

**Association of Diabetes Mellitus with ABO Blood Groups & Rh with  
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**Abstract:**

**Background:** ABO blood groups are associated with some important chronic diseases. Previous Studies have observed an association between ABO blood group and risk for obesity. **Objective:** to evaluate the prevalence of DM in various ABO and Rh blood group subjects, and to explore any association between ABO and Rh blood groups with DM. **Methods:** A cross-sectional study, conducted in Arar city, Northern Saudi Arabia. It included 312 participants from the general population of Northern Saudi Arabia. Data were collected by a pre-designed online questionnaire which was distributed among the population. It was self-administered, after a brief explanation of the idea of the research. The questionnaire included the clear questions to collect the relevant data. **Results:** the study included 532 participants, 318 (59.8%) were males and 119(22.4%) were suffering from diabetes mellitus. Surprisingly, more than half the cases were Type 1 diabetics (53.8%). The majority (38.7%) of the studied population had O blood group, 26.1% had B, and 23.5% had A, while AB were only observed in 11.8%. Around three-quarters (74.8%) were Rh positive and 23.5% were hypertensive. The results showed insignificant relations between ABO blood group with gender, DM and type of DM. There was a highly significant relation between DM and (Rh) blood group, while it showed insignificant relations between gender and type of DM with (Rh) blood group. **Conclusion:** The finding of the present study indicated that, in Arar city population, no evidence was found that particular ABO blood group was more susceptible to develop diabetes mellitus. While the study showed a highly significant relation between DM and (Rh) blood groups.

**Key words:** ABO blood group, diabetes mellitus, Arar city, Rhesus factor (Rh), risk factor, association.

**Introduction:**

The phenotypic ABO blood groups are polymorphic, inherited, antigenic substances found on the surface of red blood cells in addition to other tissues<sup>[1]</sup>. The term “blood group” refers to the entire blood group system comprising red blood cell (RBC) antigens whose specificity is controlled by a series of genes which can be allelic or linked very closely on the same chromosome<sup>[2]</sup>.

Red blood cell antigens, which are the basis of blood grouping, consist of proteins and carbohydrates attached to lipids or proteins. Blood group antigens are hereditary determined and plays a vital role in transfusion safety, understanding genetics, inheritance pattern, and disease susceptibility<sup>[3]</sup>.

Rhesus factor (Rh) is the most well-recognized blood group system after ABO, probably because of the dramatic presentation of a fetus suffering hemolytic disease of the newborn (HDN) following maternal alloimmunization to the D antigen<sup>[4]</sup>.

The Rh blood group system consists of 49 defined blood group antigens; D, C, c, E, and e are the most important among which. Rh (D) status of an individual is normally described with a positive or negative suffix after the ABO type<sup>[5]</sup>. There are more than 36 blood group systems involving over 379 antigens listed by the International Society of Blood Transfusion in which ABO is the most studied group in the human population<sup>[6]</sup>.

It was reported that there are various associations between particular ABO phenotypes and an increased susceptibility to disease<sup>[3]</sup>. For example, gastric cancer is found to be more common in blood group A individuals, whereas gastric and duodenal ulcers or Schizophrenia occur more commonly among the O blood group individuals<sup>[7]</sup>, while Rh antigens were reported to be a risk factor of different diseases such as noise-induced hearing loss (NIHL)<sup>[8]</sup>. Some epidemiological studies demonstrated significant association between the “ABO” blood group and the risk

of diabetes mellitus. In the study of **Barbalic et al.** <sup>[9]</sup>, it was reported that blood group B was associated with a decreased risk of diabetes compared to blood group O. On the other hand, **Fagherazzi et al.** <sup>[10]</sup> introduced O blood group as protective factor against type 2 DM. However, some studies did not find any relationship between blood group and DM <sup>[7]</sup>. We refer these conflicting results to having small cross-sectional hospital-based populations <sup>[11]</sup>, also, up to our knowledge; there were no previous studies in Northern Saudi Arabia about the association between DM with Rh.

Therefore, this study aimed at finding out the possible association between “ABO” blood groups and “Rhesus factor groups” with diabetes mellitus.

**Methods:**

**Study design:** A cross-sectional study was conducted in Arar city, Northern Saudi Arabia, during the period from February 2016 to May 2018.

The study included 532 participants 12 years or older from the general population of Northern Saudi Arabia.

**Data collection:** by a pre-designed online questionnaire which was distributed among the population. It was self-administered by participants after a brief introduction or explanation of the idea of the research. The questionnaire included the relevant questions to collect data about:

- Socio-demographic characteristics of the participants including age, marital status and educational status
- If the patient was diabetic, type and period of diabetes, height and weight. The BMI was calculated. Normal weight was defined as BMI $\leq$ 25 kg/m<sup>2</sup>, overweight as 25<BMI $\leq$ 30 kg/m<sup>2</sup>, and obesity as BMI $\geq$ 30 kg/m<sup>2</sup> I, .
- Blood group and Rh of participant.

**Ethical considerations:** Participants were informed that participation is completely voluntary. No names were recorded on the questionnaires and protection of

confidentiality and all questionnaires were kept safe.

