

INTERRELATION BETWEEN BLOOD GROUPS / RHESUS FACTOR AND DIABETIC INCIDENCE OF FEMALE IN ALJABAL ALAKHDAR IN LIBYA

Qurtam, A. A.

Biology Department, Faculty of Education (Al-Gobba), Omar Al-Mukhtar University , Libya

ABSTRACT

Diabetic disease has considered a major worldwide public health problem , has bad complications and also has different etiological agents such as environmentally – physiologically – immunologically – genetically reasons . It is found that the genetic variants at ABO Locus affect diabetes risk and thus ABO blood group phenotypes may be associated with diabetic incidence . So ,the present study aims to determine frequency of blood groups ABO and rhesus factor Rh phenotypes in female diabetic patients .This research includes number of diabetic populations samples which are collected from some clinical laboratories , hospitals in some regions of Aljabal Alakhdar in Libya . By current criteria for diagnosis and taking patient history , the diabetes could be classified into three types (the first type (1) , the second type(2) and the third type (3)). Then, ABO group techniques were worked by agglutination test and statistical analysis was carried out by split plot design .The findings in this research have supported the hypothesis that diabetes and blood group types are associated. Also, it could be suggested that the factor Rh which is on red blood cells may have a role to some extent in determine the type of diabetes in related to ABO groups .

Keywords: ABO / Rh groups , Type 1 & Type 2 and Type 3 female diabetes

INTRODUCTION

Kaur *et al.* , 2012 one adult in ten will have diabetes by 2030 , figures signify that the number of people living with diabetes is estimated to rise from 366 million in 2011 to 552 million by 2030 . Between 2010 and 2030 , there will be a 69% increase in number of adults with diabetes in developing countries and 20% increase in developed countries . One of the principal effects is the reduction in β - cell mass , which is ubiquitous in almost all patients with type (1) diabetes (insulin – dependent diabetes) and most patients with type (2) diabetes (insulin – non dependent diabetes). (Kaur *et al.* , 2012) each of which causes known complications , and to avoid these bad effects , the suitable treatment and the following are a must . Current therapy focuses primarily on administration of insulin to restore glucose homeostasis .

Gestational diabetes mellitus (GDM) is broadly defined as any level of glucose intolerance first recognized during pregnancy, a definition that formerly included undiagnosed type 1 and 2 diabetes mellitus. Whilst for most women glucose intolerance resolves after birth, there is up to 50% chance of developing type 2 diabetes within 5 years of delivery (Kim *et al.*, 2007). Diagnosis and treatment of GDM can reduce adverse pregnancy

outcomes, including stillbirth, neonatal macrosomia, neonatal hypoglycemia, birth trauma and neonatal respiratory distress syndrome as well as decrease the risk of preeclampsia in the mother (Landon *et al.*, 2009). For the offspring there is an evidence of potential lifelong metabolic programming as a consequence of exposure to a hyperinsulinaemic fetal environment. These changes can predispose the offspring to obesity and metabolic diseases including GDM (Pettitt and Jovanovic, 2007).

Thus GDM is a condition with great public health significance, both for improving pregnancy outcomes and identifying women and children at risk of future type 2 diabetes and GDM in the female offspring. GDM and type 2 diabetes share several risk factors and the incidence of GDM has been noted to reflect the prevalence of type 2 diabetes (King ,1998)

A blood group is a classification of blood based on the presence or absence of inherited antigenic substances on the surface of red blood cells (RBCs) . Antigens are also present on the surface of other types of cells of various tissues. Several of these red blood cell surface antigens can stem from one allele (or very closely linked genes) and collectively from a blood group system (Anthea *et al.* , 1993). Blood groups are inherited and represent contributions from both parents . A total of 30 human blood group systems are now recognized by International Society of Blood Transfusion .

