

A Comparison of Obese and Nonobese Diabetic Subjects

Ian Murray, M.D.,* and Ian Wang, M.B.,† Glasgow

From the clinical aspect the obese, lipoplethoric diabetic differs in many respects from the nonobese insulin-deficient patient, as has been pointed out by Lawrence.¹ Nevertheless, published statistics with regard to diabetes do not generally take cognizance of such differences, and it appeared that it might be of interest to investigate the characteristics of these two groups separately. Accordingly we undertook a study of 1,000 patients all of whom had been diabetic for at least one year and who were attending the diabetic clinic at the Victoria Infirmary in Glasgow.

METHOD

Before classification according to body weight is possible it is essential to adopt a standard for ideal weight. For this purpose we have used the tables for relative height and weight at different ages according to Lister from the American Medico-Actuarial Mortality Investigation reproduced by Finlayson,² accepting as the ideal the average weight of the thirty to thirty-four year age group for this or any older age. For younger patients the average for their age was taken as the ideal.

More elaborate methods have been suggested, particularly that of the Metropolitan Life Insurance Company,³ which has published tables of ideal weight for women according to the frame of the patient. It is often difficult, however, to assess with any precision whether the patient has a small, medium, or large frame. The present simpler method would appear in general to be adequate, if perhaps somewhat lenient to the obese patient of smaller frame, since the weights we have accepted as ideal fall between the upper ranges given for the medium-framed and the lower ranges for the large-framed, as shown in figure 1.

As might be expected, loss of weight was frequently found to have occurred just before the onset of diabetic symptoms, but in certain cases the patients had maintained a fairly constant weight for many years, although

IDEAL WEIGHT — FEMALE.
Weight of age group 30-34 compared with American standards for different frames.

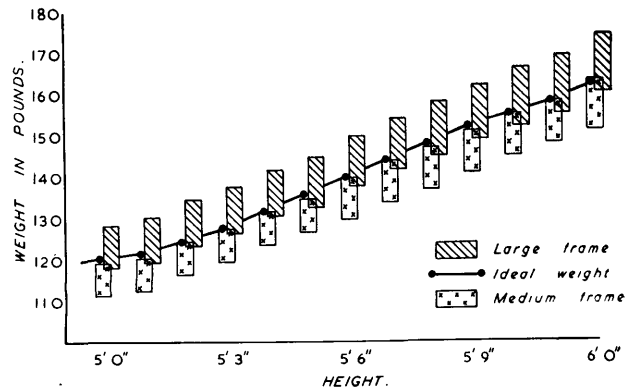


FIGURE 1

at a former age they had been much heavier. It was on account of these differences that it was considered advisable to use for our present purpose the weight of the patients when they became diabetic and not their previous maximal weight.

The obese group (group 1) consisted of all patients who were 20 per cent or more above ideal weight. Those who did not exceed the ideal weight had to be subdivided according to whether they had at no time been heavier than the ideal (group 4) or whether at some earlier age they had exceeded it (group 3). A considerable number were found to be overweight but not to exceed the ideal by 20 per cent at the time diabetes was discovered (although doubtless many had exceeded this limit earlier), and these were classified as group 2. The numbers for each of these four groups are shown in table 1. For the purpose of the present study comparison was made only between those who were still frankly obese when diabetes was detected (group 1) and those who at no time had exceeded the ideal weight (group 4).

There is a possible error in analyzing a series of so-called "old" patients. Since the general experience is that obese patients, for a variety of reasons, are more prone to absent themselves from a diabetic clinic than is the case with the acute thin diabetic, the proportion of obese patients may be smaller than it should in fact be. To check this possibility we examined 300 consecu-

Presented at the Second Congress of the International Diabetes Federation in Cambridge, England, on July 6, 1955.

From the Diabetic Clinic, Victoria Infirmary, Glasgow, Scotland.

*Physician-in-Charge, Department for Metabolic Diseases, Victoria Infirmary, Glasgow S. 2.

†Medical Registrar, Victoria Infirmary, Glasgow S. 2.

A COMPARISON OF OBESE AND NONOBESE DIABETIC SUBJECTS

TABLE 1
Classification of 1,000 patients in present series compared with 300 consecutive new cases

Group	Present Series	New Cases
I. Obese (exceeding 20% overweight).	337 (33.7%)	124 (41.3%)
II. Intermediate (+5 to +20% overweight).	215 (21.5%)	75 (25.0%)
III. Nonobese but formerly overweight	161 (16.1%)	38 (12.7%)
IV. Nonobese	287 (28.7%)	63 (21.0%)

tive new patients. The number of these falling into each of the four groups is shown also in table 1, from which it will be seen that the proportion of new obese patients is significantly higher. In the subsequent analysis, however, it has not been considered necessary to make allowance for this difference.

