

A study about the relationship between adiponectin of the serum with blood pressure and body mass index in the pregnant women

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ABSTRACT

Adiponectin is a adipocytokines that it secretes of Adipose tissue and regulate glucose, lipid metabolism and vascular function. This protein is related Inversely with cardiovascular risk factors like blood pressure. Cardiovascular disease, have irreparable effects on individuals, including pregnant women. Blood pressure, is a major cause of maternal death in brain and heart's different incidents. In developed countries, 16% of maternal deaths is related to blood pressure abnormalities. Of course 50% of these women can survive with intensive care. The most common cardiovascular disease during pregnancy, is hypertension that can endanger mother and Embryo life , so this research focus will be on this topic. This clinical test did on 110 pregnant women including two groups. 63 patients did with high blood pressure and 47 women did controls group with normal blood pressure . Groups were in terms of the same age range (18-35 years) and time of sampling (late third quarter, near the end of pregnancy and between 10-13 Am). Their blood pressure were measured with Barometer apparatus and their serum adiponectin levels were measured with by adiponectin ELISA kit. Also measured their BMI. Investigation showed that adiponectin levels are associated inversely with blood pressure during pregnancy. Presumably Deficiency of Adiponectin in pregnant women with high blood pressure, prevent to increase blood volume. So during the adaptive process, increase vascular spasms and vascular resistance that is responsible for high blood pressure and arterial vascular injury.

Key words: adiponectin, hypertension, pregnant women

INTRODUCTION

One of the important problems of the developed and developing countries is fat disease, that often increase the Hypertension disease (1). The chorionic villus cause vascular spasm and high blood pressure in some pregnant women. General edema, Proteinuria, or both of them are being associated with the high blood pressure, that is appeared or intensified by the pregnancy. The most common of the blood pressure is Preeclampsia and chronic Hypertension in these periods (2,3). The blood pressure is one of the important reasons in death of the mothers from the different brain and heart incidents (4). Adiponectin has the anticoagulant and antioxidant effects, because of having the anti- atherogenic features like the inhibition of the expression of the vascular cell adhesion molecules in the vascular endothelial cells (5), and prevents from the growth factors, that they are effective in increasing and migration of the cells of the vascular smooth muscle cells (6,7). According to the present information, the relationship between Adiponectin with the gestational diabetes and the coronary diseases has been proved (8). So,

Adiponectin can be a drug target for curing of metabolic, vascular and dyslipidemia diseases (8,9) and it can also inhibit the connection of the Monocytes to the vascular endothelial cells(10). Since the Cardiovascular diseases in the pregnant women endanger the life of mother and its fetus, it is necessary to reduce the mentioned effects by using the therapeutic effect of Adiponectin, if there is a relationship between the amount of Adiponectin and Cardiovascular diseases in the pregnant women. Adiponectin plays an important role in creating biological activities. The level of this Protein is in fat people lower than the thin (11) (including pathophysiology of the pregnant women ones, and its plasma concentration has an inverse relation with the Body Weight especially visceral fat(12)). The increase of the HDL-C serum is a protective index from the Cardiovascular diseases (13). Also the little amount of Adiponectin and Lipoprotein with a high density represent a risk factor for Cardiovascular (14). Adiponectin can effect on the heart cells and on one hand causes AMPK (Adenosine mono-phosphate Kinase) to be active, that its result can be the reduction of Hypertension and Apoptosis, and on the other hand can cause to production Prostaglandin E2 (15). There is a lot of improvements in knowing Pathogenesis and care of this disease these days, and the amount of the death of the mothers with the improvement of the care of the pregnancy period has decreased (2, 16). One of the risk factors is Body Mass Index more than 26 (2,81 times), that has a relationship with the increase of the risk of Preeclampsia. BMI<19,8 is a protective factor against the spread of Preeclampsia (17,18).