The Rh factor is the second most significant blood group system in human – blood transfusion with currently 50 antigens . The most significant Rh antigen is the D antigen , because it is the most likely to provoke an immune system response of the five main Rh antigens (Talaro , 2005) . It is common for D negative individuals not to have any anti – D IgG or IgM antibodies , because anti – D antibodies are not usually produced by sensitization against environmental substances . However , D – negative individuals can produce IgG anti – D antibodies following a sensitizing event . The presence or absence of Rh antigens is signified by the + or – sign (Moise , 2008) .

Some blood groups are associated with inheritance of other diseases for example , Kell antigen is associated with Mcleod syndrome (Chown *et al.* , 1957) . Certain blood types may affect susceptibility to infection , an example being the resistance to specific malaria species seen in individual lacking the Duffy antigen (Miller *et al.* , 1976) . The associated anti – A and anti – B antibodies are usually immunoglobulin M , abbreviated IgM antibodies ABO IgM antibodies are produced in the first years of life by sensitization to environmental substances such as food , bacteria and viruses . There is association between ABO phenotypes and Type 1 diabetes (T1D) (Kharagj *et al.* , 2008) . find that genetic variants at ABO locus affect diabetes risk (Qi *et al.* , 2010) . So , the aim of this research shows the association between diabetes and ABO / Rhesus blood groups and to determine the blood group which appears to be more susceptible to diabetes mellitus in female patients.

MATERIALS AND METHODS

A total of 26300 female diabetic cases (12350 female diabetes patients with positive ABO groups and 13950 female diabetic patients with negative ABO groups) were enrolled from some clinical laboratories and some hospitals in four regions (Derna & AL- Gobba & AI – Abraç & AL-Beida) of Aljabal Alakhdar – in Libya . Biodata information were obtained during history taking and from subject hospital case note . The range age of female diabetes was between 20 – 47 years . The current criteria for the diagnosis of diabetes were applied. Fasting blood sugar (FBS) and post – prandial sugar (PPS) were determined using standard methods as well as measurements of hemoglobin A1c (Hb Alc) by colorimetric method in the auto- analyzer (Hekimsoy *et al.* , 2004) .So ,Type 1 (Insulin – dependent diabetes) and Type 2 (Insulin – nondependent diabetes) as well as Type 3 (GDM) (Gestational diabetes mellitus) were identified and classified . ABO / Rh typing was determined by agglutination test. Biostatistics in our research carried out by split plot design at significance ($P < 0.05$) (Snedecor and Cochran , 1967) .

RESULTS AND DISCUSSION

The results of this study were subjected to reveal the correlation between relative incidence of different types of diabetic disorders of female patients with ABO / Rh grouping phenotypes in some regions of Aljabal Alakhdar. This study is considered from hypothetico – deductive method of investigation .

Table (1) : The relation between positive blood groups and diabetic Types 1 & 2 and 3 of female patients in Aljabal Alakhdar in Libya

Regions	No. of cases (\bar{x})	Blood groups		Diabetic Types	
			(\bar{x})		(\bar{x})
Derna	290	B + ve	279.2	(Type 1)	274.4
AL- Gobba	275.8	AB+ ve	260.8	(Type 2)	209.4
AI – Abraç	240	O+ ve	248.3	(Type 3)	288.1
AL-Beida	219.2	A+ ve	240		
L.S.D *	N.S.		N.S.		N.S.
P < 0.05					

L.S.D : least significant difference

N.S. : Non significant ($p < 0.05$)

It was found that Derna town enrolled no. of patients with mean value $\bar{x} = 290$, insignificantly raising with diabetic injury for positive ABO grouping females whereas the mean values of (AL- Gobba & AI – Abraç and

AL-Beida) were (275.8 & 240 and 219.2) respectively as shown in table (1). Type 3 diabetics (GDM) incidence had insignificantly prevalence from each Type 1 and Type 2 diabetic cases in these regions. This is agreement with (Hirst *et al.*, 2012) who reported that evidence of an increase in the prevalence of GDM across some Asian countries . And Type 1 diabetes recorded highly increments than Type 2 diabetes (Haiyan *et al.* , 2001) who stated that Type 1 diabetic influenced the manifestation of Type 2 diabetic in Finland and his findings supported a possible genetic interaction between Type 1 and Type 2 diabetes mediated by HLA locus .

