The Relationship between Health Locus of Control and Adherence to Diabetic Regimen among Gestational Diabetic Women

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Abstract: Adherence with diabetic regimen is important in women diagnosed with gestational diabetes because of the presence of a second "patient," the fetus, who is at risk for complications associated with inadequate metabolic control. Adherence is a human behavior with many determining factors, and critical among these is locus of control. So, this study aimed to identify the relation between health locus of control and adherence to diabetic regimen among women with gestational diabetes mellitus (GDM). A descriptive correlational methodology was used, where a convenient sample of 120 women had gestational diabetes, were selected from outpatient clinic at King Abdel Aziz University Hospital in Jeddah. Two tools were used to collect data; pregnant women's knowledge and adherence interview schedule and multiple health Locus of Control scale. **Results clarified that** Globally, 50% of women with "chance HLC" had poor knowledge as compared to 32.6% of women who were internally oriented, and then 25.7% of those who had "powerful others HLC" with a statistical significant statistical significant difference between them HLC (P=0.002). In addition, women with "powerful others HLC" had the highest percentage of satisfactory adherence to diabetic regimen (36.4) then those with "Internal HLC" (28.3%), and women with "CHLC" had the lowest satisfactory adherence to diabetic regimen (25%),with a statistical significant difference between the three dimensions of HLC as related to adherence with diabetic regimen P =<0.001. A statistical significant difference was found between the different dimensions of HLC and women's adherence to blood analysis, exercise and foot care, where P = 0.053, 0.010 & 0.023 respectively. **In conclusions**, women who adopted external powerful others health locus of control were significantly more knowledgable about and satisfactorily adherents to the diabetic regimen than those who adopted internal and chance health locus of control.
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1. Introduction:

Gestational diabetes is known as glucose intolerance or diabetes which is diagnosed for the first time during pregnancy but disappears after the pregnancy. Pregnancy is a time of increasing insulin resistance because of great hormonal changes. When insulin does not work properly, blood glucose builds up in the blood stream and gestational diabetes is the result. (1,2)

Gestational diabetes is potential life threatening and is associated with life style changes. The identification of women with GDM and caring for them is important not only in preventing prenatal morbidity but also in improving long term outcome for the mothers and their babies. The therapeutic regimen of the women with GDM is extremely complex. It involves specific behavioral and life style changes. They include incorporation of diet, exercise and medications. The high incidence of complications in individuals with diabetes indicates that adherence to the diabetes regimen is an eminent problem. (3,4)

Adherence has been defined as "the degree to which a patient's voluntary behavior corresponds with the clinical recommendations of health care providers". Adherence suggests that patients are self-sufficient individuals who assume an active and voluntary role in defining and achieving goals for their medical treatment. Other study suggests that in order to increase adherence to the diabetes regimen, it is important to determine what predicts an individual's ability to maintain the treatment objectives after the initial diabetes education program. Determining reliable predictors of adherence may allow for a better understanding of how to improve adherence to this regimen. These predictors may include personality, family behaviors, health beliefs, demographic characteristics and beliefs about personal locus of control. (5,6)

The concept "locus of control" refers to the extent to which individuals perceive control over their lives, and environment. control they have over their lives. Control orientation, which describes to what extent one's actions are instrumental to goal

attainment, was first measured in Rotter's internal-external (I–E) scale. [7]

Rotter's Social Learning Theory (SLT) employs locus of control as a generalized expectancy. According to SLT, the likelihood of a given behavior occurring, i.e., the behavior potential, varies according to; (a) the expectancy that a particular reinforcement will occur as a result of the behavior, (b) the value of the expected reinforcement, and (c) the psychological situation. He added that, generalized expectancies are applicable in situations in which an individual has not had enough experience in a particular behavior or task to develop specific expectancies. Therefore, locus of control is applicable in more general or novel situations. [8,9]

The health locus of control (HLC) is the degree to which individuals believe that their health is controlled, it can be either internal or external. Individual with high internal locus of control believe that their control over their life events results primarily from their own behavior and actions. While those with a high external locus of control believe that powerful others or chance control their decision and their life. [10]

Individual beliefs about health, illness and health care are important as they guide a person's self-care measures and care seeking behavior. Active self-care measures are essential factors for management of diabetes that correlate with short-term health outcomes. Moreover, adequate self-care in diabetes improves quality of life and decreases the number of inpatient cases. Thus, in caring for women with GD, , it is important to understand their health locus of control which is considered as one of the underlying psychological constructs that may influence women's behavioral and emotional functioning. (11) Furthermore , it is important for health care providers to recognize pregnancy as a time to develop and implement health education aimed at promoting health in a long-term and life-long perspective, for both the woman and her baby. [12]