MATERIALS AND METHODS

This study was done in 2009-2010 as a Case – Control in the laboratories of the Sabalan and Alavi hospitals in Ardabil (Ardabil, Iran). The 63-person group was chosen among the women that the professional Women's – maternity diagnosed them as patient, who they were between 18-35 years old and also suffering from high blood pressure (equal or more than 140/90 Mm Hg), that referred to the Sabalan and Alavi hospitals in Ardabil during their pregnancy. The controlling group was chosen accidentally among the healthy women, who they were between 18-35 years old. Both groups were in the same situations from some points of view for example the age range, the time of blood sampling (late third trimester of pregnancy, the ninth month and near to their childbirth and before the noon (PM) between 10 in the morning and 13). The mentioned persons took part in our study by the acceptance of the condition of the study and the blood sampling. The controlling group (observers) was assimilated the patient group one by one from the age point of view, and then they were chosen after their agreement with entering to the study. In this study, more than 120 pregnant women were examined with the third trimester age pregnancy, that 110 people were examined in this study and statistical analysis after that we omitted the inappropriate and useless cases from the lack of the questionnaire information, or inappropriate blood serum, or not acceptable result of the test of the Adiponectin measurement because of the lab error. The study was on the amount of Adiponectin, the amount of the blood pressure and also BMI of these people. For this purpose, some questionnaires were set up, and were completed by the patients with the mentioned content. The amount of Systolic blood pressure and Diastolic blood pressure of these persons measured with the monometer. The weight and also the height of the examined people were examined according to the following formula for BMI calculation per Kg with the balance and meter:

$$\text{BMI} = \text{Weight(kg)} / [\text{Stature(m)}]^2$$

The venous blood samples of the patients and also the observers were collected of 5-2 cc, and we centrifuged them in 5-3 minutes in every 2500 round per minutes after the cause of clot, and then we separated the serum with the sampler, that had a disposable head. The serums were kept in "-20" degree Celsius. The concentration of serum's Adiponectin of the patient and controlling group were measured by ELISA kit of the human Adiponectin (Netherlands). According to the nature of the studied parameters, the examination of the differences in the average between the studied groups and also the relationship between the parameters was done by the t-test examines and (X2) Chi-Squared. In this regard we used the SPSS (Version 16 & 18) software. The aims of this study is "To determine the amount of Adiponectin in the pregnancy with the high blood pressure, to determine the amount of Adiponectin in the healthy pregnant women, and to determine the relationship between the amount of Adiponectin with the high blood pressure disease in the pregnancy period" and its relationship with BMI.

Findings

To determine the amount of Adiponectin of the serum between the patient and healthy group: The results showed, there is such an important difference between the controlling and patient group in the possibility level ($P < 0.05$) from the amount of Adiponectin point of view, that the average of the amount of Adiponectin in the controlling group (80.5) was more than the patient one (73.5) (Diagram 1).

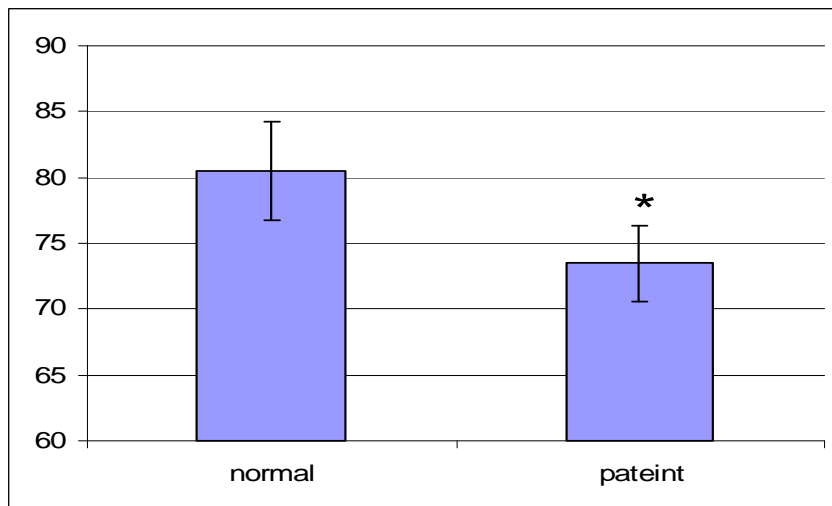


Diagram 1-The comparison of the average of the amount of Adiponectin for the two groups, the observer and the studied one ($P < 0.05^*$)

