

# Assessing Knowledge on Gestational Diabetes Mellitus and Child Health

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## Abstract

*Gestational diabetes mellitus (GDM) is a diagnosis of glucose intolerance during pregnancy. The risk of type II diabetes mellitus (T2DM) and obesity for the child and mother increases when GDM develops. Preventing the development of GDM could help lower the prevalence of obesity and type II diabetes mellitus morbidity rates in children of affected mothers. The purpose of the study was to identify the awareness level of females ages 12 and 51 years, on the long-term risk of obesity and T2DM on their children in Australia and Samoa. This is a quantitative study involving 202 females, from across Australia and Samoa, between April 2021 and November 2021, comparing the level of knowledge between a developing and developed country. In Australia and Samoa, 15% (n=16) and 34% (n=33) of females respectively, were aware of the long-term complications of GDM on their children. These findings indicate that there is inadequate knowledge regarding the long-term consequences associated with GDM on both the risk for T2DM in women and the risk for long-term complications for their children. The greatest source of information in both countries was obtained from physicians or midwives, 52% (n=105). This supports the need for increased education on GDM, through social media, the internet, and community health professionals. By increasing awareness of GDM and implementing preventive strategies, it may be possible to reduce the prevalence of obesity and T2DM in Australia and Samoa.*

## Keywords

*Diabetes Mellitus, Gestational diabetes, Samoa, Australia, Education*

## Abbreviations

DM = diabetes mellitus  
GDM = gestational diabetes mellitus  
T2DM = type II diabetes mellitus

## Introduction

Diabetes mellitus (DM) is associated with vascular disease which has a high morbidity and mortality rate.<sup>1</sup> DM is a metabolic disease characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both.<sup>1</sup> DM is subcategorized into type I, type II, and gestational diabetes mellitus (GDM).

Type II diabetes mellitus (T2DM) is predominantly diagnosed among the older population and the overweight population. Globally the prevalence of T2DM has increased from 14.0% in 1990 to 16% in 2020. Among females T2DM went from 11.5% in 1990 to 18% in 2020, partially associated with the rise in obesity.<sup>2</sup>

T2DM develops from a combination of defective insulin secretion by pancreatic  $\beta$ -cells and the inability of insulin-sensitive tissues to respond appropriately.<sup>3</sup> Obesity is 1 of the major con-

tributing factors for T2DM. Currently 53% of the adult Samoan population are classified as obese (body mass index [BMI]  $>30.0\text{kg/m}^2$ ).<sup>4,5</sup> Other studies have indicated that around 25% of children and adolescents between the ages of 2 to 17 years in Samoa are categorized as overweight increasing the risk for development of various metabolic diseases, including T2DM.<sup>6</sup>

Increasing frequency of T2DM and obesity has paralleled GDM development.<sup>5</sup> In the last 10 years, the Pacific Islands were identified as having the highest rate of T2DM, globally.<sup>7</sup> Studies indicated that 27% of women are currently diagnosed with T2DM.<sup>8</sup>

Obesity is the most significant risk factor for GDM development.<sup>9</sup> Obesity is an epidemiologic challenge for many medical practitioners.<sup>9</sup> Between 2000 and 2001 and 2016 and 2017, the proportion of women diagnosed with GDM in Australia, tripled from 5% to 15%.<sup>10</sup> T2DM in Samoa increased from 2% in 1978 to 20% in 2013.<sup>4</sup> Similarly, obesity among Samoan women increased between 1978 and 2013 from 45% to 77%.<sup>4</sup>

GDM, an endocrinopathy that has the ability to develop during pregnancy, is associated with the numerous hormonal changes. Hormonal changes that have been identified to increase the risk of GDM include placental production of diabetogenic hormones that involve human placental lactogen associated with the later stages of pregnancy.<sup>11</sup> Cortisol levels are increased and have the potential to reduce the action of insulin, leading to an insulin resistance state. During pregnancy, the body will compensate through augmenting the insulin production via the beta pancreatic cells, resulting in increased glucose levels in the blood. This compensatory increase in insulin production can lead to insulin resistance and increase the risk of developing GDM.

GDM has been associated with short-term complications during pregnancy to both the mother and the child. The increase in insulin causes the fetus' pancreas to accentuate its insulin secretion, leading to an insulin secretory defect and development of DM.<sup>12</sup>

Today, the rates of childhood obesity globally have increased 4-fold over a 30-year period.<sup>13</sup> Studies regarding the intrauterine environment and long-term complications including the increased risk of obesity, insulin resistance, neurocognitive development and cardiovascular disease have become more established over the years.<sup>14</sup> GDM has been identified to play a role in the child's health both in the short term and long term.

Currently, there is a deficit in the research addressing the maternal awareness of the long-term effects of GDM on the children's health. The literature does not indicate whether women are aware of the link between GDM and their child's increased risk for developing T2DM and obesity later in life.

The purpose of this study is to identify the level of awareness in women from Australia and Samoa, regarding GDM and the association between mothers being diagnosed with GDM their children's long-term risks of obesity and T2DM. It will also compare awareness of long-term complication awareness between women who have had children and those without children. Additionally, the sources of where women obtain their knowledge will also be identified to tailor future health promotion activities.