Saisho *et al.* 2010, have estimated insulin resistance and beta cell function in a cohort of Japanese women with and without GDM. They demonstrated that beta cell function was lower in women with GDM compared to those without GDM, irrespective of body mass index. This lends support to the argument that the underlying pathophysiological problem in GDM in Asian women may differ from that in Caucasian and other populations. In Caucasian populations overweight and obesity are thought to be major drivers of the increased prevalence in GDM, with an estimated population attributable risk fraction of 46% (Kim *et al.*,2010). Several associations with GDM have been made in Asian women that have not yet been demonstrated in other ethnic groups.

Lao and Ho , 2001 in Hong Kong have established an association with α thalassaemia and GDM in their population, with an increased OR of 9.44, and 95% confidence limits 5.52 to 16.13, compared to women without α thalassaemia. The same group also published data showing an association between chronic hepatitis B carriage and GDM (Lao *et al.*, 2007) They demonstrated an adjusted odds ratio of 1.24, 95% confidence limits 1.01 to 1.51, for developing GDM compared to women without hepatitis B infection. It has been hypothesized that both these conditions may directly affect the pancreatic beta cell.

Table (1) also , shows that the blood group "B" positive was highly distributed among diabetic disorders of female patients with mean value (\bar{x} ' = 279.2) than other groups (AB +ve & O +ve & A +ve) which have had mean values (260.8 & 248.3 and 240) respectively . These results are in disagreement with (Okon *et al.* , 2008) who found that the blood group " A" positive appears to be more susceptible to diabetes mellitus in South Eastern Nigeria .

Table (2) reveals that many main points : firstly , the B+ve phenotype frequency with mean value \bar{x} '= 377.5 is significantly ($p < 0.05$) the most distributive among type (1) individuals .This result is inconsistent with (Gong *et al.*, 2010) . Secondly , the phenotype frequency of O +ve is significantly the most associative with type (2) diabetes and this result is disagreement with (Okon *et al.*,2008) and (Qureshi and Bhatti , 2003). Thirdly , the blood group AB +ve with mean value \bar{x} '=322.5 is significantly the most interrelated to gestational diabetic mellitus (GDM) while (Donma , 2011) found that the blood group O was dominant in cases with GDM. The genetic variants at ABO locus affect diabetes risk (Qi *et al.*, 2010) .

Table (2) : The relation between the reaction of positive ABO groups and diabetic types in female patients

ABO Groups	Diabetic types		
	Type (1) \bar{x}	Type (2) \bar{x}	Type (3) \bar{x}
A +ve	242.5	210.0	270.0
B +ve	377.5	202.5	257.5
AB +ve	262.5	197.5	322.5
O +ve	215.0	227.5	302.5
LSD*	57	57	57
P< 0.05			

Table (3) : The relationship between negative blood grouping and diabetic types of female patients in Aljabal Alakhdar in Libya .

Regions	No. of cases (\bar{x})	Blood groups		Diabetic Types	
		(\bar{x})		(\bar{x})	
Al – Abraaq	325.8	A - ve	372.5	(Type 1)	255.0
Derna	295.0	O - ve	305.0	(Type 2)	328.8
AL- Gobba	272.5	AB - ve	252.5	(Type 3)	288.1
AL-Beida	269.2	B - ve	232.5		
L.S.D *	N.S.		32		N.S.
P < 0.05					

L.S.D : least significant difference

N.S. : Non significant ($p<0.05$)

Table (3) demonstrates that the relative diabetic incidence of negative blood grouping female patients in Al-Abraq region with mean value (\bar{x} = 325.8) was insignificantly elevated than that other regions (Derna & Al-Gobba and Al-Beida) with mean values (295.0 & 272.5 and 269.2) respectively . It was noticed that the relative incidence of Type (2) diabetic was the most prevalence in diabetic female populations then Type (3)(GDM) and finally Type (1) with insignificant difference (ALberti and Zimmet, 2004) who reported that the classification defines both process and stage of the disease . The processes include Type (1) , auto immune and non- auto immune , with beta – cell destruction , all of these cause Type (2) . GDM and type 2 diabetes share several risk factors and the incidence of GDM has been noted to reflect the prevalence of type 2 diabetes (King, 1998). Given the documented rise in type 2 diabetes across Asia (Chan *et al.*,2009), it is timely to assess the evidence for trends in GDM.