To determine the difference of Diastolic pressure between the healthy and patient groups: The examination have shown, there is such an important difference between the controlling and patient group in the possibility level ($P < 0.05$) from the amount of the Diastolic blood pressure point of view, that the people's Diastolic blood pressure with the 50 Mm Hg and with the 4.5% abundance is related to the patient group and the people's Diastolic blood pressure with the 110 Mm Hg and with the 5.5% is related to the observers.(Diagram 2)

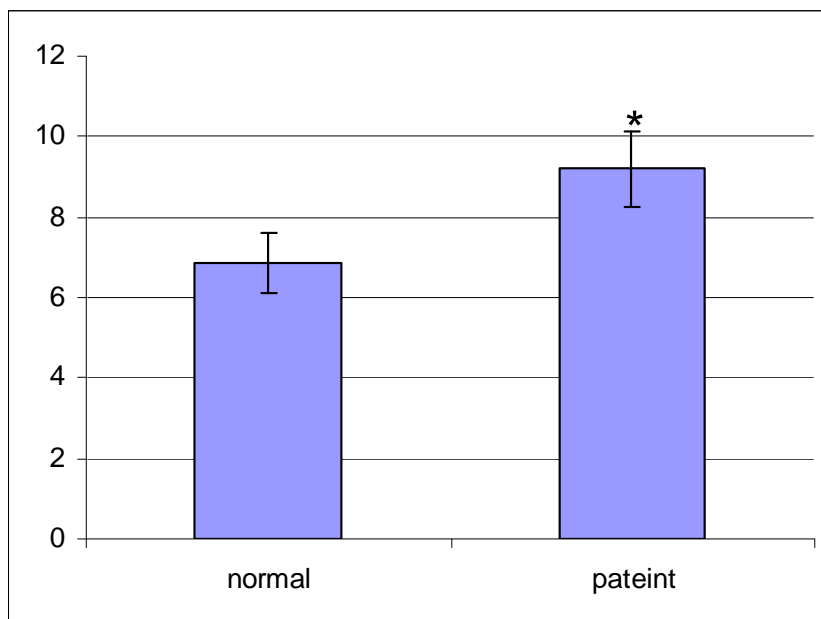


Diagram 2-The comparison of the average of the amount of Diastolic blood pressure for the two groups, the observer and the studied one

To determine the difference of Systolic pressure between the healthy and patient groups: The examination have shown, there is such an important difference between the controlling and patient group in the possibility level ($P < 0.05$) from the amount of the Systolic blood pressure point of view, that the comparison at the average of the information showed that the Systolic blood pressure was in the observer group more than the patient ones.(Diagram3)

