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Glucose or Glucose Monohydrate for Glucose Tolerance Tests?

Dear Sir,

Recently a pharmaceutical company sought our advice on the amount and chemical form of glucose which should be incorporated in a drink suitable for oral glucose tolerance testing. We had some difficulty in answering the question.

In the second report of the WHO Expert Committee on Diabetes Mellitus, a standard oral glucose load of 75 g was recommended for adults [1]. However, unlike the first report of the Expert Committee, published in 1965, the chemical form of glucose to be used in the load was not stated. The earlier recommendations specified the use of 'glucose (dextrose monohydrate)' [2]. A load of 75 g of anhydrous glucose (mol. wt. 180.2) is equivalent to 416 mmol glucose, whereas 75 g glucose monohydrate (mol. wt. 198.2) represents only 378 mmol glucose, a 38 mmol or 9.1% decrease.

The terminology used in pharmacopoeias is confusing. The 1980 British Pharmacopoeia defines 'anhydrous dextrose' as 'D-glucopyranose, anhydrous glucose'. However, 'dextrose monohydrate' is defined as 'glucose' [3].

Other recommendations concerning oral glucose tolerance testing do not clarify the nature of the glucose dose. The suggested criteria presented to the Committee of the European Association for the Study of Diabetes state: 'Load 75 g glucose in 200–500 ml or 1.75 g/kg for children' [4]. The National Diabetes Data Group of the National Institutes of Health in America require a 75-g glucose dose for non-pregnant adults, or 'a commercially prepared carbohydrate load equivalent to this glucose dose' [5]. Fajans and Conn's early criteria for the diagnosis of diabetes do not specify the use of anhydrous glucose or glucose monohydrate in glucose tolerance tests [6]. A recent report of a Working Party representing the Australian Diabetes Society, the Royal College of Pathologists of Australasia and the Australian Association of Clinical Biochemists stated that '75 g (416 mmol) of glucose should be dissolved in 250–350 ml water and drunk within 5 min'. Thus this report implies the use of anhydrous glucose.

The size of the glucose load used in glucose tolerance tests has been shown to have no influence on results in normal subjects [7]. However, the same study reported that, in subjects with mildly impaired glucose tolerance, there was an increase of 3.0 mmol/l in the 2-h post-glucose level of plasma glucose when 100 g glucose was ingested, compared with 50 g. Thus, assuming that glucose monohydrate was used, changing the load from 50 g (252 mmol) to 100 g (504 mmol) resulted in an increase in plasma glucose concentration of 3.0 mmol/l. If the relationship of increasing glucose load to in-

creasing 2-h plasma glucose level is linear, then the 38 mmol difference between 75 g glucose and 75 g glucose monohydrate would result in a 0.45 mmol/l increase in 2-h plasma glucose concentration. This difference may affect the classification of a subject.

A definitive statement is required concerning the amount of glucose to be used in 'the 75 g dose' in oral glucose tolerance tests for the diagnosis of diabetes mellitus. Glucose monohydrate is cheaper than anhydrous glucose and is the stable crystalline form of glucose at temperatures less than 50 °C. We suggest that the recommended glucose load should be 75 g glucose monohydrate.

Yours faithfully

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