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RESEARCH ARTICLE

FOOD INTAKE OF GESTATIONAL DIABETES MELLITUS WOMEN AT OMDURMAN MATERNITY TEACHING HOSPITAL KHARTOUM STATE – SUDAN

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ABSTRACT

The objective of this study was to assess the food intake of Gestational Diabetes Mellitus (GDM) women attending Omdurman Maternity Teaching Hospital. The sample included 163 diagnosed GDM with 150 non-diabetic controls. Methods included interviews and anthropometric measurements. The results showed that GDMs were significantly older than non-diabetics (31.28±5.52 and 28.39±5.7 years old, respectively). No significant differences between the two groups regarding their body mass index .The 24-hours food recalls showed that the mean number servings of cereals and sugars were significantly lower among the GDMs compared to the non-diabetics (11.6±4.4 vs. 13.5±3.9 for cereals and 4.8±4.7 vs. 8.3±6 servings for sugars, respectively). However, GDM women still take high amounts of cereals and sugars compared to the recommended amounts. Fruits intake was very low among both groups (less than one serving). The effect was compounded by the reduced intake of vegetables especially among the GDMs (2.7±1.3 vs. 3±1.3 servings, respectively). Fat intake was found to be very high especially among the GDMs compared to the non-diabetics (15.66±10.20 vs. 13.4±7 servings, respectively). In conclusion, the dietary intake of the studied GDM women is unhealthy. Therefore, to achieve safer maternity outcomes, strict intervention programs that promotes healthier dietary intake should be adopted.

INTRODUCTION

Gestational Diabetes Mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy (**American Diabetes Association, 2013**). During the last few decades, many diseases have spread rapidly in low and middle income countries. Diabetes is one of them and GDM rate in particular is also increasing. Recent data showed that GDM prevalence has increased between 10 to 100% in several race/ethnicity groups during the last 20 years (**Ferrara, 2007**). Usually, the frequency of GDM reflects Type 2 diabetes in the underlying populations. **Wild *et al.* (2004)** anticipated that the number of people with diabetes will double by 2030. GDM is a major health problem that increases the risk of many complications for both mother and fetus (**Anderson *et al.*, 2005, Zhang, 2013**). Thus, women with gestational diabetes were found to be at a higher risk for pregnancy and delivery complications including infant macrosomia, neonatal hypoglycemia, and cesarean delivery (**Wendland *et al.*, 2012 and Wong *et al.*, 2013**).

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Additionally, were also found to have an increased risk of developing Type 2 diabetes and obesity in late adolescence and early adulthood. Moreover, their off-springs are more likely to become obese and diabetic later in life (**American Diabetic Association, 2004 and Heatley *et al.*, 2013**). A study in Khartoum State in Sudan estimated the prevalence of GDM to be 2% among pregnant women attending five hospitals in Khartoum State (**Shalayel *et al.*, 2012**). Many studies have documented the important role that can be played by diet in the development, reoccurrence and control of GDM and consequently the reduced rates of serious prenatal complications (**Crowther *et al.*, 2005 and Setj, *et al.*, 2005; Zhang and Ning, *et al.*, 2011; Kheir *et al.*, 2012; Zhang *et al.*, 2014**). Therefore, this study aimed to evaluate the dietary intake of gestational diabetic Sudanese women at Omdurman Maternity Teaching Hospital in Khartoum State.

MATERIALS AND METHODS

A descriptive cross-sectional study was carried out on pregnant women at Omdurman Maternity Teaching Hospital. This hospital provides all health services concerning gynecology and obstetrics services. Data collection started in March 2011

and continued for one year until February 2012. The sample was randomly selected from pregnant women who were in their 3rd trimesters and whose urine glucose levels (UGL) for the first time were found to be above normal. The study sample included 313 women divided into two groups. The first group consisted of 163 GDM women and the control group comprised 150 non-diabetic women as determined by the laboratory analysis of their blood sugar levels. The methods used to collect the data for this study consisted of the following:

1. Interviews guided by questionnaires to determine the socio-economic characteristics and dietary intake (24-hours recall and food frequency questionnaire)
2. Anthropometric measurements (weights (kg), heights (m) and BMI (kg/m^2)
3. Laboratory data analysis - Glucose urine test was used as screening tool for all pregnant women. For those whose urine glucose was above normal, either a random blood sugar test or fasting blood sugar test was performed. If the random blood sugar test result was more than 140mg/dl or fasting blood sugar test result was more than 110 mg/dl, confirmation by OGTT (Oral Glucose Tolerance Test) was performed. These tests were carried out by Omdurman Maternity Teaching Hospital's laboratory. Data were analyzed using the SPSS Program Version 17. Analysis of frequencies and percentages were performed for all variables. Chi-square tests and T-tests were applied to compare GDM and non-GDM data.