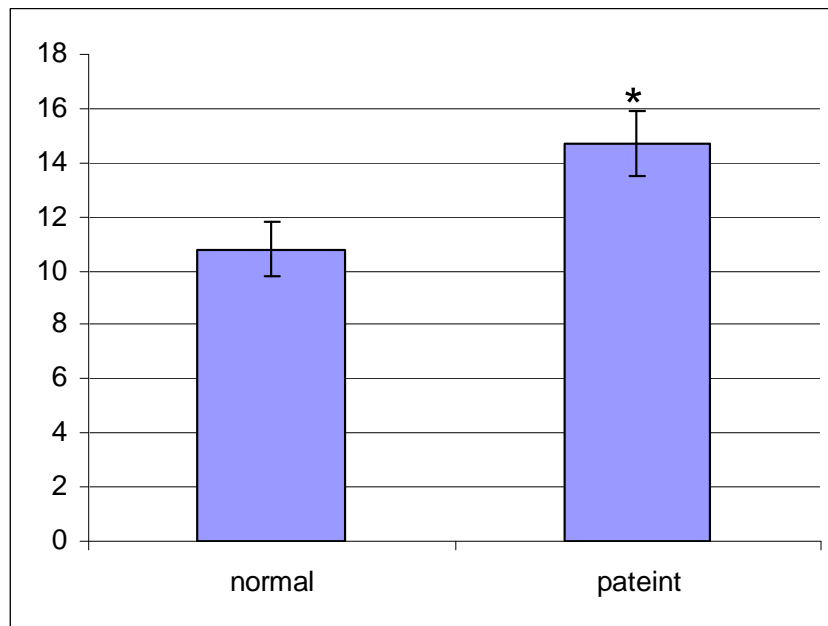


Diagram3-The comparison of the average of the amount of Systolic blood pressure for the two groups, the observer and the studied one ($P < 0.05^*$)

The relationship between Adiponectin with the Systolic and Diastolic blood pressure: The relationship between Adiponectin and Diastolic blood pressure is an inverse and significant relationship in the possibility level ($P < 0.05$). Also the relationship between Adiponectin and Systolic blood pressure is an inverse and significant relationship in the possibility level ($P < 0.05$), but there is a significant and direct relationship between Systolic and Diastolic blood pressure in the possibility level ($P < 0.01$).

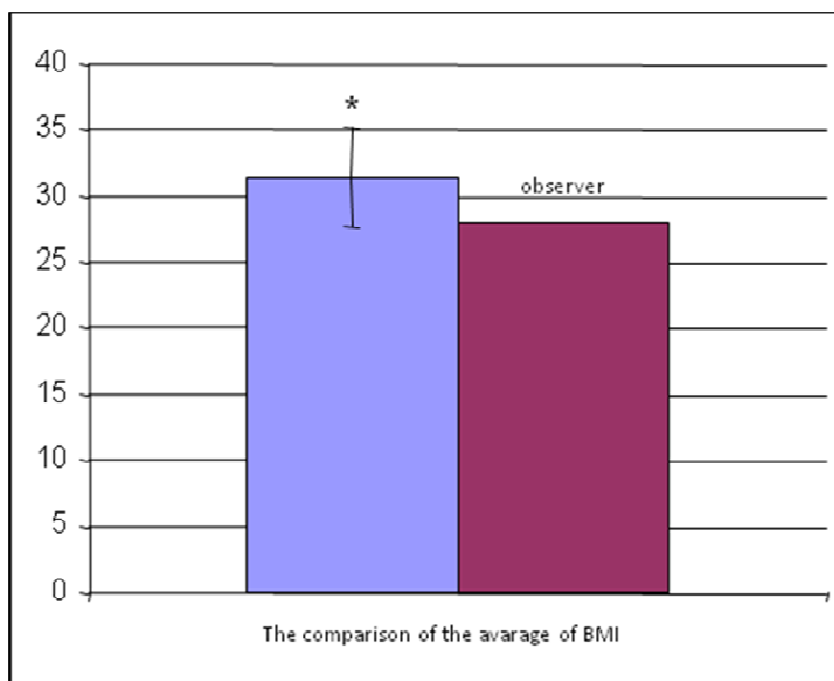


Diagram3-The comparison of the average of BMI for the two groups, the observers and the examined one

Chart 1-It was cleared in the two-way examination of Adiponectin and BMI, that the relationship of these 2 was an inverse and important in the level 0.01.

