

INCIDENCE OF DIABETES MELLITUS IN BASUTOLAND : POSSIBLE NUTRITIONAL INFLUENCES

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A recent investigation into the prevalence of diabetes mellitus in the Butha Buthe district of Basutoland revealed an incidence of 0.23% among 3,000 individuals^{1,1(a)} as against 1.7% in a White community of the USA² and 1.2% in Great Britain.³

The problem arises what possible factors are involved in the aetiology of diabetes mellitus.

Heredit

Diabetes mellitus is considered to be a hereditary disease^{5,6} and susceptibility to it has been stated to be inherited *via* a simple recessive gene.⁷ Joslin⁸ showed the disease to be inherited in 60% of diabetic children under his care who lived longer than 20 years.

In the Bantu, family histories are notoriously difficult to obtain and it cannot be ascertained how far heredity plays a part in the incidence of diabetes mellitus.

Age

Age has always been considered relevant to the incidence of diabetes. In the USA one-quarter to one-third of the cases of diabetes have occurred before the age of 45 years.⁹ This is borne out by the fact that among 69,088 male selectees for National Service in America between the ages of 18 and 37 years the incidence of diabetes was found to be 1.1%,¹⁰ whereas the total incidence of 1.7% indicates that the percentage of cases in the upper age-group will be higher.

In our own cases^{1,1(a)} the incidence of 0.23% was found in a population with an average age of 36.8 years, the average age of the diabetics being 50.6 years. In the under-40-year age-group the incidence of hyperglycaemia was only 0.05%, while in the above-40 age-group this had increased to 0.55%. Taking into consideration the shorter life expectancy among the South African Bantu,^{4,11} a lower rate of diabetes would be expected. Our figures however, are so low that further explanation is necessary.

Obesity

The association of obesity with diabetes is frequently referred to in the literature, where obesity has been described

as the commonest predisposing factor.^{8,12-16} Thus, among 1,000 new cases of diabetes Joslin⁸ found 77% to be obese. Long¹⁷ suggests that 70-80% of diabetics were over-weight before the onset of the disease. Pomeranze¹⁸ found a history of obesity before the clinical presence of diabetes in 83% of 1,140 diabetic patients. Furthermore, the susceptibility to diabetes has been found to increase with the degree of over-weight. Dublin¹⁹ showed that the higher the percentage of

TABLE I. OVERWEIGHT AND DIABETES MORTALITY

Above average weight	Diabetes mortality above normal	
	Under 45 years	Over 45 years
5-14%	1.5 times	2 times
15-24%	3.2 times	4 times
25% or more	8.5 times	10 times

overweight in men the higher the death rate from diabetes. While this was marked in the younger age-group the disproportion was even higher in the over-45 age-group (see Table I). Studies among women showed the same tendency.^{20,20(a)}

The body build of the group investigated by us was in the main tall and thin; a few, however, were obese, particularly among the older females. Of the 7 cases showing hyperglycaemia only 1 was obese.

Calorie Intake

The association of obesity with excessive intake of calories is well known. Fleisch²¹ has shown a direct relationship between the standard of living of the population in the different Swiss cantons and the incidence of diabetes. The low-calorie diets of the war years would appear to have had a remarkable effect in reducing the incidence and mortality of diabetes mellitus.²²⁻²⁵ On the other hand it is a well-known fact that a prolonged fast carbohydrate ingestion may raise the blood sugar high enough to cause glycosuria. The possibility of one or more of our cases having been affected in this way cannot be excluded. Himsworth^{26,27} has con-

sidered a high proportion of fat in the diet rather than that of carbohydrate as favouring the development of diabetes, but a low-fat diet *per se* has not been found to influence its incidence. For example, diabetes occurs frequently among the Ceylonese, who consume a low fat diet, although the late manifestations of the disease would appear to be less than in people living on a normal mixed diet.²⁸ A recent communication, in fact, suggests that a low-fat diet—the fat content being limited to 20 g. per day—favours the regression of retinopathy in established cases.²⁹

The population investigated by us was on a low-calorie, low-fat diet. The diet consisted of maize and kaffir corn (in the form of beer and porridge), and vegetables such as wild spinach, pumpkin, peas and beans as the main items. Meat and eggs were rarely partaken of, and milk was obtainable in small quantities during the winter months only.

Munoz and Anderson³⁰ recorded the calorie adequacy in Basutoland as being 87% of average normal intake.

Vitamins and Endocrines

It is to be expected that in the type of diet found among the Basuto, deficiency of vitamins will occur. Clinical signs of riboflavin deficiency in the population investigated are widespread.³¹ Ershoff³² has shown that deficiency of riboflavin markedly increases the insulin sensitivity of the rat, so much so that in some cases there occurred a pronounced and frequently fatal hypoglycaemia. It would appear, therefore, that this deficiency may be one of the factors in the low incidence of diabetes among the Basuto.

