

Variation of Glucose Concentration During Different Phases of Menstrual Cycle

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ABSTRACT:

BACKGROUND:

A woman's menstrual cycle (and accompanying hormonal changes) can cause variations in blood glucose levels. Many women may note an increase in their blood glucose after ovulation, which then decreases once menstruation starts. These changes are caused by the hormones estrogen and progesterone, which occur at higher levels before period. They influence insulin in causing blood glucose to rise. It is important to test blood glucose levels during this cycle to be certain that blood sugar variations are attributed to menstruation.

OBJECTIVE:

To study the effect of sex hormones (testosterone, estradiol and progesterone) on the level of glucose; as well as it may shed light on suitable dose of diabetic treatment during different phases of menstrual cycle.

SUBJECTS & METHODS:

This study included 50 healthy female with regular menstrual cycle aged 25-40 years (control group) and 25 diabetic type2 (well controlled) female with regular menstrual cycle aged 30-40 years. Serum fasting glucose and sex hormones (testosterone, progesterone and estradiol) were evaluated in these two groups of patients and controls during follicular and luteal phases of sexual cycle. Colorimetric method was used in the serum glucose concentration determination, Enzyme Linked Immune Sorbent assay (ELISA) was used in the determining sex hormones level.

RESULTS:

The results of the present revealed significant increase in mean (+SD) values of serum glucose ($p < 0.05$) and serum progesterone levels ($p < 0.05$) with significant decrease of serum estradiol mean (+SD) values ($p < 0.01$) in luteal phase than follicular phase of menstrual cycle of healthy women.

Similar findings were found in diabetic women who have regular menstrual cycle .Serum glucose and serum progesterone showed significant increase ,while serum estradiol showed significant decrease in the luteal phase compared with follicular phase .

No significant difference was found serum testosterone level in the above studied groups between the phases.

It was found that 22% of healthy women with regular menstrual cycle showed elevation in their serum glucose concentration during the luteal phase of their sexual cycle.

CONCLUSION:

The study revealed that blood glucose level changes along the period of menstrual cycle , due to the interaction between the hormones that control menstruation (estrogen and progesterone) and the insulin hormone .

KEY WORDS: glucose, menstrual cycle, progesterone, female sex hormone, diabetic type 2

INTRODUCTION:

It is common for women with diabetes to have difficulty with blood glucose control during the week prior to their menstrual period, with glucose levels being either higher or lower than usual. This problem seems to be more prevalent in women who say they suffer from the symptoms associated with premenstrual syndrome (PMS) ^(1,2).

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During the first half of each cycle, levels of estrogen and progesterone hormones are relatively low. During the second part of the cycle, after ovulation, these hormone levels increase, causing the lining of the uterus to thicken in preparation for nourishing a fertilized egg. If fertilization does not happen, the ovary stops making these two hormones, and their sudden loss causes the uterus to shed the lining that is not needed; this shedding is known as menstruation ⁽³⁾.

A woman's glucose levels are controlled by certain hormones, just as hormones regulate the menstrual cycle. Indeed, the interference between certain hormones can lead to irregular bloods sugar levels. For women with both type 1 diabetes as well as those with type 2 diabetes, fluctuations in blood glucose levels that are associated with menstruation can be a cause for concern ⁽⁴⁾. Most commonly, women with diabetes will experience a rise in blood glucose levels the week prior to menstruation, just after ovulation. Once a woman's period begins, her blood sugar levels will tend to drop. This fluctuation is caused by a rise in estrogen and progesterone levels, which interfere with insulin activity ⁽⁵⁾.

Many studies ^(6,7) recommended that women with diabetes monitor changes resulting from menstruation the same way they would monitor blood glucose levels. In order to find a correlation between menstruation and diabetes, make a note of the onset of your period in your blood glucose record book, and watch for any emerging patterns between glucose levels and the menstrual cycle over time.

Women with diabetes should already be keeping a record book as part of a standard diabetes management. Women with type 1 diabetes (who should be recording glucose levels at least four times a day) will tend to experience the most fluctuations in the fasting blood glucose measured before breakfast just prior to the onset of menstruation ⁽⁸⁾.

Subjects and methods:

This study was conducted at Teaching Baghdad Hospital, outpatient clinic of internal medicine . All biochemical measurement was carried out at Teaching Baghdad laboratories in / Teaching Baghdad Hospital 2009.

A total of 75 women with regular menstrual cycles were involved in this study, 50 of them are healthy female with regular menstrual cycle aged 25-40 years (control group) with mean age (\pm SD) (37 ± 3.1) years ,the remainder are diabetic type2 (well controlled) female with regular menstrual cycle aged 30-40 years with mean age (\pm SD) (35 ± 4.5) years.

Venous blood (5 ml) was collected during the follicular phase (5-11 days of menstrual cycle) and the luteal phase of the cycle (19-28 days of menstrual cycle).

Serum glucose concentration , serum estradiol, progesterone and testosterone are measured for these two studied groups during follicular and luteal phase of the cycle.

Colorimetric technique was used for glucose measurement, enzyme linked immune sorbent assay technique (ELISA) for measurement of studied hormones.

Student t-test was used in the studying the difference between studies phases, percentage of healthy female with regular menstrual cycle whom showed increasing level of glucose during luteal phase also studied.

