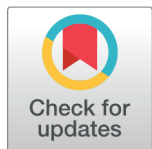


## RESEARCH ARTICLE



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## Distribution of ABO and Rhesus Blood groups among Type-2 Diabetic subjects

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### Abstract

ABO and Rh blood group systems have been associated with a number of diseases including type-2 diabetes mellitus (T2DM). Epidemiological studies have inconsistently associated ABO and Rhesus (Rh) blood groups with T2DM risk. To assess the distribution of ABO and Rh blood groups among type-2 diabetic subjects and to check the potential association between ABO and Rh blood groups with T2DM. This small retrospective case-control study was conducted at DM WIMS Hospital, Wayanad. One-year data (from Jan-18 to Jan-19) of fasting, postprandial or random plasma/serum glucose, HbA1c, ABO and Rh blood groups of Non- diabetic and type -2 diabetic subjects were collected from the Hospital Clinical Laboratory Medicine department. Among 280 randomly selected data, 147 are non-diabetic subjects, and 133 are confirmed and known cases of type 2 diabetic mellitus. Subjects with Blood group B has the highest distribution percentage among group-2 (59.39%) in comparison with group-1 (34.02%), followed by A (19.55%), O (18.79%), AB (2.27%). Statistical analysis using Chi-square test among ABO and Rh blood groups between group-1 and group-2, showed a significant ( $p < 0.001$ ) association of blood group "B +ve" and least association of blood group "O +ve" with T2DM. However, the Rh Blood groups evaluation for T2DM showed no clear association, as both Rh +ve and Rh -ve were uniformly distributed in the groups. The ABO and Rh blood groups may have a possible role to play in the development of T2DM. The subjects with B + ve blood group are at greater risk for T2DM and O + ve blood group individuals are at lower risk for T2DM .

**Keywords:** Blood groups; ABO blood groups; Rh blood groups; Type 2 Diabetes Mellitus; distribution; association

### Introduction

Diabetes Mellitus (DM) is a group of metabolic diseases characterized by

hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage,

dysfunction, and failure of different organs especially the eyes, kidneys, nerves, heart, and blood vessels.<sup>(1)</sup>

Associations between blood type and disease have been studied since the early 1900s when researchers determined that antibodies and antigens are inherited.<sup>(2)</sup> Both the ABO and Rh blood groups systems have been associated with a number of diseases, but this is more likely related to the presence or absence of these tissue antigens throughout the body and not directly or primarily related to their presence on RBCs.<sup>(3)</sup> Several epidemiological studies have demonstrated the connection between ABO and Rhesus (Rh) blood groups with type-2 DM (T2DM) risk,<sup>(4)</sup> but the findings were inconsistent.

In Wayanad, Kerala, data were lacking on the distribution of ABO and Rh blood groups among type-2 diabetic subjects and the possible association between blood groups and T2DM. Hence, this study was conducted to examine the same.

## Materials & Methods

### Study type and data source

A small retrospective case-control study was conducted at DM WIMS Hospital, Wayanad, during the period of May 2019- July 2019. Institutional Research Committee approval has been taken to conduct this study. One-year data (from Jan2018 – Jan2019) of fasting, postprandial or random plasma/serum glucose, HbA1c, ABO and Rh blood groups of Non-diabetic and type 2 diabetic subjects were collected from the data registry of Hospital Clinical Laboratory Medicine Department. Among 280 randomly selected subjects, 147 are non-diabetic subjects, and 133 are confirmed and known cases of type 2 DM.

### Study Design

#### Study Groups

1. **Control Group (Group-1):** consists of ABO and Rh blood groups data of 147 non-diabetic subjects (68 Males + 79 Females).
2. **Test Group (Group-2):** consists of ABO and Rh blood groups data of 133 type-2 diabetic subjects (71 Males + 62 Females).

#### Diagnostic Criteria for DM

As per the guidelines of WHO<sup>9</sup>, FPG > 126 mg/dl (7.0mmol/l) or Hb A1C > 6.5% or 2-h plasma/serum glucose > 200 mg/dl (11.1mmol/l) during an OGTT or random plasma/serum glucose > 200 mg/dl are labelled as diabetic subjects.

#### Inclusion Criteria

Both men and women diabetic subjects with age >40 years were included in the study irrespective of the duration of

diabetes, drugs are taken and other complications and are age-matched with nondiabetic subjects (controls).

