusion that the patient is overweight it remains to convince him and ourselves that a definite amount of this excess should be lost. Is it wise and is it worth while to reduce to the optimum figure? Perhaps the strongest appeal to the lay public is that of appearance. They know that the enviable figure becomes laughable and finally pitiable as weight is increased. The desirable figure of thirty years ago has given place to a much slimmer ideal. Perhaps this change of opinion is the outcome of the increased athletic tendencies, especially in the case of women, who have found that the figure of 1890 will not stand the speed and strain of 1936.

Diabetes.—Probably the most potent medical argument against obesity is the high incidence of diabetes among the obese. Joslin⁵ goes so far as to say that diabetes is a penalty of obesity. He also gives the following figures for the mortality of diabetic men over 45 years of age:—

Per cent. overweight	Mortality
5 to 14	2 × normal
15 to 24	4 × normal
25 and over	10 × normal

Cardio-vascular Renal Disease.—Diseases of this category are the commonest cause of death after middle age. The heart and arteries labour under the strain of carrying nourishment to an enlarged vascular bed. High blood

pressure, arteriosclerosis, apoplexy, and renal inefficiency are all concomitants of obesity, and one obvious and rational method of relieving unnecessary strain is to reduce the weight and size of the patient.

Arthritis.—Osteo-arthritis, in its many forms, is one of the commonest diseases encountered by the general practitioner and it is almost always associated with obesity. Exercises, manipulation, or any other forms of treatment are obviously of little value while one of the fundamental causes of the various conditions is ignored. A frame designed to carry 9 stone will continue to make protests in the form of painful hips, knees, arches of the feet, etc., as long as another 6 stone has to be supported. Reduction in weight is always a help to other forms of treatment and earns many grateful patients for the physician.

Nursing of Obese Patients.—Mechanical difficulties of nursing heavy patients and the increased risk of infection when large masses of adipose tissue are exposed after incision are often important factors militating against recovery of obese patients who come to operation for gall stones, diabetic gangrene, etc. Obesity is often a contributing factor in causing fractures and markedly alters the prognosis of elderly patients after these accidents.

Change of Mentality.—One of the more subtle distinctions, which is very obvious when dealing with many cases of obesity over a period of time, is the change of mentality which accompanies even a slight increase of weight. The proverbial tolerance and good nature of the slightly overweight soon degenerate into lack of ambition, apathy and torpor as this overweight becomes more marked. A possible physiological reason for the co-existence of torpor and obesity is the proximity of the centres for sleep and metabolism in the hypothalamus.

From a consideration of the above outline it can be stated, without fear of contradiction, that obesity is a dangerous malady because of its prevalence, its far-reaching effects and its insidious method of advance.

Cause of Obesity

All authorities agree that there is one fundamental cause for all forms of obesity, namely, that the energy intake is greater than the output. In other words, the sole avenue to obesity is through the mouth, and, although several factors modify the condition, there is no escape from the fundamental law that obesity can only be caused by the ingestion of food in excess of the individual's needs.

Different foods have different capacities for producing energy. Carbohydrates and proteins yield 4 calories per gram and fats 9 calories. In the course of a day a young man consumes, on an average, 500 grams of carbohydrate, 100 grams of protein, and 100 grams of fat, and this yields 3,300 calories. Of this total about half, 1,800 calories, is used to keep the vital processes going. Each day, from birth to death, the heart pounds on the chest wall 100,000 times and the bellows of the lungs open and close 20,000 times. Sleeping or waking, working or resting, eating or fasting, this activity must go on and there is no method of avoiding this expenditure of 1,800 calories.* If foods to this extent are withheld, then the patient must burn up the reserves of his body, and it is proved in practical experience that patients on diets less than the basal requirements always lose weight. This is often conveniently effected in practice by giving a diet of 1,000 calories, which, for most adults, is below the basal energy requirement. The 1,500 calories which remain of the daily ration after

* Pickworth⁶ has suggested that certain individuals may lower their metabolism considerably below normally accepted values by training themselves in the assumption of mental and physical relaxation.

the vital expenditure is satisfied are used for work and play. If the patient, from inactivity or other reason, does not use this amount but continues to eat his full allowance of 3,300 calories, then he must inevitably gain in weight.

There is a common belief among the lay public that the body can absorb differentially—that is to say, that if an excess of food is taken in the diet, the amount required can be absorbed and the excess eliminated in the stools. This conception is, of course, quite wrong. The intestine does its work in a remarkably efficient manner, and no matter how much food is eaten, practically all of it is absorbed; the requirement is burnt and the excess stored as fat. Only on rare occasions does the gastro-intestinal tract complain and reject food by vomiting or diarrhoea, which are its sole methods of gaining relief.