Although some researchers perceived internal control to be associated with better adherence to self-care regimens than when the locus of control is external., and better metabolic control (Cherepakho , 2008 and Cohen, 2007). [12] This was not always true as others have found opposite results. Poor adjustments to diabetes and poor metabolic control have been found among diabetic patients with high "IHLC"(Cohen, 2007; April, Dharani , Peters , 2012). Finally some researchers have found no link between HLC and outcomes in diabetic patients (O'hea *et al.,* 2012 and Hjelm , Mufunda, 2012).

Studies focusing on health beliefs and gestational diabetes are lacking. Moreover no studies have previously addressed the health locus of control among diabetic Saudi women. Therefore, the purpose of the present study was to determine if health locus of control is related to adherence to diabetic regimen among Saudi women with GDM.

Aim of the study:

This study aimed to assess the relationship between locus of control and adherence to diabetic regimen among gestational diabetic women.

Research question:

What is the relationship between Health Locus of Control and adherence to diabetic regimen among gestational diabetic Saudi women?

2. Material and method

Study design:

A descriptive correlational design was followed in this study.

Materials

Research setting:

This study was conducted in the outpatient clinic at King Abd El Aziz university hospital in Jeddah.

Subjects:

A convenience sampling technique was used in collecting the data. A total of one hundred and twenty pregnant women (determined by Epi-info 7 software program) attending the previously mentioned setting were included in the study. The inclusion criteria included:

- Having GDM for not less than three months.
- Free from other medical diseases.
-Accepting to participate in the study.

Tools:

Two tools were used in this study:

Tool one: Pregnant women's knowledge and adherence structured interview schedule. It entails three main parts of questions:

Part I: Basic data questions: This part was designed and used by the researchers to collect data about the subjects' general characteristics such as age, level of education, as well as their reproductive history.

Part II: GDM women's knowledge structured interview schedule: This part was developed by the researchers and comprised 25 items to identify the diabetic pregnant women's knowledge regarding the disease and their diabetic regimen. It includes seven main groups of questions that probe subjects' knowledge about the disease, needed analysis, recommended activity and exercise, diet, insulin therapy, personal hygiene, and foot care.

Answers for this part were given a score of 'one' for incorrect answers , 'two' for correct but incomplete answers and 'three' for complete and correct answers .The total score ranged between 25-75. Thus subjects' knowledge was ranked as: poor if it scored <42, fair if it scored 42-58, and good if it scored ≥59

Part III: GDM women's adherence to diabetic regimen structured interview schedule. This

part was developed by the researchers and comprised 25 items to identify the diabetic women's degree of adherence to their diabetic regimen. It included seven main groups of questions that cover subjects' adherence, namely: performing analysis, doing the required activity and exercise, sticking to diet, insulin therapy, personal hygiene, and foot care.

Answers on women's adherence interview sheet were rated on two points. A score of (1) was given to unsatisfactory adherence and satisfactory adherence was given a score of (2) .The total cores ranged between "25-50". Those who scored "16-50" were considered satisfactory adherent, while those who scored "<16" were considered unsatisfactory adherent.

Tool two: Multidimensional Health Locus of Control scale (MHLC) .[13]

It was developed by (Wallston, 1978), and it was modified by the researchers to suit the Saudian society. The scale measure the different dimensions of HLC among GDM women . It consists of three subscales; each of them composed of six items, namely, internal Health Locus of Control (IHLC), External Powerful Others Health Locus of Control (EPHLC), and External Chance Health Locus of control (ECHLC). Answers are rated on a six point likert- scale ranging from 1 (strongly disagree), to 6 (strongly agree). The range of the possible score on each subscale is 6 to 36.

Respondents were classified according to their subscale score on which they scored the highest, i.e., the higher the locus of control score, the greater the tendency to believe in that controlling source.

2. Method

A written permission was obtained from the responsible authorities of the study settings to conduct the study; after explaining the study purpose.

Development of tool I was done by the researcher after extensive review of relevant and recent literature. While tool II was adapted and modified to fit with the present study subjects. Arabic translation of the study Tools II was done. The tools were later validated by 5 experts in the related fields.

