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*WJD* mainly publishes articles reporting research results and findings obtained in the field of diabetes and covering a wide range of topics including risk factors for diabetes, diabetes complications, experimental diabetes mellitus, type 1 diabetes mellitus, type 2 diabetes mellitus, gestational diabetes, diabetic angiopathies, diabetic cardiomyopathies, diabetic coma, diabetic ketoacidosis, diabetic nephropathies, diabetic neuropathies, Donohue syndrome, fetal macrosomia, and prediabetic state.

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## Management of gestational diabetes mellitus via nutritional interventions: The relevance of gastric emptying

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### Abstract

Gestational diabetes mellitus (GDM) represents one of the most common medical complications of pregnancy and is important to the well-being of both mothers and offspring in the short and long term. Lifestyle intervention remains the mainstay for the management of GDM. The efficacy of nutritional approaches (e.g. calorie restriction and small frequent meals) to improving the maternal-neonatal outcomes of GDM was attested to by Chinese population data, discussed in two articles in recent issues of this journal. However, a specific focus on the relevance of postprandial glycaemic control was lacking. Postprandial rather than fasting hyperglycaemia often represents the predominant manifestation of disordered glucose homeostasis in Chinese women with GDM. There is now increasing appreciation that the rate of gastric emptying, which controls the delivery of nutrients for digestion and absorption in the small intestine, is a key determinant of postprandial glycaemia in both health, type 1 and 2 diabetes. It remains to be established whether gastric emptying is abnormally rapid in GDM, particularly among Chinese women, thus contributing to a predisposition to postprandial hyperglycaemia, and if so, how this influences the therapeutic response to nutritional interventions. It is essential that we understand the role of gastric emptying in the regulation of postprandial glycaemia during pregnancy and the potential for its modulation by nutritional strategies in order to improve postprandial glycaemic control in GDM.

**Key Words:** Gastric emptying; Postprandial glycaemia; Diet; Nutritional interventions; Gestational diabetes mellitus

**Core Tip:** There is now increasing appreciation that the rate of gastric emptying is a key determinant of postprandial glycaemia in both health, type 1 and 2 diabetes. It remains to be established whether gastric emptying is abnormally rapid in gestational diabetes mellitus (GDM), thus contributing to a predisposition to postprandial hyperglycaemia, and if so, how this influences the therapeutic response to nutritional interventions. It is essential that we understand the role of gastric emptying in the regulation of postprandial glycaemia during pregnancy and the potential for its modulation by nutritional strategies in order to improve postprandial glycaemic control in GDM.

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## INTRODUCTION

Gestational diabetes mellitus (GDM), defined as the onset of fasting and/or postprandial hyperglycaemia during pregnancy[1], occurs in approximately 10% of pregnant women globally[2,3] and is associated with a number of adverse health outcomes for both mothers and newborns, including excessive maternal weight gain, abnormal glucose and lipid metabolism, and newborns that are large for gestational age or with macrosomia[4]. Therefore, maintaining excellent glycaemic control both at fasting and after meals phase represents a key therapeutic goal in the management of GDM[5].

## POSTPRANDIAL HYPERGLYCAEMIA IN GDM: MORE ATTENTION IS NEEDED

Although insulin and metformin are frequently used to achieve this, lifestyle interventions, including dietary modifications and exercise, remain the mainstay for the management of GDM[6,7]. A study by Luo *et al*[8] in a recent issue reported that individualised nutrition interventions, including calorie restriction, adoption of smaller and more frequent meals, and guidance on exercise, were effective at lowering pregnant weight gain, fasting plasma glucose, haemoglobin A1c and the incidence of neonatal adverse events, such as premature birth, macrosomia and respiratory distress syndrome, in Chinese women with GDM. However, Luo *et al*[9] did not specifically document how adequately postprandial glycaemia was controlled by the nutritional intervention. The latter is of major importance, as the majority of Han Chinese women with GDM exhibit elevated plasma glucose at the 1 and 2-h time points of an oral glucose tolerance test, with normal or modestly high fasting glucose. Moreover, as raised by Sinha *et al*[10] in a later issue, it remains unclear as to whether pregnant women of different ethnicities are equally sensitive to dietary interventions. In support of a substantial ethnic disparity in the pathogenesis of GDM, the glycaemic response to an oral glucose load and the risk of GDM are reportedly higher in pregnant women of Asian origin than Caucasians[11-14].

## PATHOGENESIS AND MANAGEMENT OF POSTPRANDIAL HYPERGLYCAEMIA: THE ROLE OF GASTRIC EMPTYING

Elevation of blood glucose during pregnancy has been attributed primarily to the development of insulin resistance. However, a growing body of evidence suggests that the blood glucose excursion after a carbohydrate-containing meal, particularly within the first 2 h, is driven by the rate of gastric emptying and consequent postprandial glucose appearance [15]. This is the case in both health and type 1 and 2 diabetes[16,17]. In health, the stomach delivers ingested nutrients into the small intestine at a relatively constant caloric rate in the range of 1-4 kcal/min[18,19]. Although delayed gastric emptying is a common feature in longstanding complicated type 1 and 2 diabetes, individuals with 'early' stage type 2 diabetes and few complications often have abnormally rapid gastric emptying, which exacerbates the glycaemic response to carbohydrate-containing meals[19,20]. Moreover, in both health and type 2 diabetes, gastric emptying has been shown to be more rapid in individuals of Asian origin compared to Caucasians, associated with a greater postprandial glycaemic excursion[21,22]. Based on these observations, it is logical to understand the role of gastric emptying in the regulation of postprandial glycaemia during pregnancy and any disparities between different ethnic groups. This knowledge has the potential to inform personalised nutritional strategies to improve postprandial glycaemic control in GDM. For example, should rapid gastric emptying be found to drive postprandial hyperglycaemia in GDM, nutritional interventions should be tailored to slow gastric emptying. Such a concept has been pursued with success in the context of type 2 diabetes; for example, the administration of a small amount of protein as a 'preload' before the main meal was effective in slowing gastric emptying and reducing postprandial glycaemia in these individuals[23,24]. Furthermore, protein pre-loads have been shown to reduce postprandial hyperglycaemia in Han Chinese women with GDM, presumably by stimulating gut

hormone secretion and slowing gastric emptying although this was not measured in the study[25].

## CONCLUSION

The prevalence of both GDM and associated pregnancy complications is increasing at an alarming rate globally. To date, lifestyle interventions, particularly dietary strategies, remain the mainstay for both the prevention and management of GDM, but with inconsistent benefits which may relate to variations in diagnostic criteria, participant ethnicity, and timing and duration of the intervention[26-28]. Although the paper by Luo *et al*[8] affirmed the benefits of a dietary approach on pregnancy outcomes, there is a need to focus more specifically on postprandial glycaemia. To this end, gastric emptying is a logical target that may yield new insights into the pathogenesis of postprandial hyperglycaemia in GDM, explain ethnic differences in the prevalence, and provide a rationale for modulating gastric emptying to optimise postprandial glycaemia in the management of GDM.

## FOOTNOTES

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