Owing to the similarities in risk factors between GDM and type 2 diabetes, it has been suggested that the physiological insulin resistance of pregnancy may act as a 'stress test' for glucose tolerance, with GDM developing in those prone to developing type 2 diabetes later in life. Genetic

studies of GDM and type 2 diabetes have demonstrated several shared gene loci (Petry , 2010)

Table (3) also , shows that the blood group "A" negative was highly distributed among diabetic disorders of female patients with mean value ($\bar{x} = 372.5$) than other groups (O-ve & AB -ve & B -ve) which have had mean values (305.0 & 252.5 and 232.5) respectively . These results are in disagreement with (**Okon et al. , 2008**) who found that the blood group " A" positive appears to be more susceptible to diabetes mellitus in South Eastern Nigeria .

Table (4) : The relation between the reaction of negative ABO groups and diabetic types in female patients

ABO Groups	Diabetics types		
	Type (1) \bar{x}	Type (2) \bar{x}	Type (3) \bar{x}
A -ve	287.5	445.0	385.0
B -ve	270.0	240.0	187.5
AB -ve	217.5	317.5	222.5
O -ve	245.0	312.5	357.5
LSD* P< 0.05	N	150	150

From table (4) ,it was noticed that the blood Type (A) negative was insignificantly the most frequent and also absolutely interactive among the three types of diabetic incidence(Type 1, Type 2 and Type 3) with mean value $\bar{x} = 287.5$, 445.0 and 385.0 respectively. While " AB " negative was the least effective with mean value 217.5 for Type 1 and "B" negative showed least interrelated between Type (2) and Type (3) female patients with mean value $\bar{x} = 240.0$ and 187.5 respectively. This result is disagreement with (Gong et al.,2010)who showed in his study that blood type "B" individuals are susceptible to Type (2) diabetes . And also the results are inconsistent with (Qureshi and Bhatti, 2003) who concluded that the frequency of blood group B is significantly higher in the diabetes mellitus Type 2 patients (Donma,2011) reported that blood group "O" was dominant in cases with GDM and supported the association between blood group system and gestational diabetes mellitus(GDM)

The observations from table (1) to (4) lead to that we can suggest that the factor Rh plays very important role on identifying the association between ABO frequency and diabetes . This suggestion confirmed by (Gloria- Bottini et al. , 2000) and (Gloria- Bottini and Bottini ,2000) . The first observed that, the relationship between Rh genetic variability and HbA1C (glycosylated hemoglobin) level and thus he suggested that Rh proteins may influence glucose transport through red cell membrane and / or hemoglobin glycation .The second , his results were compatible with the

hypothesis that when the density of Rh protein in the mother is higher than that in the fetus, the conceptus is relatively protected against the toxic effect of glucose. In the opposite genotypic combination (ie, density of Rh protein higher in the fetus than in the mother), the fetus is relatively more susceptible to these effects.

Conclusion :

The present results confirm the classification of diabetic incidence into three types in female populations. The incidence of GDM has been noted to reflect the prevalence of type 2 diabetes and prevalence of GDM may be affected by location factor, female character, nutritional behavior (like weight, obesity, ...), ABO/Rh factor and some disorder associations may directly affect pancreatic Beta-cells.

This study has supported the hypothesis frequency of ABO blood groups among the diabetes mellitus patients is controlled by the broad genetic immunologic basis in both, So the diabetes and blood group ABO types are interrelated. It is concluded that the frequency of blood groups "A" and "B" negative is significantly higher and lower respectively in the diabetes, on contrary, when Rh is positive. And hence, our results proved that the Rh factor may be controlling in determine the type of diabetes in related to ABO grouping.