A pilot study was carried out on 12 women, who were excluded from the study subjects to ascertain the relevance and clarity of tools, detect any problem peculiar to the statements and to estimate the time needed to complete it. Following this pilot study, the tool was corrected accordingly and made ready for use.

The reliability of tool II was accomplished by split half reliability technique. The scale has high internal consistency with Cronbach's alpha = 0.785.

Subjects were individually interviewed by the researcher using the study tools. Data collection covered a period of five months, from the beginning of February to June 2009.

Ethical Considerations that were considered throughout the study steps:

An informed oral consent to participate in the study was obtained from the study subjects after explaining the aim of the study. Participants were also informed about their right to withdraw from the study at any time without giving a reason.

They were reassured that all research data will be confidential and used only for the purpose of the study. Subjects' privacy was always maintained.

Statistical analysis:

Was performed using SPSS for windows 16. Percentage, and Chi Square test at 5% level of significance was used to test the association between the study variables i.e. between locus of control among gestational diabetic Saudi women and their knowledge and adherence to diabetic regimen.

3. Results

Table "1" shows the relationship between health locus of control among GDM women and their socio-demographic characteristics. More than half of GDM mothers (55%) had external powerful others health locus of control (EPHLC) compared to 38.3% who perceived events to be a result of internal health locus of control (IHLC) & 6.7% for external chance health locus of control (ECHLC). It was observed that EPHLC (48.5%) was more encountered among women with GDM in the age group between "> 35", illiterate (59.1%), and house wives (80.3 %). On the other hand, a high percentage of those with IHLC orientation (63%) aged between "30 to 35 years", 43.5% had secondary school or high education, and 50 % living in nuclear family. Accordingly, HLC was found significantly related to the woman's age, educational level and family type ($P<0.05$).

Table "2" investigated the relationship between HLC among GDM women and their reproductive history and clinical characteristics. It revealed that, EPHLC was a common feature among women who were either pregnant for "four times or more" (40.9%) or multipara of "four children or more" (66.7%), as compared to 19.6% and 34.8% of those with IHLC. As well, EPHLC was common among women who detected their GDM during the second trimester (87.9%), had unplanned pregnancy (93.9%) and who did not visit antenatal clinic(60.6%), compared to 65.2%, 69.6%, and 30.4% respectively of women with IHLC. HLC was found significantly related to gravidity, parity, detection time of GDM, pregnancy planning status, number of antenatal visit, and reaction to the diagnosis($P=0.05$).

Table "3" shows the relationship between health locus of control adopted by gestational diabetic

women and their knowledge regarding diabetic regimen. Globally, 50% of women with "chance HLC" had poor knowledge as compared to 32.6% of women who were internally oriented, and then 25.7% of those who had "powerful others HLC". The difference between the three dimensions of HLC was statistically significant (P=0.002).

The results also revealed that the majority of the subjects with "External Powerful others HLC", "IHLC", and "ECHLC" exhibits "good" knowledge related to general personal hygiene (100%, 89.2, & 87.5% respectively). About half of the subjects with "EPHLC" (51.5%) had "good" knowledge about foot care as compared to 26.1% of internally oriented group and 0% of those with "ECHLC".

Less than half of the subjects (41.3%) who adopted 'IHLC" had good knowledge about dietary regimen compared to 22.7% of "EPHLC" and 25% of "ECHLC".

Among the women with "EPHLC", a high percentage of them had "fair" knowledge about the disease (53%), then blood analysis (50%), and exercise (50%), as compared to 47.8%, 45.6% & 45.6% (respectively) of the IHLC group. As regards the "Insulin therapy", 32.6% of the "IHLC" group had "poor" knowledge as compared to 24.2% of "EPHLC". Women with "ECHLC" had a poorest knowledge in relation to all the aspects of diabetic regimen.

However, a statistical significant relation was found between HLC and women's knowledge regarding exercise, insulin therapy, foot care, and personal hygiene, where ^{2} = 14.100, 10.796, 19.125 & 9.225 respectively.

Table "4": In general, women with "powerful others HLC" had the highest percentage of satisfactory adherence to diabetic regimen (36.4) than those with "Internal HLC" (28.3%). On the other hand, women with "CHLC" had the lowest satisfactory adherence to diabetic regimen (25%). There was a statistical significant difference between the three dimensions of HLC as related to adherence with diabetic regimen p=<0.001.

