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Serum Fructosamine in Pregnancy

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Abstract

Introduction: *American College of Obstetricians and Gynecologists (ACOG) and American Diabetes Association (ADA) recommend 2 step testing for diagnosis of Gestational Diabetes Mellitus (GDM). The process is cumbersome and inconvenient. Hemoglobin A1C (HbA1c) levels are adopted as a screening test in non-pregnant adults, but not during pregnancy. Alternatively, serum fructosamine is not tested for diagnosis of Diabetes Mellitus in any population. We are in the process of examining utility of serum fructosamine as a screening test for diagnosis of Gestational Diabetes Mellitus (GDM). However, no data is available regarding fructosamine concentrations in non-diabetic pregnant women. Therefore, we determined serum fructosamine levels in pregnant non-diabetic women at 24 to 28 weeks at the time of 1 hour or 3-hour oral glucose tolerance tests (OGTT).*

Subjects and Methods: *Random plasma glucose (mg/dl), serum fructosamine (mM/l) and HbA1c (%) were determined at 24-30 weeks in 200 pregnant women, age 24-40 years, in whom the diagnosis of GDM was eliminated by either normal 1 hour (OGTT) or by normal 3-hour OGTT in presence of abnormal 1-hour OGTT according to criteria established by ACOG and ADA. 25 age matched non-pregnant women participated as controls. Normal reference ranges for all determinations were established by the local laboratory (Random plasma glucose, 65-140; Serum fructosamine, 200-285; HbA1c, 4.8-5.6). Statistical comparisons between 2 groups were conducted using Student's 't' test.*

Results: *Serum fructosamine levels (182 ± 4) were significantly lower ($p< 0.01$) in non-diabetic pregnant women when compared with age matched non-pregnant women (224 ± 5). Cutoff fructosamine between groups was 198. Random plasma glucose (96 ±7) and HbA1c (5.1 ± 0.2) were not significantly different amongst groups.*

Conclusion: *In non-diabetic pregnant women, serum fructosamine concentrations are subnormal whereas random plasma glucose and HbA1c levels remain within normal range noted in age matched non-pregnant women. Further studies are underway to assess the utility of serum fructosamine as a screening test in diagnosis of GDM.*

Keywords: Fructosamine, Gestational Diabetes, Pregnancy, Glucose

Abbreviations

ACOG: American College of Obstetricians and Gynecologists
ADA: American Diabetes Association
DM: Diabetes Mellitus
GDM: Gestational Diabetes Mellitus
HbA1c: Hemoglobin A1c
OGTT: Oral Glucose Tolerance Tests
hCG: Human Chorionic Gonadotropin
IRB: Institutional Review Board

Introduction

American College of Obstetricians and Gynecologists (ACOG) and American Diabetes Association (ADA) recommend 2 step testing for diagnosis of Gestational Diabetes Mellitus (GDM) [1, 2]. The process is often cumbersome and inconvenient. Hemoglobin A1C (HbA1c) levels are adopted as a screening test in non-pregnant adults but not during pregnancy [3]. Alternatively, serum fructosamine is not tested for diagnosis of Diabetes mellitus (DM) in any population. We are in the process of examining utility of serum fructosamine as a screening test for diagnosis of GDM. However, no data is available regarding fructosamine concentrations in non-diabetic pregnant women. Therefore, we

determined serum fructosamine levels in pregnant women at 24 to 30 weeks at the time of 1 hour or 3-hour oral glucose tolerance tests (OGTT).

Methodology

The study was exempt from Institutional review board (IRB) because of the de-identification of the subjects and biospecimens, along with no communication or interpersonal contact with subjects [4]. Inclusion criteria or the specific characteristics of persons in the study included women age 18 years or older, weight of at least 110 pounds and generally healthy i.e. free from infections, no symptoms of heart conditions etc. Exclusion criteria included no history of diagnosis of Type 1 or Type 2 diabetes mellitus or GDM and not on any class of medications or have comorbidities that affect blood sugar. Fraction from the blood withdrawn at the time of 1 hour or 3-hour OGTT for screening for GDM was utilized for determination of HbA1c and serum fructosamine levels [5]. Random plasma glucose (mg/dl), serum fructosamine (mM/L) and whole blood HbA1c (%) were determined at 24-30 weeks in 200 pregnant women, age 24-40 years. The diagnosis of GDM was eliminated by either normal 1-hour OGTT or by normal 3-hour OGTT in presence of abnormal 1-hour OGTT according to criteria established by ACOG and ADA [1, 2]. 25 age matched non-pregnant women participated as controls. Normal reference ranges for all determinations were established by the local laboratory (Random plasma glucose, 65-140; serum fructosamine, 200-285; HbA1c, 4.8-5.6). Statistical comparisons between 2 groups were conducted using Student's 't' test.

Results

Serum fructosamine levels were significantly lower in non-diabetic pregnant women when compared with age matched non-pregnant women (Table 1). Cutoff fructosamine between groups was 198mM/L. Random plasma glucose and HbA1c were not significantly different amongst groups (Table 1). Mean ages were not statistically different amongst the two groups of women as well (Table 1). Finally, subnormal serum fructosamine concentrations in five pregnant non-diabetic women returned to normal levels postpartum (Table 2)

Table 1: Serum fructosamine, HbA1c and random or fasting plasma glucose concentrations in pregnant women without GDM as documented by either normal 1 hour OGTT or normal 3 hour OGTT despite abnormal 1 hour OGTT and age matched non-pregnant cohort.

	Age	Fructosamine 200-285 Mcmol/L	A1C 4.8-5.6%	Random Glucose 65-140 mg/dl
Non-Pregnant	32	224 ± 5	5.1 ± 0.1	84 ± 4
Pregnant NO GDM	29	182 ± 4*	5.1 ± 0.2	96 ± 7

***p < 0.01 vs non-pregnant age matched women**

Table 2: Serum fructosamine concentrations in five pregnant non-diabetic women at 24 weeks and 6 weeks postpartum

	Non-Pregnant	Pregnant	Postpartum
Mean SEM	224 ± 5	190 ± 5	230 ± 12
Range	200-285	180 -199	200-285

***p < 0.01 vs non-pregnant and postpartum**

Discussion

In non-diabetic pregnant women, serum fructosamine concentrations are subnormal whereas random plasma glucose and HbA1c levels remain within normal range noted in age matched non-pregnant women. Moreover, these subnormal fructosamine concentrations appear to normalize postpartum. The exact mechanism for subnormal fructosamine concentrations in non-diabetic pregnant women is unclear. Hemodilution, secondary to enlarging blood volume during pregnancy, is unlikely since HbA1c remained unaltered. Inhibition of glycation by antioxidants, including vitamin E present in 'prenatal' supplements, has been previously documented in subjects with type 2 diabetes [4]. However, this mechanism is unlikely in non-diabetic pregnant women since HbA1c concentrations were not reduced as previously reported [4]. Alternatively, inhibition of glycation of proteins may have attributed to rising human chorionic gonadotropin (hCG) and/or estrogen or unknown placental humoral factors. However, pathophysiology of decline in serum fructosamine levels in non-diabetic pregnant women remains undefined. Therefore, because of the distinct differences in serum fructosamine levels between non-diabetic pregnant women and non-pregnant age matched cohort, a further study is underway to assess the utility of serum fructosamine as a screening test in diagnosis of GDM.

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