RESULTS AND DISCUSSION

Socio--economic Characteristics

As shown in Table 1, many lower socio-economic characteristics were found to be strongly associated with GDM. Generally, the studied population ages ranged from 16 to 45 years. GDMs were found to be significantly older than non-diabetics (31.28±5.52 and 28.39±5.7, respectively). Less educated mothers were found to be significantly (P<0.05) more among the GDM group (illiteracy was 40.5% among GDM mothers compared to only 28% among non diabetic mothers), similar results regarding education were observed by Bouthoorn *et al*. (2014) in the Netherlands.

Table 1. Socio-economical Characteristics of GDM and non-diabetic women

	GDM (N=163)	Non GDM (N=150)	P-value
Age	31.28±5.52	28.39±5.7	0.000*
Mother Education			
Illiterate-Elementary	66 (40.5%)	42 (28.0%)	
School Level			
Secondary and Higher	97 (59.5)	108 (72.0%)	.014**
Education Level			
Area			
North	52 (31.9%)	36 (24.0%)	
Middle	44 (27.0%)	70 (46.7%)	
West	67 (41.1%)	44 (29.3%)	.001**

* = t-test, ** = Chi^2

Concerning the origins of the pregnant women, GDM was found to be significantly (P<0.001) higher among women from western Sudan compared to those who were from northern or central Sudan (41.1% vs. 31.9% and 27%, respectively). This might be due to the late migration of many women from western Sudan to Khartoum State due to the civil war. Consequently, many of them have probably lost their wealth and have faced dramatic changes in their diets and life style. Lower socio-economical status is a well recognized risk factor for GDM in developed as well as in developing countries. James (2008) explained that by the adoption of energy dense diets because of their lower cost. This might also be the case for Sudanese women as their main sources of carbohydrates comes from sugars and energy dense foods instead of nutritionally richer complex carbohydrates and proteins.

Nutritional Status of GDM and Non-GDM Women
Body mass indices

Increased body mass index (BMI =>25) is a well established known risk factor for gestational diabetes (**Cypryk *et al*., 2008; American Diabetes Association, 2004, Seshiah *et al*., 2009; Teh *et al*., 2011**). However, among the studied Sudanese population, BMI was not found to be significantly associated with GDM. Nevertheless, there is a higher percentage of overweight/obese GDM women (45%) compared to overweight/obese non-diabetics (37%) as shown in Table (2).

Table 2. BMIs of GDM and non-diabetic pregnant women

BMI	GDM (N=163)	Non GDM(N=150)	P-value
Underweight (<25.5)	56(34%)	59(39%)	
Normal weight (25.5-27.8)	34(21%)	36(24%)	
Overweight and obese (>27.8)	73(45%)	55(37%)	.417

Calculated from Mardones and Rosso (1997) weight gain chart for pregnant women

Food intake

Meals and snacks

As shown in Table (3), the majority (82%) of all pregnant women studied usually eat three meals per day. Snacking was also practiced daily by the majority of these pregnant women. No significant differences between GDM and non-diabetics were detected in terms of both number of meals or snacking frequency. However, among the GDMs up to 20.2% of women eat only two meals per day and also up to 36% take daily only one snack.

Table 3. Number of daily meals and snacks

Variable /day	GDM	Non GDM	P-value
Three meal	79.8%	84.7%	Not significant
Two meals	20.2%	15.3%	Not significant
Morning snack	97%	97 %	Not significant
≥2 Snacks	64%	68%	Not significant

This snack of the pregnant women was mainly comprised of a morning tea with milk and a simple carbohydrate snack (biscuits, cookies, bread or donuts); this snack is typical of most of the Sudanese population. About 97% of the pregnant women in this study eat this morning snack. Taking of three meals and at least two snacks distributed through the day are

recommended for GDM women with special emphasis on the evening snack (Franz *et al*., 2002).

The 24-Hours Food Intake Recall (servings)

When focusing on the twenty four hours recall of food intake, the study found the intake of some food groups was significantly different between the GDM women and the non-diabetic women as shown in Table (4). The mean of the number of servings of cereals and sugar groups intake were both found to be significantly higher among the non-diabetic group compared to the GDM group (mean of 13.51±3.92 vs. 11.57±4.41 servings for cereals and 8.26±6.05 vs. 4.75±4.74 servings for sugars, respectively). The majority of GDM women reported that they were watching their diets (85%). However, although these figures were significantly higher among the non-diabetics, GDM women still eat high amounts of cereals and sugar compared to the recommended amounts for gestational diabetic women (6-11servings) especially for sugars as complete avoidance is the recommended amount (**USDA, 1992; Kaiser and Allen, 2002 and Baker IDI (Heart Diabetes Institute, 2014**). **Chen *et al*. (2014)** observed that among GDM Hispanic women high calorie intake worsens insulin resistance and B-cell function.