Women with "internal HLC" were more satisfactorily adherent to insulin therapy (82.6%), the general personal hygiene (56.5%), the dietary regimen (30.4%), and foot care (30.4%). The least percentage of satisfactory adherences was with the exercise (10.9%).

As regards those with "external HLC", a high percentage of women with "EPHLC" had a satisfactory adherence with insulin therapy (86.4%), general personal hygiene (69.7%), then blood analysis (40.5%), foot care (37.9%) and exercise (36.4%). The least percentage of satisfactory adherences was with dietary regimen (18.2%). Among women with "ECHLC", their highest satisfactory adherence was with administration of the Insulin therapy (75%), then the general personal hygiene, and the least satisfactory adherence was with foot care (0.0%).More than two thirds of subjects with "ECHLC" (37.5%) were satisfactory adherent to the dietary regimen. Next to them came "IHLC" (28.3%) and "EPHLC" (21.2%). A statistical significant difference was found between the different dimensions of HLC and women's adherence to exercise, where p=0.010.

4. Discussion

Adherence with diabetic regimen is important in women diagnosed with gestational diabetes because of the presence of a second "patient," the fetus, who is at risk for complications associated with inadequate metabolic control. [14] Therefore, women with gestational diabetes are expected to carry out a set of complex, self-management behaviors directed at controlling their disease. These women usually vary considerably in relation to their knowledge and adherence to GDM regimen. In this respect, locus of control has been recognized as an important domain in diabetes that affects both knowledge and adherence of diabetic women. [15] Lefcourt *et al.*(1991) [16] contended that locus of control mediates any actions taken to prevent health problems. It correlates positively with conformity, attitude change, and achievements. Therefore, this study explores the relationship between Health Locus of Control (HLC) and adherence with diabetic regimen.

The results of the present study revealed that, about two thirds of the study subjects had external health locus of control, mainly in the form of powerful others, followed by a little more than one third of them having internal health locus of control. This may be explained by the assumption that diabetics hold that they are not responsible for their illness, thus they develop either an external chance or external powerful others HLC.

Table (1): Distributions of gestational diabetic women according to their general characteristics and their health locus of control (HLC).

General characteristics	Gestational diabetes health locus of control						Total (n=120)	
	Internal		External Chance		External Powerful others			
	No= 46	38.33%	No= 8	6.7%	No= 66	55%	No	%
Age (Years):								
< 30	11	23.9	1	12.5	16	42.2	28	23.33
30-35	29	63	7	87.5	18	27.3	54	45.00
> 35	6	13.1	0	00.0	32	48.5	38	31.67
Test of sig.	χ2/FET =25.047*, p=0.000							
Level of Education								
Illiterate or just read & write	7	15.2	5	62.5	39	59.1	51	42.5
< Secondary school	19	41.3	0	00.00	8	12.1	27	22.5
≥ Secondary school	20	43.5	3	37.5	19	28.8	42	35
Test of sig.	χ^2/FET =26.96*, p=0.000							
Work status								
House wives	37	80.4	8	100	53	80.3	98	81.7
Workers	9	19.6	0	0.0	13	19.7	22	18.3
Test of sig.	χ^2/FET =1.925, p=0.382							
Residency								
Urban	40	87.13	5	62.5	51	77.3	96	80
Rural	6	19.6	3	37.5	15	22.7	24	20
Test of sig.	χ^2/FET =3.229, p=0.199							
Type of family								
Nuclear	23	50	8	100	31	47	62	51.67
Extended	23	50	0	0.00	35	53	58	48.33
Test of sig.	χ^2/FET =8.118*, MC p=0.017							
Family income								
Enough	45	97.8	7	87.5	65	98.5	117	97.5
Not enough	1	2.2	1	12.5	1	2.5	3	2.5
Test of sig.	χ^2/FET =3.565,p=0.168							

χ^2: Chi square test FET: Fisher Exact Test *: Significant values at <0.05

Table (2): Relation between the reproductive history and reaction to the disease of gestational diabetic women and their health locus of control (HLC).

