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ORIGINAL ARTICLE

Association between healthy maternal dietary pattern and risk for gestational diabetes mellitus

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BACKGROUND/OBJECTIVES: Gestational diabetes mellitus (GDM) is associated with negative health effects for mother and child. The aim was to investigate the association between maternal dietary patterns and GDM.

SUBJECTS/METHODS: Prospective observational study including 168 pregnant women aged 18–40 years, recruited at routine 20-week ultrasound. All participants kept a 4-day weighed food record following recruitment (commencement: gestational weeks 19–24). Principal component analysis was used to extract dietary patterns from 29 food groups. A Healthy Eating Index (HEI) was constructed. All women underwent an oral glucose tolerance test in weeks 23–28.

RESULTS: One clear dietary pattern (Eigenvalue 2.4) was extracted with positive factor loadings for seafood; eggs; vegetables; fruits and berries; vegetable oils; nuts and seeds; pasta; breakfast cereals; and coffee, tea and cocoa powder, and negative factor loadings for soft drinks and French fries. This pattern was labeled a prudent dietary pattern. Explained variance was 8.2%. The prevalence of GDM was 2.3% among women of normal weight before pregnancy ($n = 86$) and 18.3% among overweight/obese women ($n = 82$). The prudent dietary pattern was associated with lower risk of GDM (OR: 0.54; 95% CI: 0.30, 0.98). When adjusting for age, parity, prepregnancy weight, energy intake, weekly weight gain and total metabolic equivalent of task the association remained (OR: 0.36; 95% CI: 0.14, 0.94). Similar results were found when only including overweight or obese women (OR: 0.31; 95% CI: 0.13, 0.75).

CONCLUSIONS: Adhering to a prudent dietary pattern in pregnancy was clearly associated with lower risk of GDM, especially among women already at higher risk because of overweight/obesity before pregnancy.

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INTRODUCTION

The number of women diagnosed with gestational diabetes mellitus (GDM) continues to grow worldwide. Negative health aspects have been associated with GDM for both mother and child. Having GDM is related to a greater risk of diabetes later in life,[1–4] miscarriage, hypertension, pre-eclampsia and delivering very large infants. This, in turn, can lead to higher risks of preterm delivery, birth trauma, cesarean section and shoulder dystocia.[2,5–8] The infants are at higher risk of various malformations,[5] growth restriction during gestation, hypoglycemia due to a lack of glucose supply through the umbilical cord after delivery[6] and type 2 diabetes later in life.[2,9–13]

Women who are overweight or obese before pregnancy have a greater risk of being diagnosed with GDM than women of normal weight.[4,14,15] Increased weight gain during pregnancy has also been associated with increased GDM risk.[16,17] Weight is usually recorded in standard maternity care, providing data to investigate pregnancy complications in relation to weight or weight gain during pregnancy. However, dietary intake is rarely recorded, and more knowledge is still needed to develop dietary indicators for clinical practice. Individual dietary factors, such as low consumption of polyunsaturated fatty acids,[18,19] high intake of saturated fatty acids[20,21] and total carbohydrates and soft drinks,[22–24] have been associated with increased risk of GDM. In recent years, a greater focus has been directed at investigating the combined effect of various foods on health or health-related factors instead of isolated foods or nutrients––for example, by using dietary patterns or a healthy eating index (HEI).[25–27] However, few studies have used this approach in pregnant women.[28] The aim of this study was to investigate associations between maternal dietary patterns and GDM, using both principal component analysis and an HEI.

MATERIALS AND METHODS

Participants were recruited over a period of 18 months from April 2012 to October 2013 at a routine 20-week ultrasound scan with the help of staff at the Prenatal Diagnosis Unit at the National University Hospital. The study was approved by The National Bioethics Committee in Iceland, and participants signed an informed consent. Initially the criteria for participation were Icelandic women living in Reykjavik, between 18 and 40 years, non-smokers with no reported family history of diabetes or GDM, body mass index between 18.5 and 24.9 kg/m^2 (normal weight) or 30 and <40 kg/m^2 (obese) and parity 1–3. Higher parity was excluded because of increased obstetric complication risks.[29] After 6 months of recruiting the criteria were widened to include women with a body mass index of 25–29.9 kg/m^2 (overweight) as well and overweight/obese women with a family history of diabetes, as considerably fewer obese women were being recruited than normal weight women. A total of 273 women were approached within the study period, of whom 56 declined participation and 49 either did not return the food diaries and/or show up for the oral glucose tolerance test. The analysis therefore included 168 women (participation rate 62%).