RESULTS

Age of Onset of Diabetes. This is strikingly different in the two groups. In the obese patients 94 per cent were 40 years of age or more when diabetes was detected, whereas almost 52 per cent of the nonobese were under this age at the onset. Moreover, unlike the obese patients, who usually develop the disease between the ages of 50 and 65, the nonobese are distributed very much more evenly in the various decades of life. This is shown in the diagram (figure 2), which in addition gives an indication of the difference in sex ratio.

Sex Ratio. The ratio of males to females in the 1,000 patients examined is 1:2.03, a value approximating very closely that of 1:2.26 found by Munro, Eaton and Glen⁴

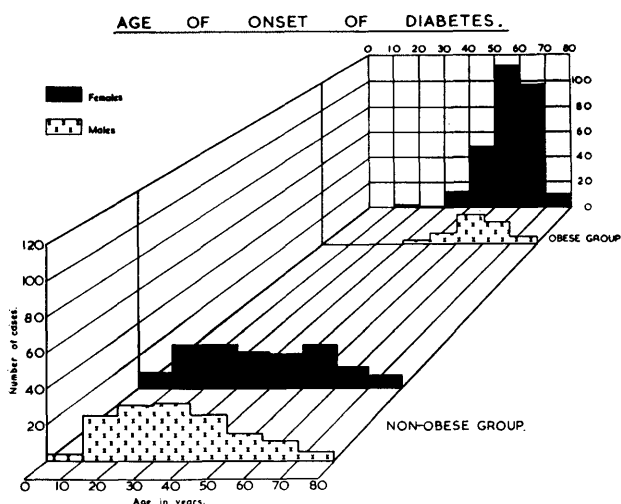


FIGURE 2

in a previous study at our clinic, and identical with the ratio of 1:2.06 obtained from the analysis of deaths from diabetes in Scotland from 1931-1940. When, however, the obese and nonobese groups are examined separately very different values are obtained. For the former the ratio is 1:5.13 and for the nonobese it is 1:0.94.

Insulin Requirements. It is to be expected that there would be a vast difference between the two groups as regards insulin requirements. The great majority (92.0 per cent) of the nonobese patients require insulin, but only a small proportion (17.5 per cent) of the patients in group 1 are having insulin (table 2). Nevertheless, insulin is certainly necessary in a number of the obese group. In this group 49 patients take insulin. In 29 patients dietary restriction alone had proved inadequate. Of these patients, 15 had reduced to ideal weight and in 14 a substantial fall in weight had been effected. All suffered from very considerable hyperglycemia and frequently complained of diabetic symptoms, for the relief of which it seemed necessary to prescribe insulin, although this, in 8 patients, had the undesirable effect of a gain in weight so that they became at least 10 per cent above ideal weight. Of the remaining 20 patients, 8 had already started taking insulin prior to attending this clinic and continued to do so. The other 12 patients showed no reduction in weight despite much encouragement and a lengthy trial of dietary control. These too had to be given insulin for symptomatic relief. Doubtless in many cases the fault lay with the patient's failure to adhere to dietary instructions. Although it may be argued that better cooperation by the patient may have rendered insulin unnecessary, nevertheless in certain cases it is essential, since at least 6 patients in the obese group showed a definite liability to develop diabetic ketosis. It will be seen from table 2 that in both groups there is a greater tendency for this to occur in the female.

Insulin sensitivity as evidenced by hypoglycemic episodes was found in 14 cases.

Inheritance of Diabetes. Both obese and nonobese

TABLE 2
Differences between obese and nonobese diabetics

	Obese (337)		Nonobese (287)	
	Male (55)	Female (282)	Male (148)	Female (139)
Mean age of onset	57.73	56.10	36.01	37.30
Sex ratio	1	5.13	1	0.94
Taking Insulin	11 (20.0%)	48 (17.0%)	137 (92.6%)	127 (91.4%)
History of Ketosis	0	6 (2.1%)	14 (9.5%)	37 (26.6%)

groups have a family history of diabetic relatives in approximately the same proportion—27.3 per cent for the obese and 25.1 per cent for the nonobese. (figure 3).