Correlations		Adiponectin	bmi
Adiponectin	Pearson Correlation	1	-.216**
	Sig. (2-tailed)		.903
	N	111	111
bmi	Pearson Correlation	-.216**	1
	Sig. (2-tailed)	.903	
	N	111	111

** . Correlation is significant at the 0.01 level (2-tailed).

Chart2-The two-way comparison between the amount of Adiponectin, Diastolic blood pressure and Systolic blood pressure ($P < 0.05^*$, $P < 0.01^{**}$).

The two-way comparison		Adiponectin	Diastolic blood pressure	Systolic blood pressure
Adiponectin	The two-way comparison of pearson	1	-.217*	-.207*
	number	110	110	110
Diastolic blood pressure	The two-way comparison of pearson	-.217*	1	.798**
	number	110	110	110
Systolic blood pressure	The two-way comparison of pearson	-.207*	.798**	1
	number	110	110	110

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

RESULTS AND DISCUSSION

We compared the variables of Adiponectin, Systolic blood pressure, Diastolic blood pressure, and BMI of both groups. The results showed that there is a significant relationship between these two groups from Adiponectin, Diastolic and Systolic blood pressure point of view, that is the amount of the average of Adiponectin in the healthy group was more than the patients, and Systolic and Diastolic blood pressure in the patients were more than the healthy ones. If the amount of Adiponectin is increased in healthy people, it shows that these persons can not have a Cardiovascular disease, because Adiponectin has a kind of relationship and solidarity with this variable, and if the amount of Adiponectin is decreased, it can cause the Cardiovascular diseases. The average of Adiponectin in the pregnant women with the high blood pressure (73.5) is much less than the healthy pregnant women (80.5). ($P < 0.05$)

Also the least and the most level of serum Adiponectin of the patients was less than the healthy people ($P < 0.05$). In 2009, according to the existent information, Broedl concluded that the relationship between Adiponectin and the coronary diseases has proved (8). Mazaki-Tovi understood in 2009 that this hormone plays an important role in causing biological activities including Pathophysiology of the pregnant women (11). In 2008, Qiao concluded in his researches about the relationship between Adiponectin and the Cardiovascular diseases that The amount of Adiponectin has an inverse relationship with the Cardiovascular risk factors like the blood pressure (19,20). In This study we have seen that the amount of Adiponectin of the serum of the healthy women is more than the specified range in the patients, and their Diastolic and Systolic blood pressure is more than the pregnant ones with the high blood pressure. So, if the amount of Adiponectin of the serum in the pregnant women decreases, it can be a risk factor for them for infection of some Cardiovascular diseases caused by the blood pressure. It means that the pregnant women with the high blood pressure can have the high blood pressure because the amount of Adiponectin of the blood serum was decreased. In this study we have 35 persons (55.55%) with the 140 mm Hg blood pressure with the most abundance, one with the 155 mm Hg (1.59%), and the other one with the 190 mm Hg with the least abundance from the Systolic blood pressure on the arrival. From the Diastolic blood pressure on arrival in the patients point of view, the most abundance was related to the blood pressure 90 mm Hg with the 47.62%. The average of Diastolic blood pressure of the observers was 68.51 mm Hg, and the average of Diastolic blood pressure of the patients was 91.95 mm Hg. Also the average of Systolic blood pressure of the observers was 108.40426 mm Hg, and the average of Systolic blood pressure of the patients was 147.73438 mm Hg. The result show that the amount of the blood pressure of the pregnant sick women can because of the reduction of Adiponectin and consequently cause of the vascular spasm. The amount of Systolic and Diastolic of the patients is more than the healthy people ($P < 0.05$). It is cleared With the comparison between the controlled and examined groups that The amount of Adiponectin of the serum is effective on Systolic and Diastolic blood pressure, and causes a significant difference in the possibility level ($P < 0.01$), which above the reason was mentioned. Perhaps the reduction of Adiponectin in the pregnant women with the high blood pressure prevents the increasing of the amount of their blood mass. As we know, according to the Scott's researchers in 1997 and Cuninghom in 2001, the amount of the blood mass in the healthy pregnant women increase more than the non-pregnant ones (21,2). Lack of the changes in the amount of the blood mass in the pregnant women with the high blood pressure can increase the vascular spasm and general contraction of arterioles in an adaptive process. So it increases the vascular resistance against the blood flow, and it can causes also the high arteriole blood pressure and vascular damage. On the other hand, Adiponectin

