Journal of Applied Sciences Research, 9(8): 5013-5018, 2013
ISSN 1819-544X
This is a refereed journal and all articles are professionally screened and reviewed

ORIGINAL ARTICLES

Does weight loss reduce the recurrence of gestational diabetes in overweight and obese women?

[1]Ashraf Hamdy, [2]Al Sayed M. Taha, [3]Amira Medhat and [4]Lobna M. Abd El-Latif

[1]*Safa Almadina hospital, AlmadinaAlmonawara, Saudi Arabia*
[2]*Sayed Gala hospital, Faculty of Medicine, Al-Azhar University, Cairo, Egypt.*
[3]*Complementary medicine department, National Research Center, Cair University ,Cairo,Egypt*
[4]*Medical biochemistry department, Faculty of Medicine for Girls Al-Azhar University, Cairo, Egypt*

ABSTRACT

Objective: To estimate the association between prepregnancy weight loss and risk of recurrence of gestational diabetes mellitus (GDM) in the subsequent pregnancy among overweight and obese women with past history of GDM **Methods:** This is a multicentric case control study. 70 overweight and obese women with past history of GDM were divided into 2 groups. 30 women in intervention group were undergone a weight loss program to loss ≥10% of body weight prior to subsequent pregnancy compared to 40 women who did under go any weight loss program acting as the control group. Screening test for GDM was performed to all women at first antenatal visit and at 24-28 weeks of gestation to detect cases with recurrent GDM. **Results:** Women in intervention group had a statistical significant decrease of BMI in the second pregnancy and more weight loss prior to second pregnancy compared to women in the control group (P<0.01).Women in intervention group showed a significant lower rate of recurrence of GDM in the second pregnancy compared to women in the control group (26.6% vs. 60%, OR = 0.24, 95% CI = 0.08-0.67; P< 0.01). **Conclusion:** Weight loss before pregnancy can reduce the recurrence of GDM in overweight and obese women and should be recommended by all health care providers for overweight and obese women before subsequent pregnancy.

Key word: gestational diabetes, obese women, weight loss.

Introduction

Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance of variable severity with first onset or recognition in pregnancy (Ehrlich *et al*, 2012).Overweight is defined as body mass index (BMI) 25-29.9 and obesity as BMI ≥30 kg/m². Overweight and obesity are established risk factors for GDM (Callaway *et al*, 2010). Being overweight, obese or severely obese increases the risk of GDM by a factor 2.1, 3.6 and 8.6, respectively (Chu *et al*, 2007). Both maternal GDM and obesity share common metabolic characteristics such as increased insulin resistance, hyperglycemia, and hyperinsulinemia (Catalano *et a*l, 2012).

Both morbidities are independently associated with adverse pregnancy outcomes and their combination has a greater impact than either one alone (Catalano *et al*, 2012). Both are associated with an increased rate of preterm labour, miscarriage, fetal chromosomal and structural anomalies, cesarean deliveries; pregnancy induced hypertension preeclampsia, dysfunctional labour, (Silverman *et al*, 1995) postpartum hemorrhage, (Glazer *et al*, 2004) urinary tract infections; increased perinatal morbidity(e.g., macrosomia, neonatal hypoglycemia, infections and neonatal jaundice);and perinatal mortality (O'Sullivan, 1991)as well as subsequent type 2 diabetes in women and their off springs (Metzger, 2007). Furthermore, obese women are more likely to suffer from risks of thromboembolism and other comorbidities (Glazer *et a*l, 2004).

The prevalence of GDM in the USA is 2-10%, (National Diabetes Information ,2011) with about 10-95% increases in prevalence reported over the last two decades (Ehrlich *et al*, 2012).Similarly, the prevalence of overweight and obesity in pregnancy has risen dramatically in recent years in both developing and developed countries (Oteng *et al*, 2012) Approximately 60% of women of reproductive age are overweight or obese in the USA and other developed countries (Flegal *et al*, 2012). Therefore, GDM is increasing in parallel with overweight and obesity in the obstetric population (Ehrlich *et al*, 2012).