Obstetric history & reaction to the disease	Gestational diabetes health locus of control						Total (n=120)	
	Internal		External Chance		External Powerful others			
	No= 46	38.33%	No= 8	6.7%	No= 66	55%	No	%
Gravidity								
< 4	37	80.4	6	75	39	59.1	82	68.3
4+	9	19.6	2	25	27	40.9	38	31.7
Test of sig.	χ2/FET =5.882 , p=0.053							
Parity								
None	13	28.2	3	37.5	3	4.5	19	16.6
< 4	17	37	2	25	19	28.8	38	31.7
4+	16	34.8	3	37.5	44	66.7	63	51.7
Test of sig.	χ^2/FET =22.066*, p=0.000							
Number of living children								
None	19	41.3	3	37.5	15	22.7	37	30.8
< 3	5	10.9	2	25	17	25.8	24	20
3+	22	47.8	3	37.5	34	51.5	59	49.2
Test of sig.	χ^2/FET =6.375, p=0.173							
Pregnancy planning status								
Planned	14	30.4	4	50	4	6.1	22	18.3
Unplanned	32	69.6	4	50	62	93.9	98	81.7
Test of sig.	χ^2/FET =16.497*, p=0.000							
Reaction to the diagnosis								
Accepted	18	39.1	6	75	52	78.8	76	63.3
Not accepted	28	60.9	2	25	14	21.2	44	.7
Test of sig.	χ^2/FET =18.861*, p=0.000							

χ^2: Chi square test; FET: Fisher Exact Test; *: Significant values at <0.05

Table 3: Relationship between the knowledge of gestational diabetic women regarding diabetic regimen and their health locus of control (HLCO).

Knowledge about diabetic regimen	Gestational diabetes health locus of control						Total (n=120)	
	Internal B		External					
			Chance		Powerful other			
	No	%	No	%	No	%	No	%
Knowledge about disease								
Good	5	10.9	0	00.00	9	13.6	14	11.67
Fair	22	47.8	1	12.5	35	53	58	48.43
Poor	19	41.3	7	87.5	22	33.3	48	40.00
Test of sig.	χ2/FET =8.872 ,p=0.064							
Blood analysis								
Good	12	26.1	1	12.5	17	25.8	30	25.00
Fair	21	45.6	0	00.00	33	50	54	45.00
Poor	13	28.3	7	87.5	16	24.2	36	30.00
Test of sig.	χ^2/FET =14.100*, p=0.007							
Diet								
Good	19	41.3	2	25	15	22.7	36	30.00
Fair	5	10.9	2	25	17	25.8	24	20.00
Poor	22	47.8	4	50	34	51.5	60	50.00
Test of sig.	χ^2/FET =6.375, p=0.173							
Exercise								
Good	12	26.1	1	12.5	17	25.8	30	25.00
Fair	21	45.6	0	00.00	33	50	54	45.00
Poor	13	28.3	7	87.5	16	24.2	36	30.00
Test of sig.	χ^2/FET =14.100*, p=0.007							
Insulin therapy								
Good	16	34.8	0	00.00	14	21.2	30	25.00
Fair	15	32.6	3	37.5	36	54.5	54	45.00
Poor	15	32.6	5	62.5	16	24.2	36	30.00
Test of sig.	χ^2/FET =10.796*, p=0.029							
Foot care:								
Good	12	26.1	0	00.00	34	51.5	46	38.33
Fair	12	26.1	6	75	14	21.2	32	26.67
Poor	22	47.8	2	25	18	27.3	42	35.00
Test of sig.	χ^2/FET =19.125*, p=0.001							
Personal hygiene:								
Good	41	89.2	7	87.5	66	100	114	95.00
Fair	2	4.3	0	00.00	0	00.00	2	01.67
Poor	3	6.5	1	12.5	0	00.00	4	03.33
Test of sig.	χ^2/FET =9.225, p=0.056							
Total score of knowledge								
Good	17	37	2	25	25	38	44	36.7
Fair	14	30.4	2	24	24	36	40	33.3
Poor	15	32.6	4	50	17	25.7	36	30
Test of sig.	χ^2/FET =17.348*, p=0.002							

χ^2: Chi square test FET: Fisher Exact Test

*: Significant values at ≤ 0.05

Table 4: Relationship between the adherence of gestational diabetic women regarding diabetic regimen and their health locus of control (HLCO)