Dietary intake

All participants were required to keep a 4-day weighed food record, either from Wednesday to Saturday or from Saturday to Tuesday, as soon as possible following recruitment, commencing in gestational weeks 19–24.

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As Fridays have been shown to have a similar intake variance as Saturdays and Sundays, the dietary intake was collected for two weekdays and two weekend days per participant.[30] The participants received oral and written instructions for the scale and the food diaries, and were asked not to change their dietary habits during the food recording. Quality of the records was checked by an experienced researcher, also responsible for entering the data into the nutrition-calculating program ICEFOOD, supported by the Icelandic food and nutrient database ISGEM.[31] The average food intake in g/day was calculated for each participant and total energy intake (kcal/day) estimated.

Eighteen food groups are predefined in the ICEFOOD software: milk and dairy products; cheese; ice cream; red meat and meat products; fish/fish products and shellfish; poultry; eggs; potato chips and popcorn; sauces/soups; preprepared meals; sugar/honey and candy; fat; drinks; vegetables; fruits; grains; supplements; yeast and spices. Six of these 18 groups were further divided into subgroups to separate between healthier choices and less healthy. The 'fat' group was divided into three groups: solid fats (animal fats, butter products and hydrogenated oils); vegetable oils and fats (all vegetable fats including coconut oil and nut butters); and fish oil. The 'drinks' group was divided into three groups: coffee/tea and cocoa powder; soft drinks, nectars and sports drinks; and pure fruit juices. As several participants failed to record water consumption, water was omitted from the analysis. The 'vegetable' group was divided into three groups: vegetables; potatoes; and French fries, and the 'fruit' group into two subgroups: nuts and seeds; and fruit and berries. The 'grain' group was divided into five groups: grains; breakfast cereals; ordinary and crisp bread; cookies and cakes; and pasta (wholegrain and normal) and couscous. The supplement food group was divided into two groups: diet- and protein shakes; and vitamin and mineral supplements. Because of the extremely low intake in the yeast and spices group it was omitted from the analysis. Therefore, the dietary patterns were extracted from intake data (g/day) from 29 food groups. No participant recorded the use of alcohol over the 4-day period.

As an additional method, adherence to an HEI was determined using the food-based dietary guidelines from the Icelandic Directorate of Health.[32] The index therefore includes fish and seafood; vegetables; fruits; vegetable oils; nuts and seeds; unground/wholeground cereals (i.e. bran, germ, oats, rice and corn); vitamin D intake (the only nutrient in the food-based dietary recommendations in Iceland due to reduced sunlight in the winter months) and soft drinks. The participants' intake of these foods was divided into tertiles based on quantity (g/day). The tertile with the lowest intake received a score of one, the medium intake tertile a score of two and the highest intake tertile a score of 100. This was done for all the included variables, except soft drinks, where the score was reversed and the lowest consumption tertile given a grade of 100. All grades were combined for each participant and the tertile with the highest total score was deemed as having the best adherence to the HEI. This way we were able to compare a predefined healthy eating pattern with the pattern revealed from the real intake data.