GDM, in an index pregnancy, increases the risk of recurrent GDM in subsequent pregnancies. The reported frequency of recurrent GDM varies widely, from 30 to 84% depending on some factors such as ethnicity, body weight, BMI, maternal age and the diagnostic criteria used (Kim *et al*, 2007). Getahun et al, 2010 reported that compared to women who were free of GDM in their first pregnancy, those with past history of GDM in their first pregnancy had a 13 folds increased risk of GDM in a second pregnancy, those who were free of GDM in

Corresponding Author: Amira Medhat Mohammed, Complementary medicine department,National Research Center, Cairo, Egypt.
E-mail: amira.medhat@live.com

the first pregnancy but experienced the condition in their second had a 15 folds increased risk of GDM in the third pregnancy, and those with GDM in their first two pregnancies had a 26 folds increased risk of GDM in the third pregnancy. MacNeil *et al* 2001 ported that increased body weight is a major risk factor of GDM recurrence and women whose prepregnancy weight at the start of the subsequent pregnancy was ≥190 lb were 70% more likely to have a recurrence of GDM.

It was hypothesized that the loss of BMI units between pregnancies would reduce the risk of recurrence of GDM (Ehrlich *et al*, 2012). Furthermore, a recent report of the Institute of Medicine (IOM) of the National Academy of Science in the USA (Institute of Medicine, National Research Council, 2009). presents evidence that prepregnancy weight loss is associated with improved reproductive outcomes for obese women undergoing bariatric surgery (Guelinckx *et al*, 2009), (Maggard *et al*, 2008). However, no studies regarding the effect of preconceptional weight loss as a result of lifestyle interventions including exercise and dietary manipulations on GDM recurrence in overweight and obese women were citied. We sought to determine whether prepregnancy weight loss reduced the risk of recurrence of GDM among overweight and obese women.

Materials and Methods

We conducted a multicentric prospective case control study among total 77 Egyptian overweight and obese women with past history of GDM between January 2011 and July 2013. 37 women underwent a program for weight loss for 6 months before planned next pregnancy aiming to loss at least 10% of body weight (intervention group) and were controlled by 40 women who did not undergo weight loss before pregnancy (control group).Cases having pregestational diabetes, major chronic illnesses, corticosteroid therapy or lactating during 6 months weight loss program, failed pregnancy or failed to loss at least 10% of body weight (in intervention group) were excluded. Detailed history and complete physical examination were performed and informed consent was obtained from all women.

The weight loss program for women in intervention group was based on a balanced low calorie diet with regular aerobic physical exercise for minimum 150 minutes per week. Basal energy expenditure based on the Harris-Benedict equation that was used to calculate basal metabolic rate. Based on the initial estimate of caloric needs, diets were individualized to achieve a 500 kcal/woman/day deficit. High-fibre, low-glycemic-index diets with 55% carbohydrates, 25% fat and 20% proteins of total kilocalories were prescribed. Compliance was assessed by weekly follow up, monthly food frequency questionnaire, 24 hour recalls and a dietitian discussed problems with the participants to ensure adherence of the diet regimen (Shalileh *et al*, 2010).

Body weights and heights as well as GDM documentations in the index pregnancies were obtained from the medical records in the participating centers. All women in both groups were checked for BMI in subsequent pregnancy prior to each screening test for GDM. Body weights were measured on a digital scale with height rod balance (6439, Detecto, USA). Weight was measured to the nearest kilogram and height to the nearest centimeter. BMI was calculated as weight in kg/height in squared meters (kg/m²).

Fifty g, 1-hr GCT screening test for GDM was performed twice, first for all women in the intervention group before weight loss program and at first antenatal visit of women in control group that was in first trimester to exclude pregestational or type 2 diabetes and second time at 24-28 weeks of gestation. Women with plasma glucose values ≥ 140 mg/dl on the screening test went on to receive a diagnostic 100-g, 3-hr GTT. GDM was defined according to the American Diabetes Association (ADA) with plasma glucose thresholds for the diagnostic test, two or more values meeting or exceeding the following cut points: fasting 95 mg/dl; 1-hour 180 mg/dl; 2-hour 155 mg/dl; 3-hour 140 mg/dl (Ehrlich *et al*, 2012). All plasma glucose measurements were performed using the hexokinase method.

Statistical testing was conducted with the statistical package for the social science system version SPSS 17.0.Continuous variables are presented as mean ± SD, and categorical variables are presented as absolute numbers and percentage. The comparison of continuous variables between the groups was performed using Student's t test. Nominal categorical data between the groups were compared using Chi-squared test or Fisher's exact test as appropriate. We used logistic regression models to generate adjusted odds ratios and their 95% confidence intervals. Statistical significance was considered achieved when P value was less than 0.05.