## Methods

A quantitative study was conducted via an online questionnaire that was distributed through schools, universities, word of mouth and hospitals across Australia and Apia, Samoa. A hard copy of the questionnaire was available for individuals without access to a computer. The questionnaire was also translated into the Samoan language. The questionnaire consisted of 20 close-ended questions (response options of "yes", "no" or "not applicable"), demographic information which included the age of participants and questions pertaining to GDM. The questions were focused on assessing the participant's knowledge of GDM, where they obtained their information and if they would make more conscious decisions to reduce the chance of developing GDM during pregnancy. Eligible participants included females from Australia and Samoa between 12 and 51 years of age, regardless of whether they have children. Respondents who answered "yes" to being a health professional were excluded from the study based on their professional training and education.

Internal Review Board approval for this project was granted in October 2020 from Oceania University of Medicine (IRB 20-0904EL). Participants younger than 18 years of age were required to obtain parental consent. Data collection occurred between April 2021 and November 2021. Information was collected and stored securely by the principal investigator. Participant's questions were directed to the principal investigator.

## Data Analysis

The data was analyzed with SPSS software version 28 (IBM Corp., Armonk, NY), using descriptive statistics. To compare the level of knowledge for both Australian and Samoan women regarding the long-term effects of gestational diabetes on their children, analysis of variance tests for continuous variables and a chi square test were used for categorical variables, with the level of significance set at  $P < .05$ .

## Results

A total of 229 females participated in the study: 127 from Australia and 102 from Samoa. Of these, 23 participants from Australia and 4 from Samoa were excluded from the study on the basis of being health professionals or older than 51 years of age. The final number included in the analysis was 104 participants from Australia and 98 participants from Samoa.

## Background Demographics

The median age range for females with children was 35-40 years. The median age ranges for females without children was 23-28 years in Australia and 18-22 years in Samoa (**Table 1**).

## Awareness of GDM

Roughly 58% of Australian and Samoan participants with children were aware of the short-term complications associated with GDM (**Table 2**). There was no difference by country. By contrast Australian females who have not had children were significantly less likely than Samoans to be aware of short-term complications associated with GDM (10% and 64%, respectively  $P < .001$ ).

Similarly, 49% of Australians and 53% of Samoan participants with children were aware that they were at increased risk of developing T2DM if they developed GDM ( $P = .66$ ) (**Table 2**). Only 23% of participants without children were aware of the increased risk developing T2DM among those with GDM; however, Samoan participants (36%) were significantly more likely than Australian participants (11%) to be aware of the increased risk ( $P = .001$ ).

Regarding awareness of the long-term effects of GDM on the health of children, Samoan women with children (49%) were significantly more likely than their Australian counterparts (22%) to be aware ( $P = .01$ ) (**Table 2**). However, there was no significant difference in knowledge by country among participants without children.

Participants selected various sources for obtaining information regarding GDM. Among Australian women with children, doctors or midwives were the largest contributing source of information (31%) followed by internet/ social media (13%) and family or friends (12%). Among Samoan women with children 32% cited family and friends, 30% internet and social media, and 26% doctors and midwives (**Table 1**).

## Attitudes to Changing

Almost all participants, 98% of Australians and 92% of Samoans and 98% of participants with children and 93% of those without children (**Table 3**), stated that they would be more conscious about decisions when pregnant if it meant it would have better outcomes long term for their child.

Table 1: Participant Demographics and Sources of Information on Gestational Diabetes Mellitus								
Age of Participants								
	With Children				Without Children			
	Australia n=42		Samoa n=43		Australia n=52		Samoa n=55	
	Number	%	Number	%	Number	%	Number	%
<b>Age (years)</b>								
12-17	0	0	2	2	8	8	25	26
18-22	0	0	1	1	12	12	15	15
23-28	6	6	8	8	18	17	4	4
29-34	12	12	7	7	22	21	6	6
35-40	11	11	8	8	1	1	2	2
41-46	6	6	3	3	1	1	2	2
47-51	7	7	14	14	0	0	1	1
<b>Didn't complete high school</b>	1	1	14	14	1	1	7	7
<b>High school</b>	23	22	15	15	11	17	23	23
<b>Tertiary education<sup>a</sup></b>	16	16	10	10	30	26	13	13
<b>Post grad/masters</b>	12	11	11	11	17	12	5	5
<b>Sources of Information Regarding GDM</b>								
Doctor/midwife	32	31	25	26	19	18	29	30
Family/Friends	12	12	31	32	15	14	5	5
Internet/social media	13	13	26	30	13	13	25	26
Courses <sup>b</sup>	5	5	11	11	3	3	2	2

<sup>a</sup> Tertiary: education for people above school age, including college, university, and vocational courses.

<sup>b</sup> Courses: Any educationally run seminar with trained professionals in the area over a period of time.