REFERENCES

- ALberti K. and Zimmet PZ., (2004) : "Definition, diagnosis and classification of diabetes mellitus and its complications", *Diabetic Medicine*, 15(7) :539-553
- Anthea M., Hopkins J. and William C.(1993) : "Human Biology and Health". Englewood Cliffs, New Jersey, :Prentice Hall .ISBN0-13-981176-1
- Chan J, Malik V, Jia W, Kadowaki T, Yajnik C. and Yoon K. (2009): Diabetes in Asia *Epidemiology, Risk Factors and Pathophysiology. JAMA*; 301: 2129-2141.
- Chown B., Lewis M., and Kaita K.(1957): "A new Kell blood –group phenotype", *Nature* 180(4588) :711.
- Donma MM.,(2011) : "Macrosomia, top of the iceberg; the clam of underlying factors" *Pediatrics International*, 53(1):78-84
- Gloria-Bottini F., Antonacci E. and Bottini N.(2000): " RH blood groups and diabetic disorders", *Human Biology*.72(2):287-94
- Gloria-Bottini F. and Bottini E.(2000): Perinatal consequences of maternal – fetal Rh blood group interaction in diabetic pregnancy ; a non-immunological perspective . *American Journal of the Medical Science*, 320(1) :31-5
- Gong Y., Yang YS . and Zhang XM .,(2010) : "ABO blood type, diabetes and gastrointestinal cancer in northern China", *World Journal of Gastroenterology*, 18(6) :563-9

Qurtam, A. A.

- Haiyan Li , Eero Lindholm and Peter Almgren (2001) : " Possible Human Leukocyte Antigen –Mediated Genetic Interaction between Type 1 and Type 2 Diabetes", *The Journal of Clinical Endocrinology Metabolism* , 86(2) :574-582
- Hekimsoy Z., Payzin B. and Ornek T. (2004) :Mean platelet volume in Type 2 diabetic patients , *Journal of Diabetes and Its Complications*, 18(3) : 173-176
- Hirst J.E. , Raynes-Greenow C.H. and Jeffery H.E. (2012): systematic review trends of gestational diabetes mellitus in Asia , *Journal of Diabetology*,; 3:4
- Kaur H., Bhaskar N., Ishaq S. and Najeeb Q.(2012) : " Stem Cells: Source for diabetes cell therapy" *Journal of Diabetology* ; 3:3
- Kharagj tsingh A.V., Prinsen K. and Lemkes H. H. (2008) : "Reduced frequency of blood groups Lewis a-b- in female type 1 diabetes patients. *Diabetic Medicine* , 25(2) :236-8.
- Kim C, Berger D.K. and Chamany S.(2007) : "Recurrence of gestational diabetes mellitus: a systematic review. *Diabetes Care*; 30: 1314-1319.
- Kim S.Y., England L, Wilson HG, Bish C, Satten G. A. and Dietz P. (2010) : " Percentage of gestational diabetes mellitus attributable to overweight and obesity. *Am J Public Health*; 100: 1047-1052
- King H.(1998) : "Epidemiology of glucose intolerance and gestational diabetes in women of childbearing age". *Diabetes Care*; 21 Suppl 2: B9-13.
- Landon MB, Spong CY, Thom E, Carpenter MW, Ramin S. M. and Casey B.(2009): " A multicenter, randomized trial of treatment for mild gestational diabetes". *N Engl J Med*; 361: 1339-1348.
- Lao TT, Chan BC, Leung WC, Ho LF. and Tse K. Y. (2007) : " Maternal hepatitis B infection and gestational diabetes mellitus". *J Hepatol*; 47: 46-50.
- Lao TT and Ho LF.(2001) : " Alpha-Thalassaemia trait and gestational diabetes mellitus in Hong Kong. *Diabetologia* ; 44: 966-971.
- Miller LH. , Mason SJ. and Clyde DF. (1976): " The resistance factor to Plasmodium vivax in blacks. The Duffy -blood –group genotype FyFy" *The New England Journal of Medicine* .295(6) : 302-4.
- Moise KJ (July 2008): "Management of rhesus alloimmunization in pregnancy". *Obstetrics and Gynecology* 112 (1): 164–76.
- Okon UA ., Antai AB ., Osim EE. and Ita So ., (2008): " The relative incidence of diabetes mellitus in ABO/Rhesus blood groups in South Eastern Nigeria", *Nigeria journal of physiological science*, 23(1-2) :1-3
- Petry C. (2010) : " Gestational diabetes: risk factors and recent advances in its genetics and treatment. *British Journal of Nutrition*; 104: 775-787.
- Pettitt DJ and Jovanovic L. (2007) : " The vicious cycle of diabetes and pregnancy. *Curr Diab Rep*; 7: 295-297.
- Qi L., Cornelis MC. and Kraft P.(2010): " Human Molecular Genetics" ,19(9) : 1856-62