Oral glucose tolerance test

All study participants underwent a 2 h, 75 g oral glucose tolerance test between gestational weeks 23 and 28, where serum glucose and insulin were measured using standard methods at the Landspítali University Hospital biochemistry laboratory. Homeostasis Model Assessment of Insulin Resistance (HOMA-IR) was used to assess the levels of insulin resistance by using results of fasting insulin (I_0) and fasting glucose (G_0) measurements calculated as ($I_0 \times G_0$)/22.5.[33] Recent guidelines from the World Health Organization were used to determine the rate of GDM in the group at weeks 23–28 gestation by a fasting plasma glucose between 5.1 and 6.9 mmol/l, 1-h value of $\geqslant$10.0 mmol/l or a 2-h plasma glucose of 8.5–11.0 mmol/l after the 75 g oral glucose tolerance test. If one, two or all of these criteria were met, the woman was diagnosed with GDM.[34] During the recruiting process and with assistance from two of the authors if required (HM and EAT), all participants answered the International Physical Activity Questionnaire from which the metabolic equivalent of task (MET) was estimated.[35] Prepregnancy weight was self-reported. Weight was recorded at recruitment in gestational weeks 19–24 and again at the time of an ultrasound examination at weeks 31–38. Weight gain was therefore reported as weekly gain, due to the variance of recorded weight. To obtain this, the differences between the two recorded weights were divided by the intervening number of weeks in each case.

Statistical analysis

Data are presented as means and standard deviations and also as median and interquartile ranges when appropriate. The Kolmogorov–Smirnov test was used to test all data for normality. Dietary patterns were extracted by using principal component analysis with the orthogonal rotation Varimax with Kaiser normalization.[36] This method is data driven and forms new components or linear factors by reducing data dimensions and grouping correlated variables (food intake). The dietary patterns (components) derived by this analysis reflect food intake combinations.[27] For each pattern extracted a variable is created, ranking participants on their adherence to the pattern. The food intake data were added in g/day. The suitability of our dietary pattern data was tested with Bartlett's test of Sphericity and Kaiser–Meyer–Olkin measure of sampling adequacy. The Bartlett test was significant ($P<0.01$). However, the Kaiser–Mayer–Olkin test was 0.5, which is acceptable but borderline. Differences in maternal characteristics over the three groups of body mass index before pregnancy were tested with the Kruskall–Wallis test, which was also used in the association of maternal characteristics to the prudent dietary pattern adherence scores, fasting glucose and HOMA-IR. The association of maternal characteristics to the prudent dietary pattern adherence scores, to fasting glucose and HOMA-IR was tested with the Mann–Whitney *U* test for parity. The association between the outcome of the pattern analysis and GDM diagnosis was determined using logistic regression. The variance inflation factor used to detect co-linearity among factors used for adjustment in the logistic regression was within limits. The chi-squared test was used to compare the number of GDM diagnoses in groups with the highest compared with lower adherence to the prudent dietary pattern or the HEI. All statistical analyses were performed in IBM SPSS statistics version 20. The significance level was set at $P<0.05$.

RESULTS

Table 1 shows the maternal characteristics. Obese women had gained less weight during pregnancy at recruitment, in weeks 19–24, than overweight or normal weight women, 2.7, 5.5 and 4.6 kg, respectively ($P=0.02$). The weekly weight gain between weeks 19 and 24 and 31 and 38 was also significantly different between the groups, as normal weight women gained more weight/week than overweight and obese women, 0.7, 0.6 and 0.5 kg, respectively ($P<0.01$). The prevalence of GDM for women of normal weight before pregnancy was 2.3%, and among overweight or obese women it was 18.3%. None of the women had glucose levels above the GDM criteria, which would indicate frank diabetes mellitus.

Two dietary patterns were extracted; however, only one had Eigenvalue >2 and showed an association with the outcome under investigation. This pattern was labeled a 'prudent dietary pattern' (Table 2) and was positive for seafood, eggs, vegetables, fruit and berries, vegetable oils, nuts and seeds, pasta, breakfast cereals, and coffee and tea, and negative for soft drinks and French fries. Variance explained was 8.2%. Adherence to the prudent dietary pattern varied somewhat when divided by maternal characteristics (Table 3). When divided by age the best adherence was seen in the oldest age group ($P=0.03$). Better adherence to the prudent dietary pattern was associated with a significantly decreased GDM risk (Table 4). That difference was still present after adjusting for age, parity, prepregnancy weight, energy intake, weekly weight gain, and total MET. An independent association was seen between weekly weight gain and GDM risk (OR: 0.02; 95% CI: 0.00, 0.54). We repeated the analysis only including the women who were overweight or obese prepregnancy ($n=82$/GDM $n=15$) (Table 4). Associations between individual dietary factors of the pattern and GDM risk were generally not significant, except for seafood and pasta consumption (Table 4). In the next step, the participants were divided into tertiles, depending on adherence to the prudent dietary pattern (Table 5). The HOMA-IR values were lower in the tertile with the highest adherence, although of borderline significance ($P=0.054$). Including only overweight or obese prepregnancy women, lower