### Statistical Evaluation

Statistical data analysis was done using Microsoft Excel worksheet, and Chi-square test was employed for correlation studies.

## Results

Results of the present study are summarized in Tables 1-4 and Pie Charts 1-12.

**Table 1.** Table showing distribution percentage of ABO blood groups in group 1 & 2

Parameters → Groups ↓	ABO Blood Groups Distribution (%)			
	A	B	AB	O
Group-1 (147)	17.69%	34.02%	3.4%	44.89%
Group-2 (133)	19.55%	59.39%	2.27%	18.79%

Note: number in parentheses denotes the number of subjects

**Table 2.** Table showing distribution percentage of Rh blood groups in group 1 & 2

Parameters → Groups ↓	Rh Blood Groups Distribution (%)	
	Rh+	Rh-
Group-1(147)	89.79%	10.21%
Group-2(133)	90.22%	9.78%

Note: number in parentheses denotes the number of subjects

**Table 3.** Table showing distribution percentage of both ABO & Rh blood groups in group 1 & 2

Blood Groups	ABO & Rh Blood Groups Combined Distribution (%)			
	Group – 1(147)		Group – 2(133)	
	Number	Percentage	Number	Percentage
A+	24	16.32%	21	15.7%
B+	46	31.29%	78	58.64%
AB+	5	3.4%	3	2.25%
O+	57	38.77%	18	13.53%
A-	2	1.36%	5	3.77%
B-	4	2.72%	1	0.85%
AB-	0	0	0	0
O-	9	6.14%	7	5.26%

Note: number in parentheses denotes the number of subjects

**Table 4.** Blood groups cross tabulation

		Groups		Total
		1	2	
A-	Count	2	5	7
	Expected Count	3.7	3.3	7
	% within Blood_group	28.60%	71.40%	100.00%
A+	Count	24	21	45
	Expected Count	23.6	21.4	45
	% within Blood_group	53.30%	46.70%	100.00%
AB+	Count	5	3	8
	Expected Count	4.2	3.8	8
	% within Blood_group	62.50%	37.50%	100.00%
B-	Count	4	1	5
	Expected Count	2.6	2.4	5
	% within Blood_group	80.00%	20.00%	100.00%
B+	Count	46	78	124
	Expected Count	65.1	58.9	124
	% within Blood_group	37.10%	62.90%	100.00%
O-	Count	9	7	16
	Expected Count	8.4	7.6	16
	% within Blood_group	56.20%	43.80%	100.00%
O+	Count	57	18	75
	Expected Count	39.4	35.6	75
	% within Blood_group	76.00%	24.00%	100.00%
Total	Count	147	133	280
	Expected Count	147	133	280
	% within Blood_group	52.50%	47.50%	100.00%

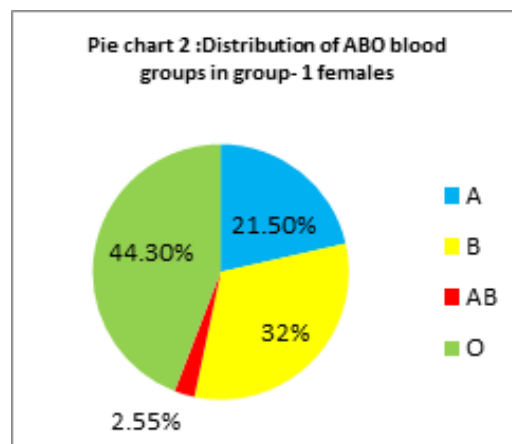


Chart 2:

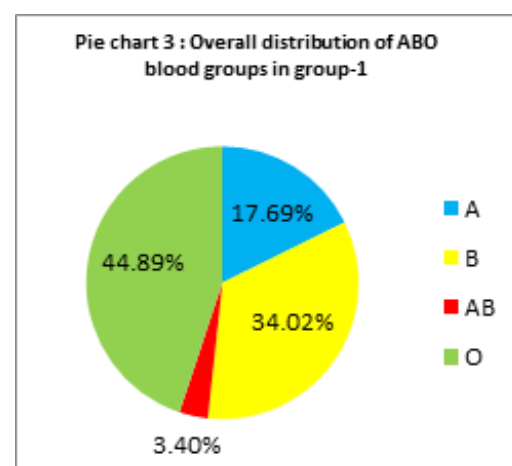


Chart 3:

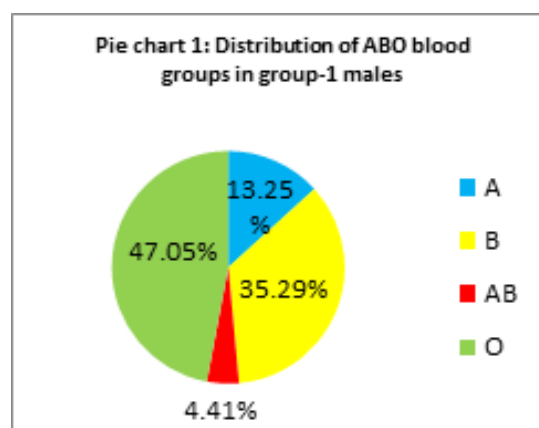


Chart 1:

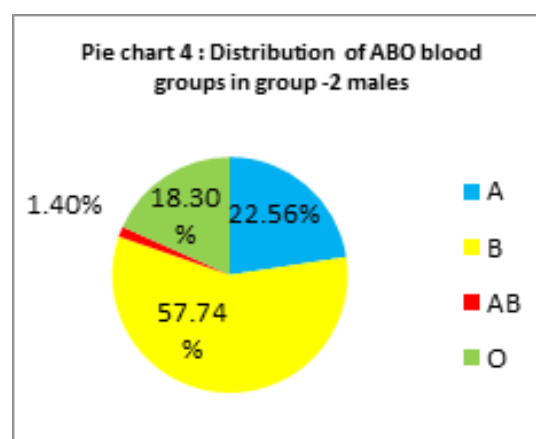


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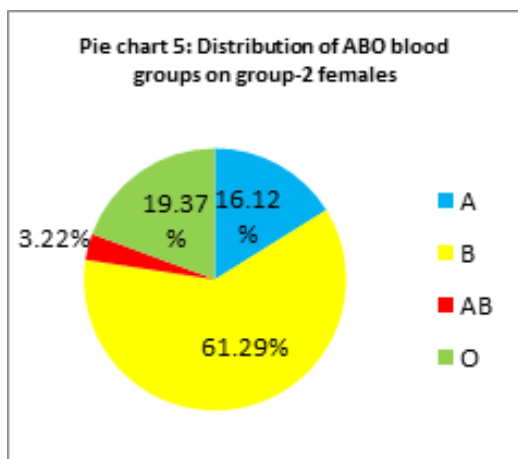


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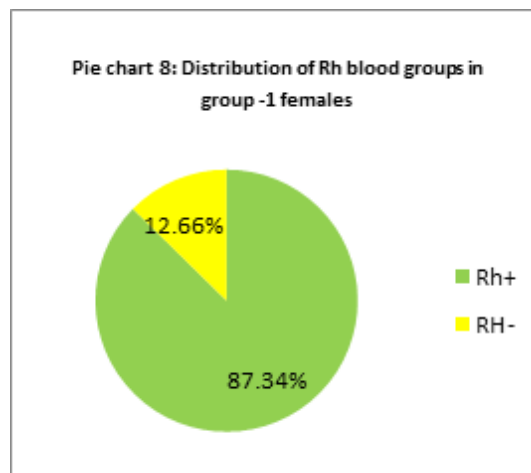


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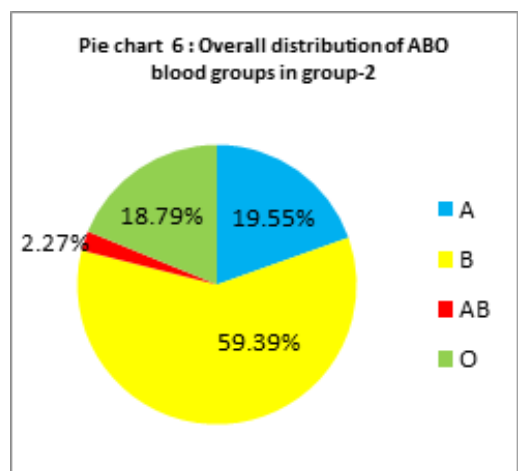


Chart 6:

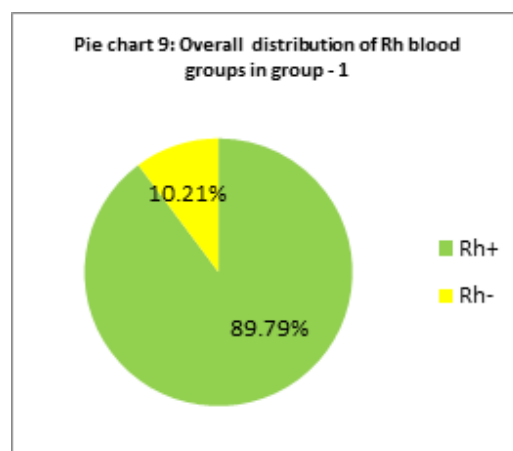


Chart 9:

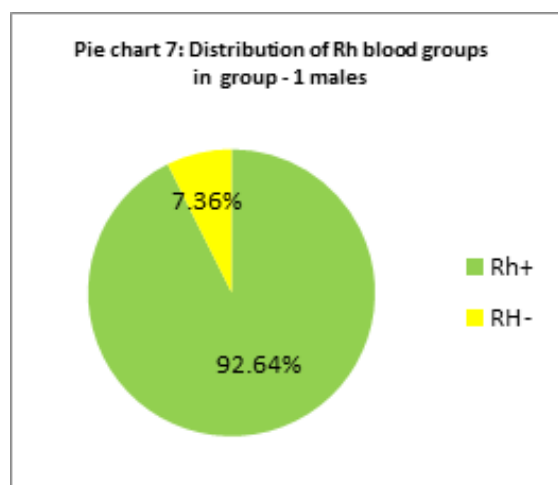


Chart 7:

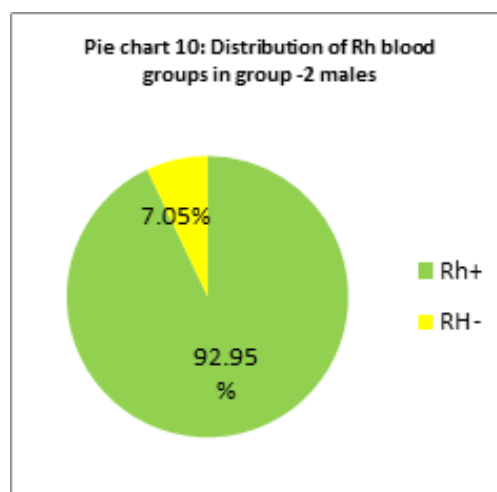


Chart 10:

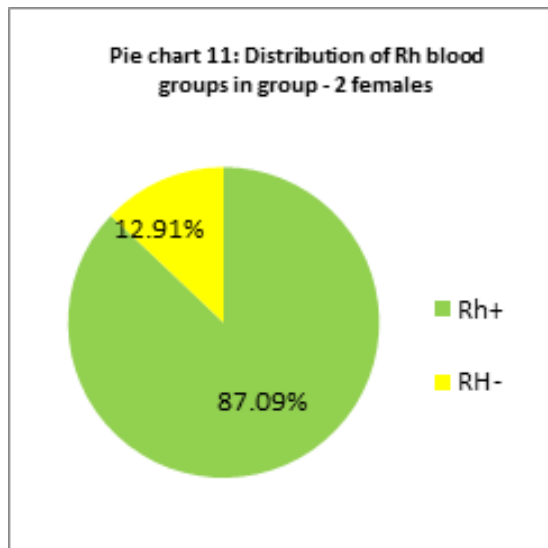


Chart 11:

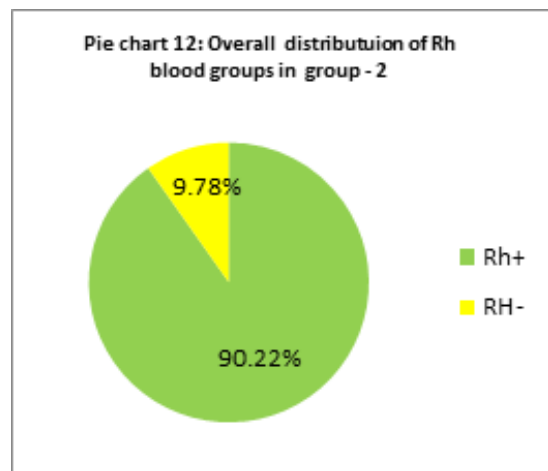


Chart 12:

## Discussion

ABO blood types and Rhesus (Rh) factors are genetically inherited traits and there is evidence in the literature that individuals with certain blood types are more prone to develop certain diseases. Many studies in recent years have shown an association between ABO groups with T2DM.<sup>(4,5)</sup> Several reports have evaluated the possible relationship between DM and Rh blood group; however, the populations vary and the findings are inconsistent.<sup>(6)</sup>

The results of the present study show that Blood group B has the highest distribution percentage among group-2 with the percentage of 59.39% in comparison with group-1 (34.02%), followed by A (19.55%), O(18.79%), AB(2.27%) [Refer Table-1]. Our study correlates with the database research studies of Meo *et al.*<sup>(7)</sup> observed that blood group B

is associated with a high incidence of T2DM. Sandhya Sharma *et al.*<sup>(4)</sup> have shown that the distribution of ABO blood groups observed was in the order of B > O > A > AB in diabetic subjects. Qureshi & Bhatti<sup>(8)</sup> found an association between ABO blood groups and T2DM with the highest distribution of diabetic patients in blood group B individuals. Many of these above studies<sup>(7,8)</sup> have also reported that blood group O has lower frequency or distribution in T2DM, and minimum association with T2DM, hence lesser risk for the same. This is consistent with the present study wherein, relatively lesser distribution of blood group O is seen in group-2 with the distribution percentage of 18.79 % whereas it has the highest distribution percentage among group-1 with 44.89% followed by B(34.02%), A(17.69%), AB(3.4%), suggesting that blood group O has the least risk for T2DM.

In the present study, when ABO blood groups and Rh blood groups data are taken together and statistically analysed using Chi-square test among different blood groups between group-1 and group-2 (refer Table-3 & 4), we observed a significant ( $p < 0.001$ ) association of blood group “B +ve” and least association of blood group “O +ve” with T2DM. This is in correlation with the studies of Fagherazzi G *et al.*<sup>(9)</sup> where they have observed that B and A blood group individuals were at increased risk of T2DM compared with those of O group. The greatest increase in risk was seen for those with the B +ve group. Moinszadeh *et al.*<sup>(10)</sup> evaluated 8126 participants, 5143 were male and 2983 were female. They observed that blood group “B +ve” was more frequent in diabetic patients (30.8%) compared to the control group (24.9%). Mandal B *et al.*<sup>(11)</sup> have found that people with O +ve blood group have the least chance of developing T2DM. Similar observations were also seen when the distribution of ABO and Rh blood groups in males and females were separately analysed (refer Pie charts 1-12) in the present study, suggesting that blood group B +ve has the highest risk for T2DM among both genders. However, when we considered Rh Blood groups alone for evaluating their association with T2DM, no clear association can be drawn as both Rh +ve and Rh -ve are uniformly distributed in both the groups (refer Table-2). But it is important to mention that Rh +ve distribution among both the groups is around 90% when compared to Rh -ve which is around 10%. This suggests that Rh +ve factor is more common in the general population as well as in type-2 diabetic subjects.

The possible mechanism in the development of an association between ABO and Rh blood types and incidence of T2DM is still not well-defined. The recent genome-wide association studies suggest that the ABO blood group antigen enhances the general body inflammatory state. Single nucleotide polymorphisms at the ABO locus are linked with two serum markers of inflammation, TNF- $\alpha$  and soluble intercellular adhesion molecule.<sup>(12,13)</sup> Increased expression of TNF- $\alpha$  has been associated with inflammation.<sup>(14)</sup> It is well-known that systemic inflammation is the main cause of

insulin resistance and ultimately plays a role in the development of type 2 diabetes. <sup>(15,16)</sup> The experimental and epidemiologic studies suggest that ABO blood groups and T2DM may be interrelated because of broad genetic and immunologic basis. <sup>(7)</sup> Moreover, the genetic makeup, which may lead to a link between the high association of blood group B and less association of blood group O with T2DM.

## Limitations of the Study

This is a small, retrospective study conducted in Wayanad region of Kerala. Further large-scale studies are needed to reach a definite conclusion.

## Conclusion

In conclusion, the ABO and Rh blood groups may have a possible role to play in the development of T2DM. The results of the present study have shown that subjects with B + ve blood group are at greater risk for T2DM and O + ve blood group individuals are at lower risk for T2DM. Our study suggests that subjects with blood group “B” may be closely monitored as they have an increased risk of T2DM. But the study on the exact mechanism of how people with certain specific blood groups will be at higher risk or lesser risk for T2DM is yet to be found out. Probably, large-scale studies with a molecular level approach might give us some insight on the molecular basis of the association of blood groups with diabetes.