- Qureshi MA. and Bhatti R., (2003) : "Frequency of ABO blood groups among the diabetes mellitus Type 2 patients ., Journal of the college of Physician Surgeons - Pakistan , 13(8): 453-5
- Saisho Y, Miyakoshi K, Tanaka M, Shimada A, Ikenoue S and Kadohira I. (2010) : "Beta cell dysfunction and its clinical significance in gestational diabetes". Endocrine journal; 57: 973-980.
- Snedecor G.W. and Cochran W.G. (1967): Statistical method 6th ed. Iowa state university press ,Iowa , U.S.A .
- Talaro ,KP. (2005) : Foundations in microbiology (5th ed.). New york:Mc Gram-Hill PP.510-1.

علاقة فصائل الدم والعامل الرئيسي بالإصابة بداء السكري للمرضى الإناث في الجبل الأخضر بليبيا

أشرف أحمد قرطام

قسم الأحياء (علم الحيوان) – كلية التربية (القبلة) – جامعة عمر المختار بليبيا

يعتبر مرض السكري مشكلة صحية عامة رئيسية في جميع أنحاء العالم ، لها مضاعفات سيئة ، ولها مسببات مرضية مختلفة مثل أسباب بيئية وفسولوجية ومناعية وكذلك أسباب وراثية. ووجد أن المتغيرات الجينية في فيفص فصائل الدم (ABO) تؤثر على مخاطر الإصابة بداء السكري وبالتالي قد يرتبط النمط المظهري لفصيلة الدم بحدوث داء السكري . لذلك تهدف هذه الدراسة إلى تعيين تكرار فصائل الدم (ABO) في مرضى السكري من الإناث الإناث.

يتضمن هذا البحث عددا من العينات جمعت من الإناث المصابات بالسكري من بعض المختبرات الاكلينيكية ، والمستوالمستشفيات في بعض مناطق الجبل الأخضر في ليبيا . بواسطة المعايير المعتمدة حاليا للتشخيص وأخذ تاريخ المريض المرض الطبي أمكننا تصنيف مرض السكري في الأفراد الإناث إلى النوع الأول (١) والنوع الثاني (٢) والنوع الثالث . الثالث (٣) . ثم تم عمل تقنيات تحديد فصيلة الدم (ABO) والعامل الرئيسي (Rh) عن طريق إختبارات التراصالتراص وتم تحليل النتائج إحصائيا بواسطة تصميم القطع المنشقة .

وقد دعمت النتائج التي تم التوصل إليها في هذا البحث فرضية أن هناك علاقة بين مرض السكري وفصائل

الدم في المرضى الإناث . و تمكنت الدراسة من تقديم إقتراح على أن العامل الرئيسي (Rh) الموجود على كرات الدم الحمراء ربما يكون يكون له دور إلى حد ما في تحديد نوع السكري ذات الصلة بفصائل الدم في الإناث.

ونوصى بمزيد من الدراسات والأبحاث في هذا المجال لتأكيد النتائج المتحصل عليها

قام بتحكيم البحث

أ.د / محمد طه شلبي

أ.د / مصطفى عبد الحلیم الحريرى

كلية الزراعة – جامعة المنصورة

كلية الزراعة – جامعة المنصورة