Table 1. Maternal characteristics

	Normal weight n = *86* *Mean s.d.*	*Overweight* n = *44* *Mean s.d.*	*Obese* n = *38* *Mean s.d.*
Age (years)	29.0 ± 4.8	30.0 ± 4.3	30.0 ± 4.6
Height (m)	168 ± 5.6	167 ± 5.6	168 ± 6
Prepregnancy weight (kg)	61.1 ± 6.5	76.2 ± 5.3	93.6 ± 9.8
Weight at recruiting week 19–23 (kg)[a]	65.9 ± 6.8	81.9 ± 7.0	96.8 ± 10.3
BMI prepregnancy (kg/m^2)[a]	21.6 ± 1.6	27.2 ± 1.2	33.2 ± 2.7
Gestational age at recruiting (weeks+days)[b]	20+2 ± 3.4	21+0 ± 6.8	20+4 ± 3.7
BMI at recruiting (kg/m^2)[a]	23.3 ± 1.8	29.3 ± 1.7	33.8 ± 2.3
Weight gain at recruiting (kg)[a]	4.6 ± 2.7	5.5 ± 4.1	2.7 ± 4.1
Weekly weight gain between weight recordings (10–17 weeks) (kg)[a]	0.7 ± 0.2	0.6 ± 0.2	0.5 ± 0.3
Parity	0.6 ± 0.8	1.0 ± 0.9	0.7 ± 0.7
Energy intake (kcal)[c]	2160 ± 400	2108 ± 459	2206 ± 535
Number of GDM diagnoses (%)	2 (2.3)	4 (9.1)	11 (28.9)

Data are presented as mean ± standard deviation (s.d.). [a]Information about weight at recruiting is missing for 13 normal weight subjects, one overweight subject and seven obese subjects. [b]Gestational age presented as weeks and days ± standard deviation of days. [c]Average intake calculated from 4-day food records.

Table 2. The prudent dietary pattern

Dietary pattern food	*Factor loading coefficient*[a]
Vegetables	0.58
Eggs	0.56
Vegetable oils[b]	0.47
Seafood[c]	0.47
Soft drinks[d]	− 0.45
Breakfast cereals	0.40
Fruit and berries[e]	0.39
Nuts and seed	0.36
Pasta/couscous	0.34
French fries	− 0.33
Tea, coffee, cocoa powder	0.33

[a]The factor loading coefficient describes the correlation (*r*) between intake of the food groups and the extracted factor. [b]Includes all vegetable oils, peanut and seed butters. [c]Includes all fish, shellfish and seafood products. [d]Includes soda- and sports drinks (sugar sweetened and sugar free). [e]Includes all fruit, berries and jams.

HOMA-IR values were seen with greater adherence to the prudent dietary pattern ($P < 0.01$) (Table 5).

Table 6 shows the number of women diagnosed with GDM according to adherence to the prudent dietary pattern and the HEI. Among women with the highest adherence to the prudent pattern, 1.8% had been diagnosed with GDM but 14.3% among women with lower adherence ($P = 0.01$). The GDM diagnosis rate of 3.7% was seen in overweight or obese women with the highest adherence to the prudent dietary pattern, but 25% of the women with lower adherences were diagnosed with GDM ($P = 0.02$). Similar results were seen for adherence to the HEI (Table 6).