However, when inquiry was made into the nature of the diabetes in these relatives it was found that there is a definite tendency to inherit the same type of diabetes. In the obese group 17.2 per cent of patients have obese diabetic relatives, as compared with 6.6 per cent in group 4. On the other hand, only 11.9 per cent of obese diabetics have nonobese diabetic relatives, as compared with 19.2 per cent of the nonobese group 4. In general where a family history of diabetes is given, the diabetic relatives are all of one or the other type, either obese or thin, but 6 patients of group 1 and 2 patients of group 4 have relatives of both types. Following this general tendency in inheritance, diabetic siblings are predominantly of the same type as the patient, but in both groups there is a significant proportion of diabetic siblings of the type opposite to that of the patient.

The relative significance of diabetes in the father or the mother was considered. Although our numbers are scarcely sufficient to provide a basis for conclusions, certain tendencies are observed (figure 4). The fact that

the mother is an obese diabetic appears of particular significance, and her child, if diabetic, is most commonly of the same type. In the obese group, 6.2 per cent have such a mother, compared to 1.4 per cent in the nonobese group. In both obese and nonobese diabetic patients, very similar proportions gave a history of the mother being a nonobese diabetic—3.3 per cent in group 1 and 3.8 per cent in group 4. With regard to the fathers, our figures are too small in the obese group to be significant, although it is apparent that in this group diabetes in the father is much less common than in the mother. In the nonobese group the proportion of patients having a nonobese diabetic father is virtually the same as the proportion having a diabetic mother of this type. In other words, where the nonobese diabetic has a nonobese diabetic parent this is almost as frequently the father as the mother. An obese diabetic parent is uncommon in this group. It is obvious that a diabetic parent may have offspring developing diabetes of the type opposite to his or her own.

**FAMILIAL
INCIDENCE OF DIABETES.**

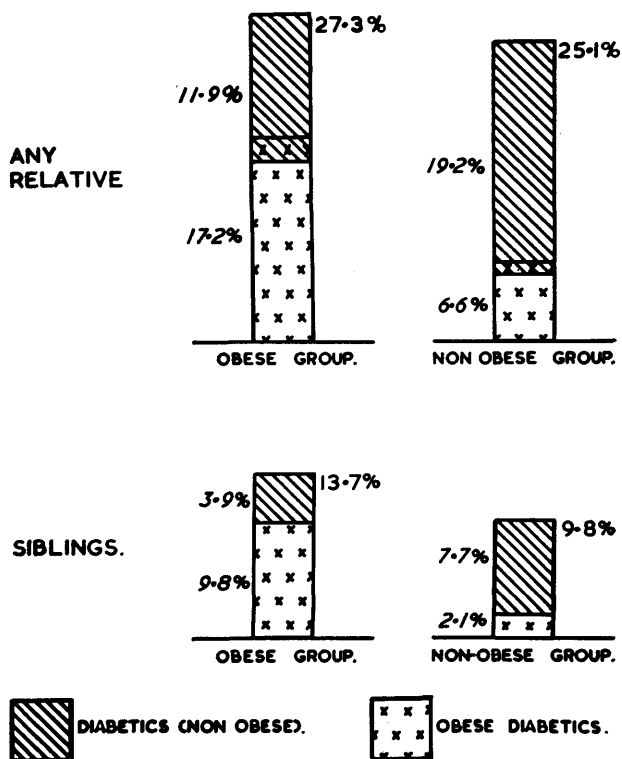


FIGURE 3

**PARENTAL
INCIDENCE OF DIABETES.**

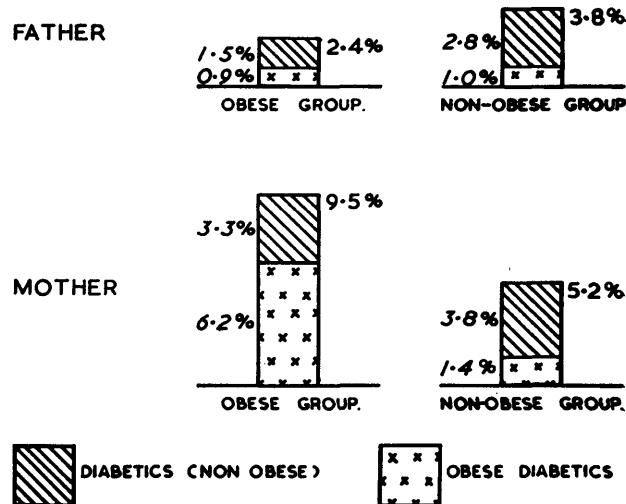


FIGURE 4

Inheritance of Obesity. As is shown in figure 5, the obese group of diabetics has a remarkable family history of obesity, 67.7 per cent of these patients having obese though nondiabetic relatives. In the nonobese group such relatives are possessed by only 23.0 per cent. This figure approximates very closely that of 22 per cent which we found in a control series of nonobese, nondiabetic hospi-

tal outpatients whom we examined.