Another great problem to patients is why some of them gain in weight while other persons remain slim on apparently the same diet. Of course this is a delusion in the great majority of cases. Very often it is not what the patient eats at meals but what is taken between meals that is the important factor. These extras may vary from large amounts of sugar in innumerable cups of tea and coffee, to cakes, pastry or chocolates which may be consumed in large quantities. Alcoholic drinks and many non-alcoholic ones, such as ginger-beer, are sources of calories which must be carefully inquired into. Few people realize the calorific value of alcoholic beverages.⁷ A glass of beer yields 168 calories, which is not much less than the 184 calories of a similar glass of milk. An imperial quart of Allsopp's gives 674 calories. Another remarkable fact is that a bottle of whisky yields approximately 2,000 calories, which is equivalent to the yield from 1 lb. of sugar or $\frac{1}{2}$ lb. of butter.

When all these aberrations of diet have been thoroughly explored it is found that many people really do require less than others if they are to remain slim. This is always a source of considerable interest to patients, and the explanation lies in the condition of the individual with regard to the three factors:—

1. Energy output, as governed by the activity, clothing, etc., of the patient.
2. Endocrine system.
3. Central nervous system.

Energy Output.—There is no doubt as to the difference of energy output of various individuals. One man is slow in all his movements and even his speech is measured and deliberate. He is apt to wrap himself in many garments with wool next to the skin and to adjust his gloves and muffler with care before venturing out to catch the nearest omnibus. He keeps in as warm an atmosphere as possible and is averse to opening windows. His slimmer neighbour walks briskly part of the way to his work, with gloves in his pocket and muffler at home. At week-ends he does not sit by the fire but enjoys exercise in the open air. All such activities are made possible by the energy of the food, but if the output of energy slackens and the diet is not decreased, then the food is stored in the body as fat.

Endocrine System.—A consideration of the above matters merges into a consideration of the endocrine system. Extreme examples of the neighbours may, of course, be cases of myxoedema and Graves's disease respectively. Formerly we were apt to dismiss the matter by saying that it was the nature of an individual to be slim and to want to take exercise or to be obese and less inclined to activity, but nowadays we realize that much of a man's nature depends on his endocrine endowment. This comes

as a surprise to most patients, but an explanation of the effects wrought by abnormal functioning of the glands often serves to clarify the position. It is a matter of common knowledge that the removal of glands such as the thyroid gland, the testicles, or ovaries generally makes a vast change in the personality of an individual, but the removal of a leg, arm, or even such an organ as the spleen, makes no such change. Moreover, a small local lesion in the thyroid, pituitary, or suprarenal glands may be attended with the most disastrous psychological results while very large lesions in the bones, lungs, and other parts are without such effects.

The pituitary gland, which is called the "master gland" by Cushing,⁸ and the "leader of the orchestra of glands" by Langdon-Brown,⁹ plays an especially important part in the management of metabolism. It is probable that many mild cases of obesity such as those commonly found at puberty and the menopause, after pregnancy and certain diseases such as pneumonia, encephalitis, etc., are associated with dysfunction of this gland, because it is well known that it changes in structure and function in many of the above conditions.

Central Nervous System.—There is no space to deal further with the endocrines nor with their interaction with the nervous system, through which they produce many of their effects. It may be stated, however, that the area of the brain in close apposition to the pituitary has been proved to be especially important in this respect. Centres have been localized in the mid-brain which govern water, sugar, and lipid metabolism and control temperature, blood pressure, hunger, thirst, and sleep. Our knowledge of this subject is based on animal experimentation and clinical experience, and, notwithstanding the inherent difficulty of the work, is rapidly being developed.¹⁰

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The annual report to the Minister of Health by the chief alkali inspector for the year 1935 is now published (H.M. Stationery Office, 9d.). The Alkali Act, 1906, requires the best practicable means to be taken, by the owners, to eliminate or render harmless the escape of noxious or offensive gases from works engaged in a number of chemical processes—for example, alkali, cement, paraffin oil, tar, sulphuric acid, and arsenic works. The report calls special attention to atmospheric pollution by smoke. Many complaints have been received of excessive dust emission from cement works and, while it is not thought that this is directly injurious to health, the complaints are held to be justified on aesthetic grounds. The report records good progress in dust elimination, and expresses confidence that a substantial abatement will soon be effected. The production of sulphuric acid in England and Wales in 1935 amounted to 784,000 tons. The total acidity of gaseous escapes from these works averaged 1.61 grains of sulphuric anhydride per cubic foot, which is a little higher than last year but still compares favourably with the 4 grains permitted under the provisions of the Act. A serious warning is sounded in connexion with emissions of hydrogen sulphide—a deadly poison.