DISCUSSION

Adhering to a prudent dietary pattern in pregnancy was associated with a decreased risk for GDM in the present study. Similar results were seen for the HEI, where dietary intake in line with dietary recommendations was associated with decreased risk of GDM, especially in women who were either overweight or obese prepregnancy.

One of the most important messages of the present paper is that the GDM risk among overweight or obese women with good adherence to the prudent dietary pattern was similar to that seen among the normal weight women. Although some randomized controlled trials have suggested benefits of a healthy diet for women already diagnosed with GDM,[37] the overall effect is still limited.[38] The results of the present study indicate that dietary interventions in pregnancy targeted towards women with a low-quality diet in the beginning of pregnancy might be more effective if intervention selection is based on prepregnancy weight. However, more studies are also needed to establish the importance of timing in adherence to a prudent pattern. It has been suggested that prepregnancy dietary patterns are continued in pregnancy,[39] making it difficult to separate the potential effect of prepregnant diet from dietary intake in pregnancy.

The whole diet approach is being established in public dietary guidelines around the world[26] yet, studies assessing its associations to GDM risk are still limited. The results of the present study are in line with previous observational studies. In a study including 1076 women in 10 countries, adherence to a Mediterranean dietary pattern was associated with better glucose tolerance and decreased incidence of GDM.[40] A prospective study by Chen *et al*. examined the effects of a prudent diet including vegetables, fruit, fish and poultry and a westernized diet, which included high intake of red and processed meat, pizza, French fries, candy and refined grains. They discovered an association between the prudent dietary pattern and a decreased GDM risk, as well as an increased risk for GDM associated with the westernized pattern.[41] Another study based on results from the Nurses' Health Study II indicated that prepregnancy adherence to the Dietary Approach to Stop Hypertension, a Mediterranean- or Healthy Eating Index (HEI) diet, was associated with a lower GDM risk. Both the Dietary Approach to Stop Hypertension diet and the Mediterranean diet included high intake of fruit, vegetables, nuts, legumes and soy, whole grains and decreased consumption of red and processed meat, whereas the Dietary Approach to Stop Hypertension diet also included low-fat dairy, sweetened beverages and sodium and the Mediterranean diet fish and seafood, moderate alcohol and monounsaturated fatty acids. However, the strongest relation was seen for the HEI diet that, like the other two patterns, includes higher intake of vegetables, fruits, nuts, legumes and soy and additionally increased white to red meat ratio, moderate alcohol, cereal fiber, polyunsaturated fatty acids, multivitamin use and decreased intake of trans fats.[42] Knowledge on healthy diet in pregnancy and showing lower risks of pregnancy complications has been growing, supporting the need for increased emphasis on

Table 3. Associations between characteristics of the participants and the prudent dietary pattern adherence score, fasting glucose and HOMA-IR[a]

Characteristics	*n (%)*	*Prudent dietary pattern*	*Fasting glucose (mmol/l)*	*s.d.*	*HOMA-IR*[a]	*s.d.*
Maternal age (years)						
18–25	45 (27)	−0.11	4.4	(0.4)	2.6	(2.5)
26–33	91 (54)	−0.11	4.5	(0.4)	3.4	(4.6)
34–40	32 (19)	0.46	4.6	(0.4)	2.1	(0.9)
P-value		**0.03**	**0.01**		0.70	
Parity						
Para 0	79 (47)	0.03	4.4	(0.4)	2.8	(2.7)
Para 1–3	89 (53)	−0.03	4.5	(0.4)	3.1	(4.3)
P-value		0.87	0.22		0.79	
Prepregnancy BMI (kg/m²)						
18.5–24.9	86 (51)	0.1	4.3	(0.4)	2.6	(4.2)
25.0–29.9	44 (26)	0.07	4.6	(0.4)	3.2	(3.4)
⩾ 30	38 (23)	−0.3	4.7	(0.4)	3.6	(2.4)
P-value		0.68	< **0.01**		< **0.01**	
Energy intake (kcal)						
Lowest energy quartile	42 (25)	−0.01	4.5	(0.4)	2.9	(3.3)
Second energy quartile	42 (25)	0.01	4.6	(0.4)	3.4	(4.7)
Third energy quartile	42 (25)	−0.11	4.5	(0.4)	2.8	(3.9)
Highest energy quartile	42 (25)	0.11	4.4	(0.4)	2.8	(2.7)
P-value		0.98	0.16		0.59	

Data are displayed as mean and standard deviation (s.d.). [a]The homeostatic model assessment of insulin resistance (HOMA-IR). Bold values are statistically significant.