can make Protein Kinase A and AMPK active after the connection to its Receptors in the Endothelial membrane, that also these subjects produce Nitric Oxide finally by making a series of reactions in cell active(21, 4). According to the Ouedraogo's researchers in 2007, Nitric Oxide has the vasodilator feature. It seems that the reduction of Adiponectin in the pregnant women with the high blood pressure can cause the reduction of producing of Nitric Oxide, that in this case the blood vessels will be in a spasm mood, and finally the blood pressure increases (22). In 2008, Ness found out that BMI>27 is one of risk factors for preeclampsia(23). Also BMI<19.8 is guarding factor for preeclampsia(17) When we examined the relationship between the amount of Adiponectin of the serum and BMI in this study, it was cleared that the average of BMI in the pregnant women with the high blood pressure was significantly more than its average in the healthy pregnant women($P<0.05$). So, the reduction of the amount of Adiponectin of the serum, when the person is fat, can be a favorable factor for cardiovascular diseases like the high blood pressure. So the people with BMI higher than 27 can have the blood pressure during pregnancy, that in this study, the people assign 72.7 % in the patient group and the people with BMI between 19.8 and 27, 27.3%. Our researches have shown that the amount of Adiponectin of the serum with the Body Mass Index in the pregnant women has an inverse relationship with the blood pressure. That is if the amount of Body Mass Index increases, the amount of Adiponectin of the serum decreases and vice versa. Since Adiponectin plays an important role in adjusting the lipid metabolism, may be with its reduction we have the increase of synthesis of lipids and fatty acids, and the rest of it accumulate in the tissues, and because of need of the mother and fetus in the pregnancy period the weight of mothers increase, the amount of Adiponectin decreases. So it is possible to do an useful action by

controlling and also preventing the reduction of the amount of Adiponectin of the serum in controlling the weight especially during the pregnancy period.

Suggestions

The time of doing this research was from the 11th of 2009 to the 8th of 2010, but we have the most referrals of the pregnant women in the warm days and months of the year especially in Jun. and Aug. So, it seems that the temperature and even the type of climate can be effective on this disease. Then, it is suggested that the examination of the relationship of the mentioned factors with this disease can be the subject of the further studies. In the further researches we can study the determination of the relationship between Adiponectin and the Diabetes in the pregnant women, the determination of the relationship between Adiponectin and the Diabetes in the pregnant women with the high blood pressure, the determination of the amount of Adiponectin in the children, whom mothers have shown the lack of Adiponectin, also the determination of the amount of Adiponectin and the blood pressure in children, whom mothers have shown the lack of Adiponectin.