Results:

77 women were enrolled in this study, 37 women in intervention group and 40 women in the control group. 7 women in intervention group were excluded from study, 3 women for failures of target weight loss and follow up and 4 women for fetal loss before time of second screening test for GDM. Thus 30 women in intervention group had fulfilled the inclusion criteria of weight loss and had successful pregnancy at time of second screening test.

Table 1 and figure 1 show that women in intervention group had a statistical significant (P<0.01) decrease of BMI in the second pregnancy and more weight loss prior to second pregnancy compared to women in the control group. There were no significant differences between both groups regarding other basic characteristics such as maternal age, BMI in the index pregnancy, weight gain in the second pregnancy (until time of second screening test), interval between two pregnancies, family history of diabetes, parity and contraceptive method used prior to the second pregnancy.

Table 2 and figure 2 reveal that Women in the intervention group showed a highly significant (P<0.01) lower rate of recurrence of GDM in the second pregnancy compared to women in the control group (26.6% vs 60%, Relative risk (RR)= 0.44, 95% confidence interval (CI)= 0.23-0.84, Odds ratio (OR) = 0.24, 95% CI = 0.08-0.67).

Discussion:

Results of this study indicate that prepregnancy weight loss by at least 10% of body weight in overweight and obese women with past history of GDM significantly reduces recurrence of GDM in subsequent pregnancy. Obesity is a significant risk factor for GDM and it is central to the development of insulin resistance causing hormonal imbalance of carbohydrate regulation mechanism and insulin sensitivity(Ford *et al*,1997) Increased insulin resistance may be relevant to the development of GDM in obese women(Catalano *et a*l, 2012). The second half of pregnancy is characterized by progressive insulin resistance, hyperinsulinemia, and mild postprandial hyperglycemia. Most women are able to compensate for this increased insulin resistant state by increasing their insulin secretion and thus maintain normal glucose tolerance. However, those overweight and obese women requiring the hypersecretion of insulin to compensate for pregnancy induced insulin resistance may experience β-cell exhaustion leading to development of GDM. Prepregnancy weight loss may improve insulin sensitivity as well as β-cell function and thus these women become better able to compensate for the increased insulin resistance during their subsequent pregnancy (Buchanan and Xiang 2005).Furthermore, weight loss improves beta-cell responsiveness to glucose and has been associated with an increase in insulin clearance and a reduction in proinsulinimmuno reactivity (Polonsky *et al*,1994).Callaway *et al*,2010 reported that a combined dietary and exercise intervention might have a stronger impact on insulin resistance, and subsequently on the prevention of GDM. This would be supported by Wolff *et a*l, 2008 study showing the success of a dietary intervention in reducing the deterioration in glucose metabolism in obese pregnant women.Tuomilehto *et a*l 2001 reported that lifestyle interventions in overweight women with weight reduction of 5% or more can reduce the risk of diabetes by 58% compared to control group.

Table 1: The basic characteristics of intervention group in comparison with control group.