Table 2. Awareness of Short- and Long-term Complications and Developing the Risk of T2DM from GDM			
Awareness of the Short-term Complications Associated with GDM			
Women With Children			
	Yes (Number)	Percent (%)	Overall P-value <sup>a</sup>
Australia	24	59	.97
Samoa	25	58	
Total	49	58	
Women Without Children			
Australia	6	10	< .001
Samoa	34	62	
Total	40	34	
Awareness of Risk of Developing T2DM if They Develop GDM			
Women With Children			
	Yes (Number)	Percent (%)	P-value <sup>a</sup>
Australia	20	49	.67
Samoa	23	53	
Total	43	51	
Women Without Children			
Australia	7	11	.001
Samoa	20	36	
Total	27	23	
Awareness of the Long-term Effects of GDM on Children			
Women With Children			
	Yes (Number)	Percent (%)	Overall P-value <sup>a</sup>
Australia	9	22	.010
Samoa	21	49	
Total	30	36	
Women Without Children			
Australia	7	11	.114
Samoa	12	23	
Total	19	16	

<sup>a</sup> Chi square test: with the level of significance set at  $P < .05$

Table 3. Women Who Would Make a More Conscious Decision about Their Health During Pregnancy, Knowing That There Is an Increased Risk of Long-term Effects on Their Children							
	Women With Children			Women Without Children			Total
	Yes #	%	Sub-Total	Yes #	%	Sub-Total	
Australia	40	98	41	62	98	63	104
Samoa	42	98	43	48	87	55	98
Total	82	98	84	110	93	118	202

## Discussion

Globally, GDM is the most common complication of pregnancy.<sup>14</sup> This study found that majority of participants who willing to change their behavior during pregnancy if it would reduce the risk of developing GDM and reduce the risk on their child's health. Previous studies have assessed the in-utero exposure to GDM as a risk factor for macrosomia and the development of obesity and T2DM among children during their adolescence and young adulthood.<sup>14</sup> Studies conducted on obesity and T2DM risk in children of mothers with GDM have shown a positive association through many studies including Northwestern Diabetes in Pregnancy Study in Chicago,<sup>15,16</sup> Pima Indian,<sup>17</sup> HAPO in Hongkong<sup>18</sup> and Kaiser Permanente centers.<sup>21</sup>

A study conducted at Kawempe National Referral Hospital<sup>16</sup> concluded that a significant portion of pregnant women were not aware of GDM and its risk factors or complications. The authors noted that increasing age and higher education were associated with increased awareness regarding GDM. Results from this study show that participants from Samoa had greater knowledge of complications of GDM, which could be linked to increased prevalence of diabetes in Samoa.

Regarding the educational component of GDM and the increased risk of obesity and T2DM in children, there still stands a gap between education and knowledge regarding the long term impacts of GDM on their children. Almost all participants (98% of those with children and 93% of those without) said they would change their behavior if it helped reduce the risk of obesity and T2DM for their children.

Participants obtained information about GDM and children's risks through various sources. Doctors and midwives are still the dominant source. Education to individuals early in pregnancy or prior to becoming pregnant is paramount to reduce the chance of developing GDM.

## Strengths and Limitations

The study was created as a quantitative study to assess the awareness of the knowledge of women on the long-term complications on their children if they develop GDM. The results of the study can help provide guidance in education and health care promotion in Australia and Samoa.

The studies limitations consisted of duration, sample size, and sample area. The study was conducted over a 3-month time period, providing a limited snapshot of time, and reduced capacity to increase sample size. The sample size was targeted to 100 individuals per country, of similar demographics. The narrow sample size does not account for a variety of socioeconomic statuses, and therefore may not have captured individuals at higher risk of GDM.

Limitations existed in the level of understanding of participants answering questions based on answers to questions contradicting another. For example, 1 answered “yes” they had developed T2DM post-partum but had previously answered that they were nulliparous. The limitation may have fallen in line with not using validated questions or conducting inter-reliability. Caution needs to be addressed when interpreting the data.

## Recommendations

Awareness of GDM among women who have had children from Australia and Samoa show that a vast majority are not aware of the long-term complications for themselves or their children. Globally, obesity and diabetes are becoming more prevalent and continue to be a common risk factor for GDM development in pregnant women. Increased education through health professionals or online resources for the long-term complications of GDM is essential.

Early education prior to pregnancy is likely to have its benefits. The majority of participants with no children indicated little knowledge on the short- and long-term complications of GDM associated with themselves and their children’s health.

Further research into the population’s exercise, and diet habits would be beneficial. Participants in this study identified that they are likely to change their approach to health if it concerned their child. Further studies are required to see if women are likely to implement changes to help reduce the risk of GDM.

## Conclusions

The knowledge of GDM and its complications have increased over the past few years. However, the ability to relay the information to females of childbearing age has correlated with improvements in knowledge. Samoan women have shown greater knowledge regarding GDM and their child’s risk of developing T2DM and being overweight compared to women in Australia. The study shows that there is room for improvement regarding the awareness and education of the complications linked to GDM for the child across both cultures. It is essential that accurate information is available to patients, health professionals, and the general public.

## Conflict of Interest

The author does not identify any conflicts of interest.

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