## References

- 1) Expert committee on the Diagnosis and Classification of Diabetes Mellitus. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. 1997.
- 2) HHS Public Access, Blood Type Biochemistry and Human Disease. HHS Public Access. 2016.
- 3) Garratty G. Blood groups and disease: A historical perspective. *Transfusion Medicine Reviews*. 2000;14(4):291–301. Available from: <https://dx.doi.org/10.1053/tmrv.2000.16228>.
- 4) Sonwalkar J, Soni N. Strategies for Doing Business with Bulgaria. *Journal of Management Research and Analysis*. 2015;2:277. Available from: <https://dx.doi.org/10.5958/2394-2770.2015.00006.x>.
- 5) Alanazi M, Alkhidhr M, Alhadhari A, Al-Hathloul A, Alsharif E, Albahli S, et al. Association of Diabetes Mellitus with ABO Blood Groups & Rh. *The Egyptian Journal of Hospital Medicine*. 2018;73(4):6535–6540.
- 6) Jha S, Deep G, Shrestha S. Case control study of ABO blood group and Rhesus (Rh) factor in type 2 Diabetes Mellitus. *Indian Journal of Applied Research*. 2014;4(4):1–3.
- 7) Meo SA, Suraya F, Jamil B, Rouq FA, Meo AS, Sattar K, et al. Association of ABO and Rh blood groups with breast cancer. *Saudi Journal of Biological Sciences*. 2017;24(7):1609–1613. Available from: <https://dx.doi.org/10.1016/j.sjbs.2017.01.058>.
- 8) Qureshi MA, Bhatti R. Frequency of ABO blood groups among the diabetes mellitus type 2 patients. *J Coll Physicians Surg Pak*. 2003;13:453–455.
- 9) Fagherazzi G, Gusto G, Clavel-Chapelon F, Balkau B, Bonnet F. ABO and Rhesus blood groups and risk of type 2 diabetes: evidence from the large E3N cohort study. *Diabetologia*. 2015;58:519–522. Available from: <https://dx.doi.org/10.1007/s00125-014-3472-9>.
- 10) Moinszadeh F, Najafabady M, Toghiani G, A. Type 2 diabetes mellitus and ABO/Rh blood groups. *J Res Med Sci*. 2014;19:382.
- 11) Mandal B, Shukla R, Basu AK, et al. Association of ABO blood groups with type-2 diabetes mellitus and its complications. *J Diabetes Metab Disord Control*. 2018;5(1):1–7.
- 12) Paré G, Chasman DI, Kellogg M, Zee RYL, Rifai N, Badola S, et al. Novel Association of ABO Histo-Blood Group Antigen with Soluble ICAM-1: Results of a Genome-Wide Association Study of 6,578 Women. *PLoS Genetics*. 2008;4(7). Available from: <https://dx.doi.org/10.1371/journal.pgen.1000118>.
- 13) Melzer D, Perry JRB, Hernandez D, Corsi AM, Stevens K, Rafferty I, et al. A Genome-Wide Association Study Identifies Protein Quantitative Trait Loci (pQTLs). *PLoS Genet*. 2008;4(5):e1000072.
- 14) Park EJ, Lee JH, Yu GY, He G, Ali SR, Holzer RG, et al. Dietary and genetic obesity promote liver inflammation and tumorigenesis by enhancing IL-6 and TNF expression. *Cell*. 2010;140:197–208.
- 15) Schmidt MI, Duncan BB, Sharrett AR, Lindberg G, Savage PJ, Offenbacher S, et al. Markers of inflammation and prediction of diabetes mellitus in adults (Atherosclerosis Risk in Communities study): a cohort study. *The Lancet*. 1999;353(9165):1649–1652. Available from: [https://dx.doi.org/10.1016/s0140-6736\(99\)01046-6](https://dx.doi.org/10.1016/s0140-6736(99)01046-6).
- 16) Meigs JB, Hu FB, Rifai N, Manson JE. Biomarkers of endothelial dysfunction and risk of type 2 diabetes mellitus. *ACC Current Journal Review*. 2004;13(6):22. Available from: <https://dx.doi.org/10.1016/j.accreview.2004.06.067>.