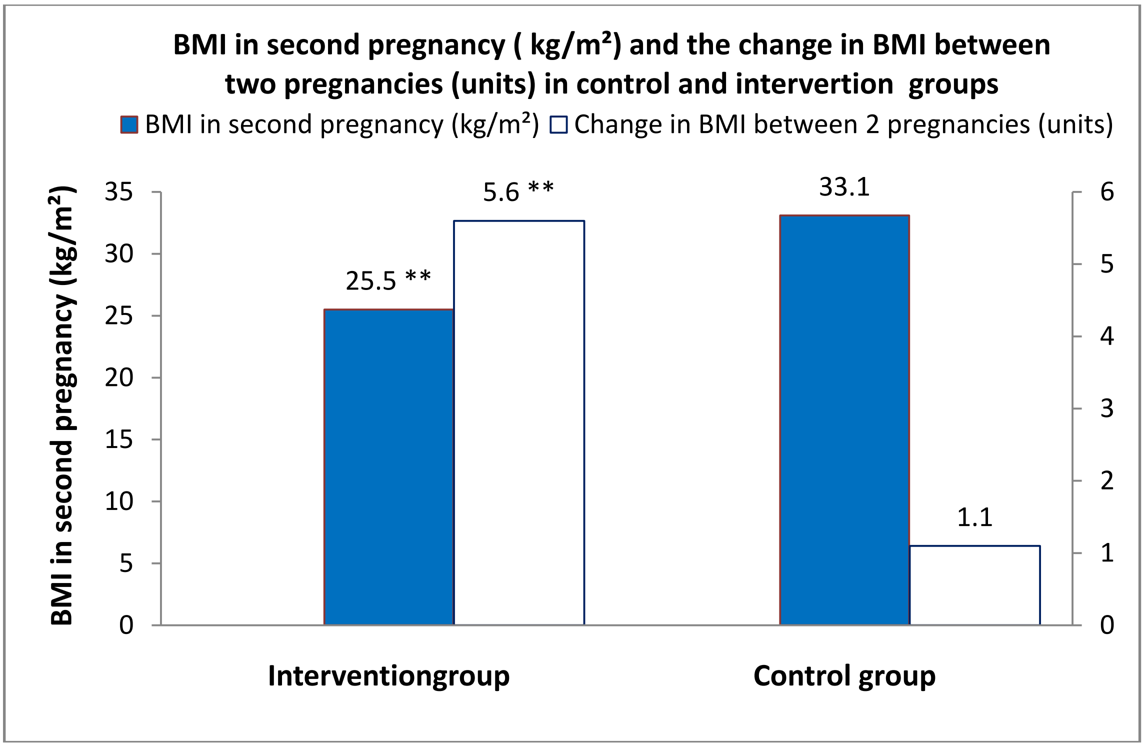
Characteristic	Intervention group n=30	Control group n=40	P value
Age at time of screening (years)	28.8 ± 3.2	29.3 ± 3.5	>0.05
BMI in index pregnancy (kg/m²)	32.3 ± 3.8	32.5 ± 4.1	>0.05
BMI in second pregnancy (kg/m²)	25.5 ± 2.7	33.1 ± 3.9	<0.01
Change in BMI between 2 pregnancies (units)	5.6 ± 1.7	1.1 ± 0.8	<0.01
Weight gain during pregnancy (kg)	7.2 ± 2.3	7.8 ± 2.6	>0.05
Interval between 2 pregnancies (months)	29.2 ± 11.3	28.5 ± 10.9	>0.05
Family history of diabetes	10 (33.3%)	14 (35%)	>0.05
Parity	1.5 ± 0.6	1.6 ± 0.8	>0.05
Contraceptive method between 2 pregnancies			
IUCD	16 (53.3%)	21 (52.5%)	>0.05
Minipills	5 (16.6%)	7 (17.5)	>0.05>0.
COCP	3 (10%)	4 (10%)	05
Depot injection	2 (6.6%)	2 (5%)	>0.05>0.
Norplant	2 (6.6%)	3 (7.5%)	05
Other	2 (6.6%)	3 (7.5%)	>0.05

Data are means ±SD or n (%). BMI= body mass index, IUCD= intrauterine contraceptive device, COCP= combined oral contraceptive pills, NS= non significant=P > 0.05,P<0.01=highly significant.

Table 2: The recurrence of GDM in both intervention and control group.

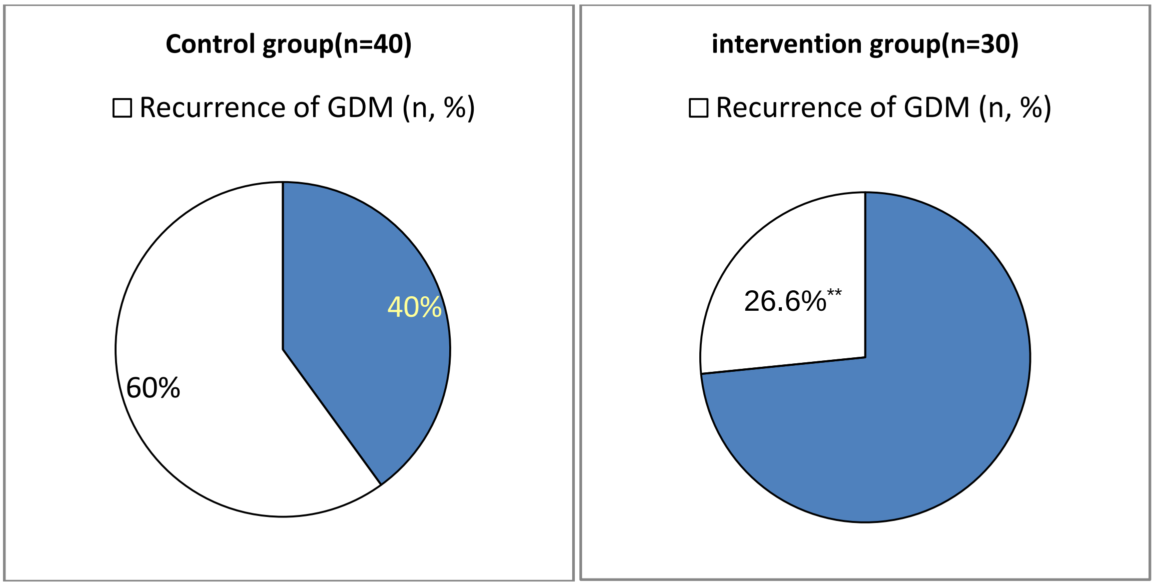
	Intervention group n= 30	Control group n= 40	P value
Recurrence of GDM (n, %)	8 (26.6%)	24 (60%)	<0.01**