Adherence	Gestational diabetes health locus of control						Total (n=120)	
	Internal (n= 46)		External					
			Chance (n= 8)		Powerful others (n= 66)			
	No	%	No	%	No	%	No	%
Blood analysis								
Satisfactory	10	19.6	2	25	25	40.5	37	31.67
Un Satisfactory	36	80.4	6	75	41	59.1	83	68.33
Test of sig.	χ^2/FET =5.883*, *p*=0.053							
Diet								
Satisfactory	14	30.4	3	37.5	12	18.2	29	25.00
Un Satisfactory	32	69.6	5	72.5	54	81.8	91	75.00
Test of sig.	χ^2/FET =3.052, *p* =0.217							
Exercise								
Satisfactory	5	10.9	2	25	24	36.4	31	25.8
Un Satisfactory	41	89.1	6	75	42	63.6	89	74.2
Test of sig.	χ^2/FET =9.199*, *p* = 0.010							
Insulin therapy								
Satisfactory	38	82.6	6	75	57	86.4	101	84.2
Un Satisfactory	8	17.4	2	25	9	13.6	19	15.8
Test of sig.	χ^2/FET =0.827 , *p* = 0.661							
Foot care								
Satisfactory	14	30.4	0	00.00	25	**37.9**	39	32.5
Un Satisfactory	32	69.6	8	100	41	62.1	81	67.5
Test of sig.	χ^2/FET =7.544*, *p* = 0.023							
General personal hygiene								
Satisfactory	27	56.5	4	50	48	**69.7**	79	65.8
Un Satisfactory	19	43.5	4	50	18	30.3	41	34.2
Test of sig.	χ^2/FET =3.328 , p= 0.189							
Total score of adherence								
Satisfactory	13	28.3	2	25	24	**36.4**	39	32.5
Un Satisfactory	33	71.7	6	75	42	63.6	81	67.5
Test of sig.	χ^2/FET =22.466*, *p* <0.001							

χ^2: Chi square test FET: Fisher Exact Test

*: Significant values at < 0.05

Accordingly Thomas *et al.*(2004) [17] believe that the outcome of their illness is determined by their doctor and generally leave their care in the hands of the medical professionals . Additionally, they added that the "powerful others" health locus of control that is more frequently displayed by the study subjects, indicates that they are more likely to believe that professionals or others outside themselves determine their illness successes or failures. This result was supported by Anthony *et al.* (2013) [18] who showed that, the women with gestational diabetes obtained higher scores on the "powerful others" and "chance" subscale of the multidimensional health locus of control scale. As such his results showed that pregnant women with diabetes are more likely than nondiabetics to believe that the health of their unborn baby is a function of powerful others, namely the health care providers . Accordingly they were more complying with their diabetic regimens. This is true for the current study, but only for the powerful others.

Hjelm *et al.* (2005) [19] seems that once the woman is pregnant; the health of the woman's fetus becomes the focus of attention. Their concerns are often related to the health and well-being of the baby as the mother feels a moral commitment and exaggerated responsibility towards the baby. Anthony *et al.* (2013) [18] added that during pregnancy, the prevailing feelings of uncontrollability appear to be predominant to the extent that they believe that powerful others have more control on their condition).

As such, the external powerful others HLC could serve to protect the self-esteem of those women by making them less likely to attribute the control over desired outcomes to their own behaviors, and more likely to blame external forces . [15] Eswi *et al.* (2012) [20] added that women perceived Powerful Others HLC during pregnancy as a result of psychological distress.

It is possible that the cultural variation has an influence on health locus of control. Al-Krenawi *et al.* (2010) [15] suggested that the social structure in various Arab societies tends to remain male-dominated. Consequently, women who grow up in such a society may develop a lower internal sense of control. Some other studies suggested that a myriad of societal, cultural and religious factors are reflected in MHLC. Societies that value individual choice over family or community volition were found to rate higher on "Internal HLC". [21,22] Congruent with this interpretation of Hjelm *et al.* (2005) [19] found that the Swedish women with "GD" showed an internal locus of control, as they saw the possibilities of influencing their health compared with the Middle-Eastern women, who expressed more of an external locus of control.

On the other side, this is in contrast with Sharifabad *et al.* (2010) [23] who had reported that diabetic patients displayed internal locus of control, followed by powerful others and chance locus of control. These findings indicate that the participants in their study considered themselves having the greatest influence on their own adherence to diabetes regimen. Therefore, those with internal HLC are willing to follow treatment recommendations as the individual believes the path of the disease progression can be controlled via personal ability and action; in this sense referring to adherence.