Table 4. Association between the prudent dietary pattern and its components to gestational diabetes mellitus

	Unadjusted		*Adjusted*[a]	
	OR	*CI*	*OR*	*CI*
All participants (n = 168)				
Prudent dietary pattern	0.54	(0.30, 0.58)[b]	0.44	(0.21, 0.90)[b]
Seafood	0.98	(0.95, 1.02)	0.84	(0.72, 0.97)[b]
Eggs	0.99	(0.95, 1.03)	0.98	(0.90, 1.06)
Vegetables	1.00	(0.99, 1.01)	1.00	(0.99, 1.00)
Fruit and berries	1.00	(1.00, 1.01)	1.09	(0.99, 1.01)
Vegetable oils	0.95	(0.78, 1.16)	0.80	(0.58, 1.10)
Nuts and seeds	1.01	(0.95, 1.07)	0.94	(0.76, 1.17)
Pasta, couscous	0.98	(0.95, 1.01)	0.89	(0.81, 0.99)[b]
Breakfast cereal	1.00	(0.99, 1.01)	1.02	(0.99, 1.05)
Coffee, tea and cocoa powder	1.00	(1.00, 1.01)	1.00	(0.99, 1.01)
Soft drinks	1.00	(1.00, 1.00)	0.99	(0.98, 1.00)
French fries	1.01	(0.99, 1.04)	1.02	(0.99, 1.11)
Overweight/obese before pregnancy (n = 82)				
Prudent dietary pattern	0.38	(0.18, 0.83)[b]	0.31	(0.13, 0.75)[b]
Seafood	0.96	(0.93, 1.00)[b]	0.96	(0.93, 1.00)[b]
Eggs	0.98	(0.94.1.03)	0.98	(0.93, 1.03)
Vegetables	1.00	(0.99, 1.00)	0.09	(0.99, 1.00)
Fruit and berries	1.00	(1.00, 1.01)	1.05	(0.92, 1.20)
Vegetable oils	0.96	(0.70, 1.32)	0.90	(0.67, 1.22)
Nuts and seeds	0.99	(0.91, 1.07)	1.05	(0.92, 1.20)
Pasta, couscous	0.96	(0.92, 1.00)	0.95	(0.91, 1.00)[b]
Breakfast cereal	0.99	(0.98, 1.01)	0.99	(0.98, 1.01)
Coffee, tea and cocoa powder	0.96	(0.90, 1.03)	0.95	(0.89, 1.03)
Soft drinks	1.00	(1.00, 1.00)	1.00	(1.00, 1.00)
French fries	1.01	(0.99, 1.04)	1.02	(0.99, 1.05)

[a]Adjusted for age, parity, prepregnancy weight, energy intake (kcal), weekly weight gain and total MET. [b]Association is significant.

dietary intake in maternal care. Information from different populations is also of high importance, as sources of key nutrients differ between countries. The association between the prudent dietary pattern and the lower risk of GDM in the present study was stronger than for individual food groups included in the pattern. This suggests that the benefit of combined dietary factors is stronger than for isolated foods. The lower risk of GDM with seafood intake seen in our analysis might be related to ω-3 and studies showing lower risk of GDM with increased intake of polyunsaturated fatty acids[43] or simply that seafood intake reflects lower intake of red and processed meat and is an indicator of a healthier diet in general. Weight gain in pregnancy also appears to be an obvious risk factor in association with GDM risk.