n=number, ** = highly significant, P<0.01



** = highly significant(P<0.01)

Fig. 1: Represents the significant decrease in the mean of BMI in second pregnancy (kg/m²) of intervention group when compared with control group . Also the figure shows the change in BMI between two pregnancies in (units).



** = Highly significant, P<0.01

Fig. 2: Pie charts represent the statistically significant decrease in recurrence of GDM among intervention group when compared to control group.

Our results are also in accordance with Ehrlich *et al*, 2011 those conducted a retrospective cohort analysis of 22,351 women and reported that inter-pregnancy increases in BMI increase a woman's risk of GDM pregnancy. The loss of BMI units was associated with a lower risk of GDM only among women who were overweight or obese in the first pregnancy (OR= 0.26, 95% CI= 0.14-0.47) for the loss of more than 2.0 BMI units).Ehrlich's(Ehrlich *et al*, 2011) results also suggest that the effects of body mass gains may be greater among women of normal weight in their first pregnancy, while the effects of losses in body mass appear greater among overweight/obese women. Ehrlich *et al* 2011 results explained the featured protective effect of weight loss to GDM in overweight and obese women. Glazer *et al*,2004 reported that women who lost at least 10 lbs between pregnancies had a decreased risk of gestational diabetes relative to women whose weight changed by less than 10 lbs. Numerous studies showed that weight loss via bariatric surgery is associated with a decreased incidence of GDM in subsequent pregnancies (Guelinckx *et al*, 2009), (Maggard *et al*, 2008), (Burke *et al*, 2012) and (Hezelgrave and Oteng, 2011).

There were several limitations to this study. Lack of randomization was due to inability to enroll enough participants in control group and following them for at least 6 months before subsequent pregnancy contrary to women in intervention group who were motivated and encouraged by the expecting positive health effects and pregnancy outcomes resulting from weight loss. Another limitation was inability to follow up participants beyond 28 weeks of gestation. However we tried to avoid the possible bias by checking the medical records of all women after their deliveries. The relatively small sample population of the study was another limitation that interfered with more precise quantification of weight loss effect regarding to optimum degree of weight loss on prevention of GDM recurrence. Randomized clinical trials on larger population for more accurate addressing the weight loss effect on prevention GDM are warranted.

Conclusion:

Weight loss before pregnancy can reduce the recurrence of GDM in overweight and obese women. Therefore both overweight and obese women with past history of GDM should be recommended by all health care providers for weight loss before subsequent pregnancy in order to improve both maternal and perinatal outcomes of subsequent pregnancy.

References

Buchanan, T.A., A.H. Xiang, 2005. Gestational diabetes mellitus. J Clin Invest., 115(3): 485-491.

Burke, A.E, W.L. Bennett, R.M. Jamshidi, M.M. Gilson, J.M. Clark, J.B. Segal, A.D. Shore, T.H. Magnuson, F .Dominici, A.W .Wu, M.A. Makary, 2010. Reduced incidence of gestational diabetes with bariatric surgery. J Am Coll Surg., 211(2): 169-75.

Callaway, L.K., P.B. Colditz, N.M. Byrne, B.E. Lingwood, I.J. Rowlands, K. Foxcroft, H.D. McIntyre, BAMBINO Group, 2010. Prevention of gestational diabetes: feasibility issues for an exercise intervention in obese pregnant women.Diabetes Care., 33(7): 1457-9.

Catalano, P.M., H.D. McIntyre, J.K. Cruickshank et al., 2012. Study Cooperative Research Group. The hyperglycemia and adverse pregnancy outcome study: associations of GDM and obesity with pregnancy outcomes. Diabetes Care., 35(4): 780-6.