Although about two thirds of the women in the current study had reasonable total knowledge (good and fair), nearly one third only of them had satisfactory adherence with diabetic regimens. These findings were unexpected, since a previous research has established that short-term regimens are associated with better adherence and women with GDM understand that they need to adhere to diabetes regimens for just a few months and also for the sake of their unborn children. [17]

This finding highlights that although it's important for diabetic patients to acquire the knowledge for how to best manage their diabetes and maintain proper glucose control, knowledge has not been shown to be a good predictor of adherence to the diabetes regimen (32). Therefore, individuals with diabetes may be acquiring the knowledge for how to properly control their diabetes; yet, they are not successfully incorporating the lifestyle changes needed to implement it over time. This is evident in the poor adherence rates reported for individuals with diabetes (4, 5, & 33 In Ref. 103). [6] In this respect, a study conducted on pregnant women in aboriginal communities in Canada found that while there was a high level of awareness of the need for blood glucose testing during pregnancy, adherence to the guidelines was generally poor and was not significantly altered by educational reinforcement. [24]

The low satisfactory adherence of the subjects could be attributed to the complexity of the therapeutic regimen. It is crucial that individuals with diabetes follow a strict treatment regimen in order to maintain control over their blood sugar. This regimen includes maintaining a proper diet, engaging in regular physical activity or exercise, blood glucose monitoring, and taking the prescribed medications. This view is supported by *Morowatisharifabad et al (2009)* [6] who found that the complexity of the medical regimen were significant predictors of non-adherence. He added that a patient with a more complex regimen is less likely to be adherent than a patient with a less demanding regimen.

Another explanation could be that, the women the women in the present study may have low self-efficacy and social support. In this respect, Gonder-Frederick *et al.* (2002) & Glasgow *et al.* (2001) speculate that low levels of both self-efficacy and internal locus of control are considered barriers to diabetes management. It also has demonstrated that low self-efficacy affects the development of an internal health locus of control. They added that lack of social support, particularly from friends and family, is also considered a barrier to adherence and self-care, while high levels of support are related to better long-term management, health outcomes, and glucose control . [25,26]

Furthermore, the subjects of the present study with "powerful others HLC" were more adherent with their regimen than those with internally oriented HLOC, while those with "external chance HLC" were the lowest adherent to diabetic regimen with a significant difference between the three dimensions of "HLC".This is consistent with the result s of O'Hea *et al.* (2005) [5] who found that the diabetics who believe their health control lies with their physicians will be more likely to follow their physicians' instructions and turn decisions over to those they think control their health.

This is also supported by Anthony *et al.* (2013) [18] who studied 30 insulin-dependent outpatients and found that the 'powerful others' subscale of the MHLC exhibited the strongest relationship with overall regimen compliance. As well, the resulting findings of Cherepakho (2008) [27] showed that African American patients with type 2

diabetes who strongly believed chance determined their health status were more likely to have poor glycemic control (as an indicator of adherence) over a period of 6 months.

On the other hand, a contradictory results reported by Hjelm *et al.* (2005) [19] Hjelm *et al.* (2005 found that Women with GDM who feel they have control over their health are more likely to be compliant and carry out health-related behaviors.

This is on the same line with *Morowatisharifabad et al. (2009)* [6] who concluded that internal locus of control was the only statistically significant predictor of adherence to diabetes regimen. He also suggests that the diabetic patient with high perceived control may have better health because he or she is more likely to take health-enhancing action.

Furthermore, previous studies conducted by Macrodimitris *et al. (2001)* [28] examined the relationship between perceived control and HbA1c levels in 115 individuals with type 2 diabetes. Results indicated that perceived control was negatively related to HbA1c levels.

The subjects of the current study showed fewer adherences to follow dietetic regimen, and practicing exercise; and highest adherence to Insulin administration. This is in parallel with several studies that have shown difficulty maintaining optimal adherence with all aspects of therapy. In this respect, a research conducted by Brides *et al. (2001)* [29] has generally shown that lower regimen adherence can be expected when a regimen is more complex, and when a treatment regimen requires lifestyle changes. Furthermore, patient adherence to diet and exercise regimens is often suboptimal. In one random survey, 85% of primary care providers identified following diet regimens as a problem for people with Type 2 diabetes. Sherman *et al.* (2000) [30] reported that patients are somewhat less adherent to dietary aspects of diabetes regimens than they are to taking the appropriate amount of insulin or testing their glucose levels. They report the highest frequency of barriers to dietary adherence compared to other aspects of care and tend to adhere poorly to dietary prescriptions.

The results of the present study also revealed that the women who adopted IHLC had more tendencies to acquire knowledge and to adhere to dietary aspects of diabetes regimens than those who adopted EPHLC. This makes sense because people lower in internal locus of control do not feel as capable of managing their diabetes independently. They may look to others for behavioral cues and be more affected by their social surroundings. and have less ability to resist temptation when it is present.

