

## Physical Activity for Gestational Diabetes Mellitus

Ayako Hayashi<sup>1</sup> and Nobuhiko Suganuma<sup>2\*</sup>

<sup>1</sup>Department of Maternity Nursing, Faculty of Nursing, Osaka Medical College, Takatsuki, Japan

<sup>2</sup>Department of Human Health Sciences, Kyoto University Graduate School of Medicine, Kyoto, Japan

**Corresponding author:** Nobuhiko Suganuma, Department of Human Health Sciences, Kyoto University Graduate School of Medicine, Kyoto, Japan, E-mail: suganuma.nobuhiko.4s@kyoto-u.ac.jp

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### Abstract

Gestational diabetes mellitus (GDM) is one of the perinatal complications. This disorder affects women not only during pregnancy but also after delivery. It is necessary for pregnant women to be cognizant of both their diet and physical activity. Although recommendation for dietetic treatment for GDM was represented, a consensus on diet treatment for GDM has not been obtained yet. Effectiveness of physical activity interventions on preventing GDM was demonstrated, however, scientific evidences related to non-exercise activity thermogenesis are still lacking. More researches concerning nutrition and physical activity during pregnancy should be performed to establish the better management protocol for prevention and treatment of GDM.

### Key words

Gestational diabetes mellitus; Physical activity; Dietary treatment; Non-exercise activity thermogenesis

### Introduction

Gestational diabetes mellitus (GDM) is one of the perinatal complications. This disorder of carbohydrate metabolism occurred within the gestational period affects women's health not only during pregnancy but also after delivery. Previous studies have reported that women who experienced GDM developed type 2 diabetes mellitus (T2DM) in the future at a high rate [1,2]. The prevalence rate of T2DM is increasing in parallel with the rate of GDM [3]. Since complete recovery seems to be difficult once a woman develops T2DM, preventing the occurrence of GDM is of primary importance.

Pregnancy itself easily induces abnormalities of carbohydrate metabolism because the placenta, which completes development in the second trimester, makes proteolytic enzymes and decomposes insulin in the mother's body. It has been reported that pregnant women who showed hyper-response at glucose challenge test were associated poor perinatal and fetal outcomes [4].

GDM would be defined as transient glucose intolerance during pregnancy [5], and the hyperglycemia at GDM does not reach at T2DM level [6]. It is necessary to separate GDM from pregnancy with T2DM, because GDM predict whether the woman will suffer T2DM after childbirth. Factors such as age, family history of T2DM, body weight before pregnancy, fasting blood glucose, and hemoglobin A1c values might be predictors for the necessity of insulin treatment for GDM [7].

International Association of Diabetes and Pregnancy Study Group proposed diagnostic criteria of GDM on the basis of the Hyperglycemia and Adverse Pregnancy Outcomes (HAPO) Study [8] in 2010 [9]. Before the criteria became available, the reported frequency of GDM had been very diverse [10,11] because the GDM diagnostic criteria have been different among each country. Even

recently, the frequency of fetal macrosomia as perinatal outcome of GDM is different with race [12]. Epidemiologic analyses for GDM also should be considered in future.

An unhealthy lifestyle, including poor nutrition and low physical activity, influences the expression of genes that participate in the energy metabolism process via oxidative phosphorylation in mitochondria and induces insulin resistance [13]. Thus, it is necessary for pregnant women to be cognizant of both their diet and physical activity. Similar to the way that many management protocols based on nutrition and physical activity has been demonstrated for preventing T2DM, preventive and treatment protocols for GDM must be prepared.

### Dietary Treatment for GDM

Pregnant women can take care of feeding behavior smoothly because it is easily for them to image that fetus growth may depend on food and drink that they are taking. In fact, glucose is the primary source of energy for fetal growth [14]. Of course, dietary control plays an important role in the management of GDM, and the dietetic treatment for GDM support adequate pregnancy weight gain and fetus growth through maintaining euglycemia and avoiding ketones.

Many studies related to dietetic therapy for women with GDM have been available. Summary and recommendation for dietetic treatment for GDM was represented from International Workshop-Conference on GDM sponsored by the American Diabetes Association [15]. The Diabetes Care and Education and the Women's Health and Reproductive Nutrition dietetic practice groups indicated that women with GDM who received nutrition practice guidelines care improved glycaemic levels [16]. However, a consensus on diet treatment for GDM has not been obtained yet [17] because it would be necessary to consider about energy balance, carbohydrates, fat, sweeteners and so on in detail [18].

Cochrane database of systematic reviews [19] summarized the diet intervention for GDM as follows. The dietary interventions were primarily implemented by a dietician/nutritionist [20-24]. Dietary

counselling was provided by nurses [25], or participants met with a variety of health professionals such as physicians, nurses, nutritionists, and counsellors [26]. Other cases received the counselling from master's and doctoral level staff with training in nutrition or clinical psychology [27]. Trained researchers [28], a health coach (exercise physiologist) [29] or health trainers [30] also provided the sessions.