Chu, S.Y., W.M. Callaghan, S.Y. Kim, C.H. Schmid, J. Lau, L.J. England, P.M. Dietz, 2007. "Maternal Obesity and Risk of Gestational Diabetes Mellitus". Diabetes Care, 30(8): 2070-2076.

Ehrlich, S.F., M.M. Hedderson, J. Feng, E.R Davenport, E.P. Gunderson, A. Ferrara, 2011. Change in body mass index between pregnancies and the risk of gestational diabetes in a second pregnancy. Obstet Gynecol., 117(6): 1323-30.

Flegal, K.M., M.D. Carroll, C.L. Ogden, L.R. Curtin, 2010. Prevalence and trends in obesity among US adults, 1999-2008. JAMA; 303: 235-241

Ford, E.S., D.F .Williamson, S. Liu,1997. Weight change and diabetes incidence: findings from a national cohort of US adults. Am J Epidemiol., 146: 214-222.

Getahun, D., M.J. Fassett, S.J. Jacobsen, 2010. Gestational diabetes: risk of recurrence in subsequent pregnancies. Am J Obstet Gynecol., 203(5): 467.e1-6.

Glazer, N.L., A.F. Hendrickson, G.D. Schellenbaum, B.A. Mueller, 2004. Weight change and the risk of gestational diabetes in obese women. Epidemiology, 15(6): 733-737.

Guelinckx, I., R. Devlieger, G .Vansant, 2009. Reproductive outcome after bariatric surgery: a critical review. Hum Reprod Update., 15: 189-201.

Hezelgrave, N.L., E .Oteng-Ntim, 2011. Pregnancy after Bariatric Surgery: A review.J Obes., 2011: 5.

Institute of Medicine, National Research Council, 2009. Weight gain during pregnancy, re-examining the guidelines. In: Rasmussen KM, Yaktine AL, eds. Washington, DC; The National Academy Press., pp: 1-13.

Kim, C., D.K., Berger, S .Chamany, 2007. Recurrence of gestational diabetes: a systematic review. Diabetes Care, 30: 1314-1393.

MacNeill, S., L. Dodds, D.C. Hamilton, B.A. Armson, Vanden Hof M., 2001. Rates and risk factors for recurrence of gestational diabetes. Diabetes Care., 24(4): 659-662.

Maggard, M.A., I. Yermilov, Z. Li, M. Maglione, S .Newberry, M. Suttorp, et al, 2008. Pregnancy and fertility following bariatric surgery: a systematic review. JAMA; 300: 2286-2296.

Metzger, B.E., 2007. Long-term outcomes in mothers diagnosed with gestational diabetes mellitus and their offspring. ClinObstet Gynecol., 50(4): 972-979.

National Diabetes Information. Clearinghouse (NDIC). http://diabetes.niddk.nih.gov/DM/PUBS/statistics/#Gestational. 2011.

O'Sullivan, J.B., 1991. Diabetes mellitus after GDM. Diabetes., 40(2): 131-135.

Oteng-Ntim, E., R. Varma, H. Croker, L. Poston, P. Doyle, 2012. Lifestyle interventions for overweight and obese pregnant women to improve pregnancy outcome: systematic review and meta-analysis. BMC Medicine, 10: 47.

Polonsky, K., B. Gumbiner, D. Ostrega, K. Griver, H. Tager, R. Henry, 1994. Alterations in immunoreaciveproinsulin and insulin clearance induced by weight loss in NIDDM. Diabetes., 43: 871-877.

Shalileh, M., F. Shidfar, H. Haghani, S. Eghtesadi, I .Heydari, 2010. The influence of calcium supplement on body composition, weight loss and insulin resistance in obese adults receiving low calorie diet. J Res Med Sci., 15(4): 191-201.

Silverman, B.L., B.E. Metzger, N.H. Cho, C.A. Loeb, 1995. Impaired glucose tolerance in adolescent offspring of diabetic mothers: relationship to fetal hyperinsulinism. Diabetes Care., 18: 611-617.

Tuomilehto, J., J. Lindstrom, J.G. Eriksson, et al, 2001. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. N Engl J Med., 344: 1343-1350.

Wolff, S., J. Legarth, K. Vangsgaard, S. Toubro, A. Astrup, 2008. A randomized trial of the effects of dietary counseling on gestational weight gain and glucose metabolism in obese pregnant women. Int J Obes (Lond); 32: 495-501.