REFERENCES

- [1] Halberg N, Wernstedt-Asterholm I, Scherer PE, **2008**, *Endocrinol Metab Clin North Am*, 37(3):753-68.
- [2] Cuninghom F. G., Gant N. f, leveno K. J. et al, **2001**, Williams Obstetricsb and Gynecology, Newyork, Mc-Graw, Hyper Tensive disorders in pregnancy, page 597- 619, 21(th) edition.
- [3] Gyton A.C. and Hall J.E., *Medical Physiology*-vol 1., **2006**.
- [4] Cuninghom F. G., Gant N. f, leveno K. J. **2010**, Williams Obstetricsb and Gynecology, Newyork, mc- Graw, Hyper Tensive disorders in pregnancy, page 693-745, 1(th), Edition 7.8. Gyton A.C. and Hall J. E. Medical Physiology-vol 2, page 1623-24, **2006**
- [5] Ouchi N, Walsh K, **2007**, *Clin Chim Acta* 380(1-2):24-30
- [6] Shojaie M, Sotoodah A, Shafaie G, **2009**, *Lipids Health Dis*, 8:17
- [7] Samad F, Yamamoto K, Pandey M, Loskutoff DJ, **1997**, *Mol Med*, 3(1):37-48
- [8] Broedl UC, Leberherz C, Lehrke M, Stark R, Greif M, Becker A, von Ziegler F, Tittus J, Reiser M, Becker C, Göke B, Parhofer KG, Leber AW, **2009**, *PLoS One*, 4(3):e4733
- [9] Jin H, Meyer JM, Mudaliar S, Jeste DV, **2008**, *Schizophr Res*, 100(1-3):70-85
- [10] Teoh H, Quan A, Bang KW, Wang G, Lovren F, Vu V, Haitsma JJ, Szmitko PE, Al-Omran M, Wang CH, Gupta M, Peterson MD, Zhang H, Chan L, Freedman J, Sweeney G, Verma S, **2008**, *Physiol Endocrinol Metab*, 295(3):E658-64
- [11] Mazaki-Tovi S, Romero R, Vaisbuch E, Kusanovic JP, Erez O, Gotsch F, Chaiworapongsa T, Than NG, Kim SK, Nhan-Chang CL, Jodicke C, Pacora P, Yeo L, Dong Z, Yoon BH, Hassan SS, Mittal P, **2009**, *Perinat Med*, 37(4):349-63
- [12] Bryzgalova G, Lundholm L, Portwood N, Gustafsson JA, Khan A, Efendic S, Dahlman-Wright K., **2008**, *Physiol Endocrinol Metab*, 295(4):E904-12
- [13] Mosher MJ, Lange LA, Howard BV, Lee ET, Best LG, Fabsitz RR, Maccluer JW, North KE, **2008**, *Genes Nutr*, 3(2):87-97
- [14] Kadowaki T, Yamauchi T, Kubota N, Hara K, Ueki K, Tobe K, **2006**, *Clin Invest*, 116(7):1784-92
- [15] Laughlin GA, Barrett-Connor E, May S, Langenberg C, **2009**, *Epidemiol*, 165(2):164-74

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- [16] Cuninghom F. G., Gant N. f, Ikeno K. J. et al, **1997**, Williams Obstetrics and Gynecology, New York, McGraw-Hill, Hypertensive disorders in pregnancy, page 693-745, 20 (th) Edition.
- [17] Cond A- Agudelo Perinatal Researcher, Jose M. Belizan Director. *BJOG*. 107(1). 75- 83. **2000**
- [18] Lee CJ, Hsieh TT, Chiu TH, Chen KC, Lo LM, Hung TH, **2000**, *Gynaecol Obstet*, 70(3):327-33
- [19] Qiao L, Zou C, van der Westhuyzen DR, Shao J, **2008**, *Diabetes*, 57(7):1824-33
- [20] Williams CJ., Fargnoli JL., Hwang JJ., Van Dam RM, Blackburn GL, Hu FB and Mantzoros CS, **2008**, Coffee consumption is associated with higher plasma adiponectin concentrations in women with or without type 2 diabetes: a prospective cohort study, 31(3): 504–507
- [21] Scott J. r., Saia P. J. di. Hammond C. B, et al, **1997**, Danforth's obstetrics and Gynecology. Kluwers company Philadelphia. hypertensive disorders in pregnancy. page 309-327. 8 Edition.
- [22] Ouedraogo R, Gong Y, Berzins B, Wu X, Mahadev K, Hough K, Chan L, Goldstein B J., and Scalia R, **2007**, *Clin Invest*, 117(6):1718-26
- [23] Ness RB., Zhang J., Bass D, and Klebanoff MA., **2008**, Interactions between Smoking and Weight in Pregnancies Complicated by Preeclampsia and Small-for-Gestational-Age Birth, 15; 168(4): 427–433