GLUCOSE-TOLERANCE CURVES IN 500 OBESE CASES *

BY

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The series consists of 242 males and 258 females. All the subjects were definitely obese, but did not necessarily present themselves for examination from this point of view; every case of obesity in which a glucose-tolerance curve was made during the last fifteen years has been included. No examples of gross endocrine disturbance, with the exception of diabetes, are given in this paper. It is possible that the series does not represent a fair sample of the obese population of the country, as the cases have, in the main, been derived from the better-off classes. A small proportion only have presented themselves because sugar has been found in the urine.

In discussing the question of obesity it is important to have some standard of normality from which to work. So far as it has been possible to ascertain, no such standard is available. One is therefore compelled to fall back on the weight tables published in the text-books. These tables are not really tables of "normality," but have been compiled from people, apparently in good health, presenting themselves for insurance. The weight tables therefore express an average weight but not an index of normality. It is probable that the greater the age of the subject the greater the error. For example, a six-foot man at the age of 25 has an average weight of 11 st. 3 lb., while at the age of 42 a weight of 12 st. 3 lb. is given. There is thus a gain of one stone in under twenty years. This gain might be attributable in part to increased calcium in the bones, but could not be entirely due to this. It is likely there would be a loss of weight in the musculature with advancing years which would, to a large extent, set off the increase. It is hard to see how this increase can be explained except by the

increase in fat laid down as life advances. There would appear to be little real reason for a normal person to increase more than a few pounds in twenty years. The same argument can be brought forward in the woman.

There would seem to be the same fallacy in the text-books with regard to blood pressures—a rise here as age advances is looked upon as normal, whereas it is really an average, and is in any case a degenerative condition. In the absence of normal weight tables the average weight tables have been employed here.

Technique of the Tests

The glucose-tolerance curves have all been arrived at by the method of Hagedorn and Jensen. A standard technique has been adhered to for obtaining the glucose tolerance throughout the whole period of fifteen years. The patients are encouraged to follow their usual unrestricted dietary regime until the night before the test is made. On the morning of the test a standard breakfast is given at 8 a.m.: one cup of tea with milk, with one lump of sugar if usually taken; one slice (about 1 oz.) of bread or toast, and butter. The glucose-tolerance test begins at 10 a.m.; 50 grammes of glucose in 300 c.cm. of water are given directly the initial sample of blood has been taken. Urine is collected at the start, and at one hour and two and a half hours after the glucose.

Analysis of Results

The curves obtained (Fig. 1) have been somewhat arbitrarily grouped under six headings, and are conventionally recorded in this table.

TABLE I

Curve No. I.—A normal rise not above 180 mg. at the half hour and thenceforward a normal descent to below 120 mg. in the one and a half hours.

Curve No. II.—A rise not above 180 mg., but a slow descent not reaching 120 mg. in the one and a half hours.

Curve No. III.—A flat curve under 135 mg. throughout the two-and-a-half-hour period.

Curve No. IV.—A peak at the half hour above the 180 mg. line, but a return to the 120 mg. line or below at the one-and-a-half-hour period.

Curve No. V.—A peak at the half hour or one hour above the 180 mg. line, and failing to reach the 120 mg. line until the two-hour period.

Curve No. VI.—A "diabetic curve": a considerable elevation above the 180 mg. line, 120 mg. not being reached at the two-hour period. This curve has been called "diabetic," but it does not mean to indicate that the author considers that a curve of this type is definitive of the clinical condition diabetes mellitus.

FIG. 1.—Glucose tolerance curves obtained in 500 obese cases.

* Read in the Section of Pathology at the Annual Meeting of the British Medical Association, Plymouth, 1938.