It is worthy of note that in the obese group the incidence of obesity in all branches of the family, male and female, is much higher than in the other group and cannot be related solely to pregnancies as has been suggested.

FAMILIAL INCIDENCE OF OBESITY.

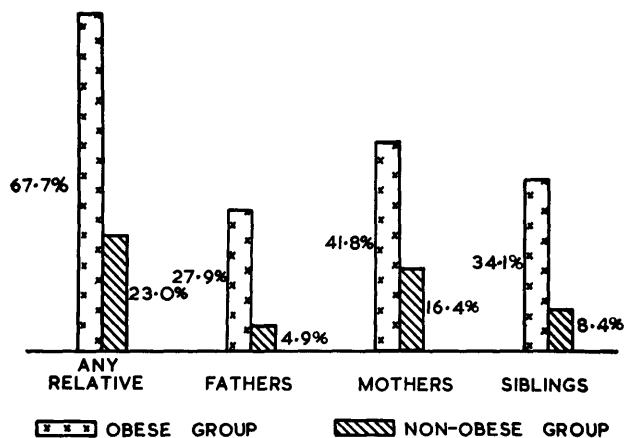


FIGURE 5

CONCLUSIONS

It is apparent that there are many differences between obese and nonobese diabetics. It seems probable that statistical surveys of diabetics as a whole may not be truly representative of either type individually; witness, for example, the difference in sex ratio between the two groups. It would be of great interest if diabetes could be classified into different types which could be dealt with separately, but it has to be admitted that such classification presents many difficulties.

In the present series of 1,000 cases nearly 40 per cent have been regarded as intermediate between the two typical groups. Even these two groups show a certain intermingling. For example, some obese diabetic patients may eventually develop characteristics of the more acute nonobese group. Again this intermingling is seen in a study of inheritance of the disease. An obese diabetic mother may have a child of either type. An acute non-obese diabetic may have an obese mildly diabetic sibling. Nevertheless, these difficulties should not obscure the fact that important differences do exist between different types of diabetics, the further study of which may elucidate some of the problems of diabetes.

CONCLUSIONES

Un Comparation de Obese e Nonobese Diabeticos

Il ha multe evidente differentias inter obese e nonobese

diabeticos. Il es probabile que le statistica del diabeticos in general non provide un ver representation del duo typos individual. Iste observation es supportate per exemplo per le facto que le statistica monstra pro le duo gruppos un differentia del proportion inter le sexos. Il essera de grande interesse si le population diabetic poteva esser classificate in varie typos con que on poterea occupar se separatamente, sed on debe admitter que un tal classification presenta multe difficultates.

In le presente serie de 1000 casos, circa 40 pro cento esseva considerate como intermediari inter le duo gruppos typic. E etiam le gruppos mesme monstra un certe intermiscimento. Per exemplo, certe diabeticos obese disveloppa in le curso del tempore characteristics del plus acute gruppo nonobese. Tal intermiscimento es observabile etiam in le studio del hereditabilitate del morbo. Un obese matre diabetic pote haber un infante del un e del altere typo. Un nonobese diabetic acute pote haber un fraterno qui es un diabetico levemente obese. Non-obstante, iste difficultates non deberea obscurar le facto que importante differentias existe inter differente typos de diabeticos. Le continue studio de iste differentias va possibilmente contribuir al elucidation de certe problemas de diabete.

ACKNOWLEDGMENT

We wish to express our appreciation of the great help given to us by Miss Elizabeth M. Irving in the compilation of the statistical data.

REFERENCES

- 1 Lawrence, R. D.: Types of human diabetes. Brit. M. J. 1:373-75, Feb. 1951.
- 2 Finlayson, J.: Clinical Manual, 4th Edition. London, G. Bell and Sons, Ltd., 1926, p. 783-84.
- 3 Metropolitan Life Insurance Company: Ideal Weights for Women. Statistical Bulletin 23:6-8, October 1942.
- 4 Munro, H. N., Eaton, J. C., and Glen, A.: Survey of a Scottish diabetic clinic. J. Clin. Endocrinol. 9:48-78, Jan. 1949.

DISCUSSIONS

CECIL STRIKER, M.D., (*Cincinnati*): I would like to ask Dr. Murray, in the obese children from the obese parents, whether psychological factors were involved? Did they want their children to be fat, or what was the dietary pattern of those children?

DR. MURRAY: I am afraid I could not answer that, although I do believe there is a very important factor there. Not, I think, that the parents admire obesity in their offspring, but that their environment does play an enormous part and that obesity, in many cases, is a reflection of psychological upset.