Among other factors to be considered in our series is endocrine imbalance. Munoz and Anderson³⁰ undertook a goitre survey in the lowlands of Basutoland and found an average incidence of 32%. A committee of the Department of Nutrition of the Union of South Africa in 1955³³ found that the whole of the Drakensberg area including the whole of Basutoland could be regarded as an endemic goitre area.

The combination of hypothyroidism with diabetes is not at all common. Joslin⁸ reports only 11 cases among 32,148 true diabetics, and while endemic goitre may not be associated with marked hypothyroidism it can be expected that the incidence of diabetes in an endemic goitre area may be lower than in iodine-sufficient regions. The association of hyperthyroidism with diabetes is well known but hyperthyroidism is rare in the Bantu³⁴ and was definitely not a factor in the cases described by us.

The relationship of starvation and undernutrition to a lowering of the activity of the pituitary gland, particularly of its anterior lobe, is well known.³⁵ It has been stated that undernutrition has the same effect as hypophysectomy.³⁵ Soskin and Levine³⁶ reported that depancreatized dogs on deficient diet, i.e., on protein only, showed the same amelioration of their diabetes as was demonstrated in dogs that had their pituitary removed. Young's experiments³⁷ showed that injection of crude or purified growth hormone from the anterior pituitary produced a diabetic state. However, this induced diabetes was considerably improved by fasting, and even complete recovery took place provided that the β -cells of the pancreas had not yet been completely destroyed.³⁷ It is possible therefore, that the low-calorie diet of the Basuto may have an inhibitory effect on the anterior pituitary, which may be a further factor in the low incidence of diabetes.

Similarly, it is possible that hypofunction of the suprarenal

gland may play a part. Thus Politzer and Tucker³⁸ have found a significant paucity of 17-ketogenic hormone in the Bantu male. This finding, as well as the related one of small suprarenal glands in West Africans,³⁹ indicates a deficient production of glucogenic hormone in the African. If the low hormone production leads to decreased gluconeogenesis it may be postulated that a lower incidence of glycosuria and hyperglycaemia will be initiated in these people. However, it must be acknowledged that there is little to point to adrenocortical hypersecretion as a cause of clinical diabetes apart from its occurrence secondarily to conditions such as Cushing's syndrome and pheochromocytoma.

Iron Metabolism

In contradistinction to the factors influencing the low incidence of diabetes is the occurrence of siderosis in certain parts of Africa.⁴¹⁻⁴³ Heavy deposits of iron pigment in the viscera have been described by several authors.⁴¹⁻⁴³ The iron pigment may be deposited in the reticulo-endothelial cells of the liver, in which case the condition may be asymptomatic, or it may lead to parenchymal deposition, in which case symptomatic haemochromatosis may ensue. Dodu⁴⁴ in a series of 44 diabetics in Ghana found heavy iron-pigment deposits in the bone-marrow in 7 cases. In 5 of 6 cases in which liver biopsy was performed haemochromatosis was diagnosed. The Basuto like many other Bantu use iron cooking utensils and beer-making receptacles. It is natural to assume that they too are consuming a considerable quantity of iron. The possibility, therefore, emerges that some cases of diabetes may find their origin in haemochromatosis.

CONCLUSION

A number of factors bearing on the incidence of diabetes mellitus have been discussed.

The influence of heredity and age is, of course, predominant, but that of diet and nutrition has been shown to be of great importance. In various countries the reduction of calories during the war years with its associated lowering in diabetic incidence suggests that reduction in calories may cause the hereditary tendency to diabetes to remain latent. It is difficult to estimate to what extent the other factors mentioned may have a bearing on the low incidence of the disease in the Basuto, but hormonal factors secondary to the low-calorie diet cannot be discounted. Likewise, although there is no evidence that diabetic incidence is markedly reduced in countries where fat intake is small, recent studies in fat metabolism and its relationship to atherosclerosis⁴⁵⁻⁴⁸ and diabetes mellitus⁴⁹ (including the late manifestations of the disease⁵⁰) would point to the necessity for evaluation of a low-calorie, low-fat diet as a preventive measure in those hereditarily predisposed to this disease. In this connection we would particularly refer to those in whom the hereditary trait is found in both sides of the family.

Finally, we would suggest that the low-calorie, low-fat, high-carbohydrate diet taken by the Basuto and other African tribes may be the main factor in their being preserved from the discomfort and progressive development of diabetes mellitus and its late manifestations.

SUMMARY

1. The incidence of diabetes mellitus was found to be 0.23% among 3,000 individuals in the Butha Buthe district of Basutoland.

2. While hereditary influences and age are of importance in the incidence of the disease, nutritional factors must be considered.

3. The problem is discussed from the point of view of obesity, caloric and fat intake, vitamin deficiency, and endocrine imbalance.

4. The rôle of dietary iron is commented on.

5. The lowered incidence of diabetes mellitus in various countries during the war years is stressed as suggesting that reduction in calories and fats may cause the hereditary tendency to diabetes to remain latent.

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