RESULTS:

The change in glucose levels in healthy & diabetic type2 female with regular menstrual cycle which is attendant with changes in studied female sex hormones (estradiol , progesterone and testosterone) are illustrated throughout the following results

The mean (\pm SD) of serum glucose, estradiol, progesterone and testosterone concentration are illustrated in table1

Table 1: Mean (\pm SD) of the studied hormones (serum estradiol , serum progesterone &serum testosterone) and glucose level in healthy female with regular menstrual cycle

	On follicular phase (5-11 days of menstrual cycle)	On luteal phase (19-28 days of menstrual cycle)
Serum glucose mg/dl	90 \pm 22	110 \pm 35*
Serum estradiol pg/ml	300 \pm 65	100 \pm 30**
Serum progesterone ng/ml	0.77 \pm 0.2	26 \pm 3.2**
Serum testosterone ng/ml	0.9 \pm 0.2	0.8 \pm 0.18^

** p<0.01 ,p<0.05, ^ not significant

Significant increase observed in glucose concentration of healthy female with regular menstrual cycle with (p <0.05), as well as significant

increase observed in progesterone concentration of healthy female with regular menstrual cycle with(p <0.001),while it was found significant decrease in

estradiol level($p < 0.01$) during the luteal phase in comparison with follicular phase of menstrual cycle. No significant difference was observed in serum testosterone concentration between the two studied phases of cycle. It was found that 22% of these 50 healthy female with regular menstrual cycle showed elevation in

serum glucose concentration (reference value 100 mg/dl) with mean 107 mg/dl during the luteal phase of menstrual cycle, while the reminders have normal glucose concentration during this period. Data in table 2 represent mean (\pm SD) of each of studied hormones estradiol , progesterone and testosterone as well as glucose level in diabetic women with regular menstrual cycle

Table 2: Mean (\pm SD) of the studied hormones (serum estradiol , serum progesterone & serum testosterone) and glucose level in diabetic type2 (well controlled)female with regular menstrual cycle

	On follicular phase (5-11 days of menstrual cycle)	On luteal phase (19-28 days of menstrual cycle)
Serum glucose mg/dl	130 \pm 25	150 \pm 40**
Serum estradiol pg/ml	230 \pm 50	95 \pm 15**
Serum progesterone ng/ml	0.5 \pm 0.3	20 \pm 2.9**
Serum testosterone ng/ml	1.2 \pm 0.3	1 \pm 0.2^

** $p < 0.01$, ^ not significant

Significant increase was observed in serum glucose concentration & progesterone concentration of diabetic type2 (well controlled) female with regular menstrual cycle with ($p < 0.01$), significant decrease in estradiol level ($p < 0.01$) during the luteal phase compared with follicular phase No significant difference was observed in serum testosterone concentration between two phases of menstrual cycle

DISCUSSION:

Women with diabetes frequently report problems with blood glucose control around the time of menstruation. This present study discusses the controversy effect of the menstrual cycle on metabolic control in women with type 2 diabetes. There are some common changes that can be observed in glucose levels during different phases of menstrual cycle in healthy and type 2 diabetes studied women as tables 1,2 show, healthy women showed that 22% of them have high levels of glucose during the luteal phase, while the rest have no significant change in either phases.; Probably may be related to the changes in female hormones (estrogen and progesterone) throughout the menstrual cycle⁽⁸⁾ . One theory is that increased levels of progesterone cause increased insulin resistance. in turn this leads to hyperglycemia , while the decrease of glucose concentration during follicular phase can be concerned to high estrogen causing increased insulin sensitivity⁽⁹⁾

the mechanism of these two hormonal action is not known till now.

The results of the present study is in agreement with other studies ^(11, 12) which reported that Many factors have been attributed to this phenomenon. These studies have reported elevated progesterone levels during premenstrual hyperglycemia and suggested that premenstrual symptoms may explain the unsatisfactory blood glucose control found during this period.

Other studies ^(13,14) which showed that it is possible that eating patterns change in the week before menstrual cycle and affect glucose levels; that women often have increased appetites and cravings during the days leading up to menstruation “ many women experience cravings for high-carbohydrate foods during the late luteal phase of their cycle”, However these studies suggest that this cannot be the sole cause of premenstrual hyperglycemia.

Many studies^(15,16) found that progesterone is thought to be the main culprit in decreased insulin sensitivity during the luteal, or post-ovulation, phase, it’s not completely understood . The hormone progesterone plays a vital role in controlling blood sugar levels. One of the many functions of progesterone is blood sugar regulation in all vertebrates. If the level becomes either too high or too low, loss of consciousness occurs, followed by death. Blood sugar imbalances are an increasingly common problem and in some measure can be laid at the door of hormone imbalances.

The other theory reported that the variation in insulin sensitivity over the menstrual cycle was minimal and probably associated with psychological stress^(17,19) and have correlated psychological stress, presented as constituting part of the premenstrual syndrome in some diabetic women, with poor metabolic control including diabetic ketoacidosis (and hypoglycemia during this period. These investigators even suggested that treatment of the premenstrual syndrome may mitigate any menstrual cycle-related effects, improving insulin sensitivity and blood glucose control

The study is disagreement with other study^(18,20) which compared 10 male and 20 female type 1 diabetes patients, using diaries in which variations in insulin dose were recorded. These investigators failed to detect any statistically significant difference in insulin sensitivity related to gender or to the phases of the menstrual cycle. Moreover, they suggested that changes in metabolic control during the menstrual cycle are probably attributable to Metabolic Control.

CONCLUSION:

The study revealed that blood glucose level changes along the period of menstrual cycle, due to the interaction between the hormones that control menstruation (estrogen and progesterone) and the insulin hormone.

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