## Physical Activity for GDM

In adults with T2DM, many reports and a systematic review [31] have been available. The effect of exercise interventions for glycaemic control was evaluated by hemoglobin A1c and body mass measured as body weight or body mass index. The meta-analysis showed that exercise significantly improved glycaemic level and reduced visceral adipose tissue and plasma triglycerides, but not plasma cholesterol, in people with T2DM even without weight loss [32]. American Diabetes Association and American College of Sports Medicine stated the effects of physical activity on GDM treatment as follows: It is established that participation in regular physical activity improves blood glucose control and can prevent or delay T2DM, along with positively affecting lipids, blood pressure, cardiovascular events, mortality, and quality of life. Most benefits of physical activity on diabetes management are realized through acute and chronic improvements in insulin action, accomplished with both aerobic and resistance training [33].

Physical activity is divided into 2 types of "leisure sport" and "life activity". Leisure sport is defined as the body movement with cardiac beats rate above 140/minute and temporal duration over 60 minutes, that is to say, higher exercise intensity. Life activity is assessed as any form of body movement with energy expenditure above resting levels in the daily life. Therefore, life activity means lower exercise intensity. A technical term rewords life activity to non-exercise activity thermogenesis (NEAT).

## Leisure sport

From Cochrane database of systematic reviews [19], the nature of the exercise intervention differed among studies, with a number of trials offering predominantly advice [20,21,26-30,34], and the others having an increased focus on interactive exercise sessions [22,23,25,35]. The individual recommendations for exercise goals also varied. These researches include various physical activities such as walking of life activity and aerobics and swimming of leisure sports.

There is a meta-analysis about effectiveness of physical activity interventions on preventing GDM [36]. It provided the recommendation to advise mothers to engage in physical activity programmes as an effective and safe strategy to experience healthier pregnancies because they would have less risk of GDM, particularly when the exercise programme was performed throughout pregnancy [36]. However a consensus on physical activity treatment for GDM may be impossible to obtain because appropriate amount of exercise to prevent and control GDM are still obscure.

## Life activity

Since lifestyle controls of nutrition and physical activity are effective to adult metabolic syndrome, they are expected to be important also during pregnancy for maternal health and newborns. Because pregnant women may tend to pay attention to not physical activity but their diet, health care providers need to make pregnant women watching physical activity. Since leisure sports often need special

facilities and medical doctors' regulation, and the mother's body weight also increases along advanced gestational weeks, pregnant women are expected to be hard to continue the leisure sports.

Not only leisure sport but also life activity as NEAT prevent metabolic syndrome. Levine et al. [37] reported that obese people spent 164 minutes and more as sedentary time per day, which was longer than non-obese people. This sedentary duration is very important to prevent and improve obesity. As epidemiological studies, it has been reported that sitting time and non-exercise activity were linked to occurrence rates of metabolic syndrome, T2DM, obesity, and cardiovascular disease [38]. Glucose tolerance during pregnancy was also indicated to associate with physical activity [39,40]. Although it seems to be suitable for pregnant women to increase NEAT, scientific evidences concerning NEAT effect are still lacking.

## Intervention

Hamilton et al. [38] pointed out two necessities of physical activity to prevent obesity, metabolic syndrome, T2DM and cardiovascular disease in adults. Firstly, interventional studies are needed to do more conclusively test for specific negative metabolic effects of prolonged sitting or to compare and contrast the potential benefits of daily non-exercise physical activity and structured exercise. Secondly, translational studies are needed at multiple levels, ranging from cellular research determining whether there are plausible mechanisms regulating risk factors to more epidemiological research identifying clinical outcomes in diverse populations. Those analyses should be also performed among pregnant women.

Six studies subjected to pregnant women who experienced GDM at previous pregnancies demonstrated significant increases of physical activity after receiving lifestyle interventions targeting physical activity only [41] or both physical activity and diet [42-46]. However, these results are still lacking to show evidential effects to prevent GDM occurrence. Healthy pregnant women and pregnant women with GDM need how to prevent GDM occurrence and how to maintain euglycemia, respectively. Since these pregnant women are getting heavy weight gain in association with gestational weeks, not only exercise but also NEAT are suitable for all women during gestation. A recent study using a feasibility randomized controlled trial demonstrated that a pregnancy lifestyle intervention with moderate-intensity physical activity declined GDM risk in overweight women [47].

## Conclusion

Approximately 8.8 % of the adults in the world already have diabetes. In order to maintain a woman's health over her future lifetime, it is useful to determine how GDM can be prevented and controlled. Because leisure sport of higher exercise intensity seems to be a hard performance for pregnant women, life activity as NEAT should be applied. Thus more researches concerning not only nutrition but also physical activity such as life activity during pregnancy should be performed to establish the better management protocol for prevention and treatment of GDM.

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