**Statistical analysis:** Collected data were coded and analyzed using statistical package for the social sciences, version 15 (SPSS Inc., Chicago, Illinois, USA). The X<sup>2</sup>-test was used as tests of significance. Differences were considered significant at P value 0.05 or less.

**Results:**

Table (1): Shows Gender, age group, BMI group, educational level, marital status, working status and DM in the studied population. The studied population were 532, 318 (59.8%) were males. Most of the population were 20-29 years old (41.4%). Normal weight, overweight and obese were all around 30% (each), the majority were university or higher educated (58.5%), more than half were singles (55.8%), slightly less than half were working (44.9%), and 119 were suffering from diabetes mellitus (22.4%).

Table (2): demonstrates type of DM and its treatment, ABO blood group, Rhesus factor and hypertension in the studied diabetic cases (N=119). Surprisingly, more than half the cases were Type 1 diabetics (53.8%). 35.3% of the cases used only tablets for treatment, 33.6% used only insulin, 10.1% used both, and those who use diabetic diet were around fifth (21%). Most of the cases had O blood group (38.7%), 26.1% had B, 23.5% had A, while AB were only 11.8%. Around three-quarters were Rh positive (74.8%), and 23.5% were hypertensives.

Table (3): Illustrates the association of gender, DM and type of DM with ABO blood group. The table reveals insignificant relations between gender, DM and type of DM with ABO blood group.

Table (4): Illustrates the association of gender, DM and type of DM with (Rh) blood group. The table displays a highly significant relation between DM and (Rh) blood group, while insignificant relations between gender and type of DM with (Rh) blood group.

Table (1): Gender, age group, BMI group, educational level, marital status, working status and DM in the studied population. (N=532)

| <b>Gender</b>            | <b>No.</b> | <b>%</b> |
|--------------------------|------------|----------|
| - Male                   | 318        | 59.8     |
| - Female                 | 214        | 40.2     |
| <b>Age group</b>         |            |          |
| - 12 – 19 years          | 101        | 19.0     |
| - 20 – 29 years          | 220        | 41.4     |
| - 30 – 39 years          | 111        | 20.9     |
| - 40 – 59 years          | 90         | 16.9     |
| - > 60 years             | 10         | 1.9      |
| <b>BMI group</b>         |            |          |
| - Underweight            | 54         | 10.2     |
| - Normal weight          | 163        | 30.6     |
| - Overweight             | 160        | 30.1     |
| - Obese                  | 155        | 29.1     |
| <b>Educational level</b> |            |          |
| - Primary                | 23         | 4.3      |
| - Intermediate           | 38         | 7.1      |
| - Secondary              | 160        | 30.1     |
| - University or higher   | 311        | 58.5     |
| <b>Marital status</b>    |            |          |
| - Single                 | 297        | 55.8     |
| - Married                | 218        | 41.0     |
| - Divorced               | 13         | 2.4      |
| - Widow                  | 4          | 0.8      |
| <b>Working status</b>    |            |          |
| - Working                | 239        | 44.9     |
| - Not working            | 293        | 55.1     |
| <b>Diabetes mellitus</b> |            |          |
| - Yes                    | 119        | 22.4     |
| - No                     | 413        | 77.6     |

Table (2): Type of DM and its treatment, ABO blood group, Rhesus factor and hypertension in the studied cases. (N=119)

|                                  | <b>Frequency</b> | <b>Percent</b> |
|----------------------------------|------------------|----------------|
| <b>Type of diabetes mellitus</b> |                  |                |
| - Type 1                         | 64               | 53.8           |
| - Type 2                         | 55               | 46.2           |
| <b>Type of treatment</b>         |                  |                |
| - Only tablets                   | 42               | 35.3           |
| - Only insulin                   | 40               | 33.6           |
| - Both Insulin and tablets       | 12               | 10.1           |
| - Diabetic diet                  | 25               | 21.0           |
| <b>ABO blood group</b>           |                  |                |
| - A                              | 28               | 23.5           |
| - B                              | 31               | 26.1           |
| - AB                             | 14               | 11.8           |
| - O                              | 46               | 38.7           |
| <b>Rhesus factor (Rh)</b>        |                  |                |
| - Rh +                           | 89               | 74.8           |
| - Rh -                           | 30               | 25.2           |
| <b>Hypertension</b>              |                  |                |
| - Yes                            | 28               | 23.5           |
| - No                             | 91               | 76.5           |

Table (3): Association of gender, DM and type of DM with ABO blood group.