It is therefore possible that when the patient faced with temptation (such as the presence of another person eating differently than oneself), he might have difficulty subsequently maintaining dietary adherence. In this respect, a research reported that women with gestational diabetes were highly compliant with dietary recommendations and insulin administration. [18]

As regards the adherence with medication regimens, the women in the current study reported a highest adherence regarding the insulin therapy. The patients with EPHLC showed a higher adherence than the internally oriented group. O'Hea *et al.* (2005) [5] ; Bane, Hughes, and McElnay (2006); and Takaki and Yano (2006) found that psychosocial factors, such as locus of control, are helpful in explaining and understanding non-compliance in medication regimens. These researchers stated that non-compliance may be associated with HLC and that healthcare providers need to understand these psychosocial reasons for noncompliant behavior to prevent lapses in the medical regimens. They added that individuals with higher self-efficacy scored highest on attributing their health outcomes to their personal control and reported more health seeking behaviors. [5,31,32]

However, Snyder (2006) [33] , found that people who scored highly on Powerful Others HLC generally believed that health professionals could control one's health outcomes. Therefore those with high Powerful Others HLC scores were more compliant with medication instructions. On the other hand, individuals who attributed their health status to internal factors were more noncompliant in medication taking.

Concerning the women's knowledge about diabetes regimens, two thirds of the subjects with IHLC have good and fair knowledge as compared to about three fourth of subjects with EPHLC. While, poor total score of knowledge was associated with ECHLC with a statistical significant difference. This finding is unexpected because about half of the IHLC as compared to one quarter of EPHLC had secondary school education or more, while about two thirds of EPHLC were illiterate.

A contradictory findings were reported by Brown(1999) [34] other investigators. They stated that education is the process of influencing behavior and producing changes in knowledge, attitudes and skills required to manage problems related to the disease. In this respect, Jacobs et al (2011) [10] stated that, individual with internal expectancies is more likely to be more alert to those aspects of the environment which provide useful information for his future behavior.

As such, Pires-Yfantouda *et al.* (2012) [35] shows in his study that adult with type 1 diabetes who is high in internal and/or external (health

professionals) locus of control beliefs is knowledgeable about his/her condition.

Results of the present study also revealed that Knowledge about the disease itself was the poorest area of knowledge with no statistical significant difference among both internal and external powerful others groups. This finding is on the same line with Sawsan *et al.* ( )[36] who found that knowledge about the disease was the poorest area of knowledge among patients who adopted both internal and external health locus of control.

In the current study, although, those with "External powerful others HLC" had a significantly more knowledge than the internally oriented, the internally oriented had more tendency to have good knowledge about diet, and blood analysis which are the core aspects of diabetic control. This is supported by Sharifabad *et al.* (2010) [23] who mentioned that internals who believed that their behavior may lead to positive outcome could make attempts to control their disease through seeking out relevant information. Hence, they may be more inquisitive with health care providers about diabetes and the details of the therapeutic regimen.

Conclusion

The study revealed that the women with gestational diabetes hold more external powerful others health locus of control than internal or chance health locus of control. In addition, women who adopted external powerful others health locus of control had significantly higher total knowledge about and satisfactory adherence to the diabetic regimen than those who adopted internal and chance health locus of control.

Recommendations

The following are the main recommendations yielded by the present study:

1- Counselors and educators should attend to the locus of control in their interventional courses and programs.

2- Interventional programs to enhance diabetes self-care will be more successful if patient's locus of control is addressed.

3- Providing a positive feedback to patients for their small successes, as any feeling of success may make them feel that they are in control of their illness.

Recommendations for health education prgrams of internally oriented women with GDM :

-health care providers should cultivate patient-centered relationships that respect patient autonomy; talk collaboratively with patients about treatment rationales and goals; brain-storm and problem-solve with their patients; gradually implement and tailor the

-Provide constant counseling and direction to enhance patient's self-management, as well as provide patients with alternative actions of self-management.

-Health care providers should give the patients more opportuinity to participate in assessing their process.

-Encourage self-instructions by providing patients with audio-visual materials such as booklets, films, or pictures.

Recommendations for health education program of women with external powerful others health beliefs:

-Provide patients with feelings of genuine caring through active listening and empathic understanding.

-The major supportive persons of the patient could be involved during the session of patient's education program.

-Provide the patients with group education program for the benefits of sharing experiences and providing and feeling of support.

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