Table 5. Frequencies of Traditional Sudanese foods rich in carbohydrates

	GDM (163)	Non GDM (150)	P-value
Bakeries, biscuits, *baklawa* and cakes			
≤ 7 serving per week	114(69.9%)	67(44.7%)	.000
> 7 serving per week	49(30.1%)	83(55.7%)	
Daily intake of soft drinks			
Yes	21(12.9%)	12(8%)	.111
No	142(87.1%)	138(92%)	
Daily intake of fresh juice			
Yes	39(23.3%)	47(31.3%)	.090
No	124(76.1%)	103(68.7%)	
Daily intake of local juice			
Yes	49(30%)	33(22%)	.068
No	114(69.9%)	117(78%)	
Daily intake of sweet tahini (*tahnia*)			
Yes	16(9.8%)	17(11.3%)	0.411
No	147(90.2%)	133(88.7%)	
Daily intake of dates			
Yes	99(60.7%)	103(68.7%)	.089
No	64(35.5%)	47(31.3%)	
Puddings (sweetened rice with milk, ice-cream, sweet porridge with milk)			
≤ 7 servings per week	130(80.2%)	112(74.7%)	.148
> 7 servings per week	32(19.8%)	38(25.3%)	
Sugar per week			
≤ 42 tea spoons sugar per week	80(49.1%)	67(44.7%)	.003
> 42 tea spoons per week	83(50.9%)	83(55.3%)	

Meat and dairy intakes were both not found to be significantly different between the two groups. Again, meats and legumes servings were higher than the recommended amounts, however, the dairy servings of these pregnant women was the only food group which was taken within the recommended levels. Fruits intake was also not found to be significantly different between non-diabetic and GDM women. However, both groups of pregnant women had reduced intake of fruits (less than one serving per day). This reduced intake of fruits is compounded by the reduced intake of vegetables especially among the GDM women (3.01±1.33 servings of vegetables were daily taken by the non-diabetics vs. 2.67±1.27 servings for the GDMs). Daily intake of 2-3 servings of fruits and 4-5 servings of vegetables are the recommended levels (**Kaiser and Allen, 2002 and Baker IDI (Heart Diabetes Institute), (2014**). Fruits and vegetables supply the body with vitamins and minerals; which contain high amounts of fiber that help with constipation. More importantly, they are rich sources of complex carbohydrates which supply the energy (glucose) gradually and prevent spikes in high blood sugar levels. The mean of fats servings intake was found to be significantly higher among the GDM group compared to the non-diabetics (mean of 15.66±10.20 vs. 13.41±7.01 servings, respectively) and much higher than the recommended daily 6 servings. Similar results were observed by **Wang *et al*., (2000)** who found higher intakes of fat among GDM women independent of their body mass indices. Bao *et al*. (2014) has also found that higher fried foods consumption particularly away from home was highly associated with a higher risk of developing gestational diabetes.

Among the Sudanese population studied, the majority of GDM women dietary intake amounts deviates from the recommended amounts (their fruit and vegetables intakes were below the recommended levels, and their simple carbohydrates and fats intake was much higher than the recommended levels).

Frequency of Some Commonly Taken Rich Carbohydrates

As shown in Table (5), the Food Frequency Questionnaire (FFQ) listed only the most commonly eaten Sudanese foods which are rich in carbohydrates. Lower significant carbohydrate intake of GDM women as compared to non-diabetic ones were only observed for baked foods intake, sugars and puddings. However, a higher percentage of GDM women take some other foods rich in simple starches and sugars. More than 60.7% of the pregnant women in this study eat more than 3 dates daily. Fresh juices and local juices (*KarKadeh* juice *(hibiscus sabdariffa), Tabaldi* juice *(Adansonia digitata)* or *Aradaib* juice *(Tamarindus indica)*) with added sugar were taken daily by 23.3% and 30%, respectively. Note that for a cup (250 ml) of each of these local juices at least 2 tablespoons of sugar were usually added. About 20% of GDM women eat more than 7 servings of sweet puddings per week. More than 6 teaspoons of sugar were taken daily by 50.9% of the GDM women. To a lesser extent soft drinks and sweet tahini (mainly consists of sugar and sesame) were eaten daily (12.9% and 9.8% respectively). Many GDM women in this study were found to regularly take most of the listed foods high in starch and/or sugar. These foods were known to have a great impact on blood glucose levels, and will probably lead to hyperglycemia which potentially can cause many health problems for both mother and her baby.

Conclusion

The majority of GDM Sudanese women were adopting very unhealthy dietary practices. Thus, their dietary intakes have strayed from the recommended daily amounts for most food groups. Their simple carbohydrates intake (refined sugar, local sweetened juices and bakeries) were much higher than the recommended levels for GDM women. On the other hand, their intake of fruits and vegetables were much below the recommended levels. Also high intakes of fat were observed.

All these practices will probably lead to increased birth weight babies and the obesity of mother, increased risk of high blood pressure, preeclampsia, insulin resistance and many other complications. Therefore, for achieving safer maternity and off-spring outcomes and reduced cost of medications, intervention programmers must focus on nutritional education and healthier dietary practices of pregnant women.

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