|                            |        | ABO blood group |              |              |              | Total<br>(N=532) | P value |
|----------------------------|--------|-----------------|--------------|--------------|--------------|------------------|---------|
|                            |        | A<br>(N=136)    | B<br>(N=129) | AB<br>(N=47) | O<br>(N=220) |                  |         |
| Gender                     | male   | 90              | 74           | 29           | 125          | 318              | 0.320   |
|                            |        | 66.2%           | 57.4%        | 61.7%        | 56.8%        | 59.8%            |         |
|                            | female | 46              | 55           | 18           | 95           | 214              |         |
|                            |        | 33.8%           | 42.6%        | 38.3%        | 43.2%        | 40.2%            |         |
| Diabetes mellitus          | yes    | 28              | 31           | 14           | 46           | 119              | 0.529   |
|                            |        | 20.6%           | 24.0%        | 29.8%        | 20.9%        | 22.4%            |         |
|                            | no     | 108             | 98           | 33           | 174          | 413              |         |
|                            |        | 79.4%           | 76.0%        | 70.2%        | 79.1%        | 77.6%            |         |
| *type of diabetes mellitus | type 1 | 16              | 20           | 6            | 22           | 64               | 0.408   |
|                            |        | 57.1%           | 64.5%        | 42.9%        | 47.8%        | 53.8%            |         |
|                            | type 2 | 12              | 11           | 8            | 24           | 55               |         |
|                            |        | 42.9%           | 35.5%        | 57.1%        | 52.2%        | 46.2%            |         |
| Rhesus factor (Rh)         | Rh +   | 121             | 109          | 43           | 178          | 451              | 0.109   |
|                            |        | 89.0%           | 84.5%        | 91.5%        | 80.9%        | 84.8%            |         |
|                            | Rh -   | 15              | 20           | 4            | 42           | 81               |         |
|                            |        | 11.0%           | 15.5%        | 8.5%         | 19.1%        | 15.2%            |         |

\*percentages calculated only in DM cases, N=119

Table (4): Association of gender, DM and type of DM with (Rh) blood group.

| Parameters                 |        | (Rh) blood group |                 | Total<br>(N=532) | P value |
|----------------------------|--------|------------------|-----------------|------------------|---------|
|                            |        | Rh - (N=81)      | Rh +<br>(N=451) |                  |         |
| Gender                     | male   | 51               | 267             | 318              | 0.306   |
|                            |        | 63.0%            | 59.2%           | 59.8%            |         |
|                            | female | 30               | 184             | 214              |         |
|                            |        | 37.0%            | 40.8%           | 40.2%            |         |
| Diabetes Mellitus          | yes    | 30               | 89              | 119              | 0.001   |
|                            |        | 37.0%            | 19.7%           | 22.4%            |         |
|                            | no     | 51               | 362             | 413              |         |
|                            |        | 63.0%            | 80.3%           | 77.6%            |         |
| *Type of Diabetes Mellitus | type 1 | 16               | 48              | 64               | 0.560   |
|                            |        | 53.3%            | 53.9%           | 53.8%            |         |
|                            | type 2 | 14               | 41              | 55               |         |
|                            |        | 46.7%            | 46.1%           | 46.2%            |         |
| Hypertension               | yes    | 6                | 47              | 53               | 0.271   |
|                            |        | 7.4%             | 10.4%           | 10.0%            |         |
|                            | no     | 75               | 404             | 479              |         |
|                            |        | 92.6%            | 89.6%           | 90.0%            |         |

\*percentages calculated only in DM cases, N=119

**Discussion:**

ABO blood type and Rhesus (Rh) factors are genetically inherited traits and there is an evidence in literature that individuals with certain blood types are more prone to develop certain diseases. For example, it was suggested in the study of **Zakai et al.** [12] that AB blood type is associated with risk of stroke compared with the O blood group. It was also reported that more diabetic patients were individuals

with the AB blood group than with other blood groups.

Studies run in Malaysia [13], and India [14] found an association between DM and type B blood group. Moreover, the study of **Qureshi & Bhatti** [15] found an association between ABO blood group and DM type 2 with highest distribution of diabetic patients in blood group B individuals.

A study by **Sahi et al.** [16], run among Algerian

population found contrary results of lower frequencies of type A and B blood among diabetic patients in comparison to the healthy population.

Although in the present study associations did not reach the level of statistical significance, higher percentage (29.8%) of diabetic patients had AB blood group and those with type B blood group (24%) were more than those having type A and type O (20.6% and 20.9%, respectively). It was also found that type B blood group was most frequent among Type 1 diabetes mellitus.

Several reports have evaluated the possible relationship between diabetes mellitus and Rh blood group; however, the populations vary and the findings are inconsistent.

Our study found a high statistical association between Rhesus factor and developing diabetes mellitus. Where more frequencies of diabetic patients are Rh negative. These findings are in accordance with the results of **Waseem *et al.*** <sup>[17]</sup>, who found increased frequency of Rh negative blood group in diabetics. Other studies found no association between rhesus blood groups and DM. According to **Sahi *et al.*** <sup>[16]</sup>, the Rhesus factor may play a role in glucose metabolism and may influence the expression of DM.

Studies reported conflicting results and this may be due to the geographical factors and genetic expression of diseases. Future research and investigations are required to fully understand the interrelation of ABO and Rh blood groups and different diseases.

#### **Conclusion and recommendations:**

The finding of the present study showed that, in Arar city population, we could not find any evidence that particular ABO blood group was more susceptible to develop diabetes mellitus. While the study showed a highly significant relation between DM and (Rh) blood groups. We recommend large-scale study with full investigations of DM and ABO and (Rh) blood groups.

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