The most striking result from the analysis is the difference between the obese of the two sexes. The males show a total of 73 per cent. high curves for all ages, whereas the females show only 35 per cent. of high curves. This difference in response to glucose is still more pronounced if the percentage of high curves is plotted for

FIG. 2.—Percentages of obese cases showing high glucose-tolerance curves at various age groups.

the various decades, as in Fig. 2. Here we see that in the male up to the age of 35 years the percentage of high glucose-tolerance curves is below 30. After this age a sudden rise occurs, so that between 35 and 45 nearly 80 per cent. of obese males show a high glucose-tolerance curve, after which this high level is maintained up to the age of 65 and beyond. Obese women, on the other hand, show a very different picture. The percentage of high curves remains low until a decade later—45 years. The rise when it occurs is less sharp, the highest percentage of high curves (70) not being reached until the decade 55 to 65 years. From this it would appear that the condition underlying the obese state is different in the two sexes, or, what is more likely, a smaller number of women suffer from the defect commonest in men.

A striking difference is often evident in the post-mortem room. An obviously obese woman may be encased in layers of fat, but within this the body appears healthy and the muscles a bright red and not infiltrated with fat. In the male this is very rare, if it ever occurs, the musculature being heavily infiltrated with fat. With regard to the obese males showing normal or low curves, no distinct type could be picked out, but an analysis gives the following peculiarities:

Renal glycosurics	34%
Thick-set; barrel-shaped chest, short thick muscular limbs; athletic, intelligent .. .	30%
Impotence; sex organ defects .. .	6%
Patients already on diets—namely, gastric and duodenal cases	18%

In Table II an analysis of these obese subjects is shown, in which the percentage of high blood-sugar curves is correlated with percentage of overweight. The figures for the males are not very regular, but it would not appear that a male is more likely to have a high blood-sugar curve if he is 50 per cent. overweight than if he is even under 10 per cent. overweight. The female figures are more regular, with the exception of the first and last in the series, but give the same result. A woman 60 per cent. overweight is not more likely to show a high blood-sugar curve than one only 10 per cent. overweight.

TABLE II.—An Analysis of the Cases

Percentage Overweight	Percentage High Glucose-Tolerance Curves	
	Males	Females
Under 10	67	50
10 - 20	78	33
20 - 30	60	29
30 - 40	79	35
40 - 50	67	30
50 - 60	100*	33
Over 60	100*	57*

* Too few cases for accuracy.

Summary

In an analysis of 500 obese subjects (242 males, 258 females) it has been shown:

1. That high glucose-tolerance curves are obtained in 73 per cent. of males but in only 35 per cent. of females.
2. That up to the age of 35 high glucose-tolerance curves occur in only about 27 per cent. of males and 23 per cent. of females. Above this age about 80 per cent. of obese males have a high curve; but women always show a much lower percentage, only reaching a maximum of nearly 70 per cent. at the 55-65 age period.
3. That the percentage of high glucose-tolerance curves does not increase *pari passu* with an increase in the subjects' weight.

CORNEAL TRANSPLANTATION

RESULTS OF A SERIES OF 56 OPERATIONS ON 48 EYES*

BY

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At the B.M.A. Annual Meeting held at Oxford in 1936 I read a paper on the results of corneal transplantation, including some references to those obtained by other surgeons (Thomas, 1937). In the present paper my own results will be given and classified, but space will not permit me to enumerate those of others. It is gratifying, however, to know that excellent results are now being obtained by many surgeons in all parts of the world. The technique I employ is similar to that which gave me the best results in experimental rabbits (Thomas, 1931) and was afterwards used for operations on man (Thomas, 1935); but since the 1936 paper it has been modified in two ways—namely, by using saline instead of oil for receiving the graft, and by so arranging the cross-stitches that the knots do not lie on the graft or on its margin. These modifications were described at the Oxford Ophthalmological Congress in 1937 (Thomas, 1938), and their adoption appears to be justified by the results obtained since 1936.

The results of all my corneal graft operations from the first one in 1930, nearly eight years ago, to the fifty-sixth operation, four months ago, are here given. The scheme described in 1936 (Thomas, 1937) is again adopted for the classification of eyes as "suitable" or "unfavourable,"

* Read in the Section of Ophthalmology at the Annual Meeting of the British Medical Association, Plymouth, 1938.