Strengths and limitations

Information regarding food intake was acquired through weighed food diaries where intake of all food and drink, including all supplements, was recorded for the duration of 4 days early in pregnancy. The food diaries were filled out and delivered before the diagnosis of GDM. The volume of information available is another strength. As age and overweight/obesity are both risk factors for GDM, we adjusted for age and prepregnancy body mass index in our model. We also calculated weight gain per week between the second and third trimesters when weighing was performed by study staff on two occasions. As the HEI analysis supported the finding of an association between the prudent pattern and the lower risk for GDM, the relatively low score in the Kaiser–Meyer–Olkin test in the dietary pattern analysis was of less concern. Limitations included the change in criteria during recruiting. However, adjustments of the model for a family history of diabetes demonstrated no changes, and thus it appears to be irrelevant in this case. Even though physical activity was adjusted for in the model as total MET, it may have an association to dietary habits, as the two factors often correlate, and increased physical activity is often associated with healthier diet choices.[44] For instance, when total MET was substituted with vigorous activity in the regression model, the association between dietary patterns and GDM was somewhat attenuated. Future studies should account for both physical activity and dietary intake when assessing the associations between lifestyle and risk of GDM and use measurements of physical activity specifically designed for pregnant women.

Table 5. Relationship between different prudent dietary pattern adherence score (lowest to highest tertile) and HOMA-IR, 120 min outcomes for glucose and insulin at an oral glucose tolerance test

Prudent dietary pattern	*All participants* (n = *168)*	*Normal weight* (n = *86)*	*Overweight/obese* (n = *82)*
HOMA-IR			
Lowest score tertile	2.34 (2.37)	1.46 (0.94)	3.24 (2.19)
Medium score tertile	2.23 (1.76)	1.73 (1.04)	3.18 (1.65)
Highest score tertile	1.88 (1.04)	1.53 (1.1)	2.18 (1.05)
P-value	0.054	0.73	< **0.01**
Glucose 120 min (mmol/l)			
Lowest score tertile	5.8 (1.6)	5.2 (2.0)	5.9 (1.2)
Medium score tertile	5.6 (1.7)	5.3 (0.9)	5.9 (1.3)
Highest score tertile	5.3 (1.6)	5.1 (1.4)	5.9 (1.4)
P-value	0.18	0.92	0.51
Insulin 120 min (mU/l)			
Lowest score tertile	56.1 (44)	48.9 (52)	69.2 (46)
Medium score tertile	61.1 (66)	57.9 (33)	99.1 (98)
Highest score tertile	50.3 (44)	50.1 (39)	66.3 (37)
P-value	0.25	0.52	**0.06**

Data are displayed as medians (interquartile range). Significance in differences was found using the Kruskal–Wallis test. mU/l: milliunits per liter. Bold values are statistically significant.

Table 6. Adherence to the prudent dietary pattern and Healthy Eating Index and the rate of gestational diabetes mellitus

	GDM diagnosis n	*Non-GDM* n	*Total* n	*GDM* %
Prudent dietary pattern				
All participants ($n = 168$)				
Highest adherence	1	55	56	1.8
Low/medium adherence	16	96	112	14.3
				***P* = 0.01**
Overweight/obese women ($n = 82$)				
Highest adherence	1	26	27	3.7
Low/medium adherence	14	41	55	25.5
				***P* = 0.02**
Healthy Eating Index				
All participants ($n = 168$)				
Highest adherence	2	54	56	3.6
Low/medium adherence	15	97	112	13.4
				***P* = 0.05**
Overweight/obese women ($n = 82$)				
Highest adherence	1	25	26	3.8
Low/medium adherence	14	42	56	25.0
				***P* = 0.02**

The Chi-squared test was used to define significance of differences.

CONCLUSION

Adhering to a healthy or a prudent dietary pattern may prove beneficial in preventing GDM or reducing its adverse effects, especially among women already at higher risk due to overweight or obesity before pregnancy. Promoting a healthy diet for the prevention of GDM, with a special focus on women at increased risk, appears meaningful and merits testing with intervention studies. The results could contribute to changes in dietary advice and monitoring in an effort to lower the rates of GDM.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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