



## Abnormal high Whole blood viscosity in Diabetes Mellitus: A Study

### KEYWORDS

Diabetes mellitus, Whole Blood Viscosity, Hematocrit, RBC deformability etc.

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**ABSTRACT** Diabetes mellitus is a chronic, lifelong condition that affects ability of our body to use the energy found in food substances. It is one of the most common endocrine disorder. All the Hemorheological parameters in diabetes mellitus are usually disturbed. These parameters consist of plasma proteins, erythrocyte aggregation, hematocrit, and erythrocyte deformability. The abnormalities associated with each of these parameters have been shown to noticeably increase both plasma and whole blood viscosity (WBV). Blood viscosity is a measure of the resistance to blood flow. Purpose of the present study is to explore the factors responsible for rise in blood viscosity in diabetes mellitus patients. In present study, estimation of blood viscosity has been done on 50 patients of diabetes and 25 controls. In present study it was observed that there is significant rise in blood viscosity in diabetes mellitus patients in compare to normal control person.

### Introduction

Diabetes mellitus is a chronic, lifelong condition that affects ability of our body to use the energy found in food substances. It is one of the most common endocrine disorder. It is a group of diseases (syndrome) which is characterized by disordered metabolism and abnormally high blood sugar. This high blood sugar is a result of either low insulin level or insulin resistance at numerous body cells. All the Hemorheological parameters in diabetes mellitus are usually disturbed. These parameters consist of plasma proteins, erythrocyte aggregation, hematocrit, and erythrocyte deformability. The abnormalities associated with each of these parameters have been shown to noticeably increase both plasma and whole blood viscosity (WBV).

Blood is a wonderful complex substance containing many chemical compounds to perform many functions. It constantly changes and adapts to meet the body's requirement. Healthy blood varies in viscosity as it flows normally and become much thinner by time it reaches the capillaries. It can even change viscosity locally at a given point in order to pass through a constriction. Blood viscosity is a measure of the resistance to blood flow. It can also be described as the thickness and stickiness of blood. Many studies show that microvascular complications are commonly seen in uncontrolled diabetic patients which lead to retinal damage and renal damage.

The principle determinants of blood viscosity are hematocrit red blood cell deformability, red cell aggregation and plasma viscosity. Plasma's viscosity is determined by water-content and macromolecular components. The macromolecular components are the plasma protein concentration and various types of protein in the plasma. Blood is Non Newtonian fluid so there is rise in blood viscosity at low blood flow rate. It is believed that it happens as a result of reversible aggregation of red cells at low shear rate. By making cone and plate viscometer direct observation made possible of the blood flowing under defined shear rates. Red cell aggregates occurring in all cases of low flow but there reversible dispersion of red cells by increasing the shear rate. In present study the cause of abnormal high whole blood viscosity in diabetic patient is established by measuring blood viscosity in vitro using Brookfield LV-2 viscometer.

**Objective of study-** To explore the factors responsible for rise in blood viscosity in diabetes mellitus patients.

**Material Method-** In present study, estimation of blood viscosity has been done on 50 patients of diabetes and 25 controls. This study does not include to patient affected by systemic hypertension, thrombo-embolic disease, patient under treatment with anticoagulant drugs and patient during menstrual cycle.

Using disposable plastic syringe, 3ml blood was collected by venepuncture in a vial containing 120IU of heparine. Blood viscosity measurement was done by Brookfield LV-2 type of viscometer with CP40 cone, which work on cone and plate principle at different shear rate of 22.5, 45 and 90 respectively.

### Observation-

#### Whole blood viscosity (cp) at different shear rates

Shear rates (Per second)	Blood Viscosity (centipoises)	
	Control	Patient with Diabetes Mellitus
22.5	6.51±1.23	8.39±1.58
45	5.22±1.00	6.49±1.24
90	4.07±0.64	5.70±1.15

#### Control/patient with diabetes mellitus

**P value -  $p < .001$**

**Result-** Whole blood viscosity was significantly higher than controls in diabetic patients.

**Discussion and Conclusion** This study is showing that there is significant rise in blood viscosity in diabetes mellitus patients in compare to normal control person.

The causes of rise of whole blood viscosity are

Rise in haematocrit: Many studies reported that there is increase in capillary permeability in Diabetes Mellitus.

Decrease in RBC deformability: In various studies it is found that the elevated glucose level causes stiffness in red cell membrane in chronic Diabetes Mellitus.

Increase in RBC aggregation: diabetes causes increase in red cell aggregation.

Increase in plasma viscosity: In diabetes mellitus plasma fibrinogen level rises which is one of the cause for rise in plasma viscosity.

**REFERENCE**

1.Cho, young I, Mooney, M Michael P and Cho, Daniel J (2008), Hemorheological disorder in Diabetes Mellitus, J Diabetes Sci Technol, 2(6) pp.1130-1168. | | 2. Barber, Alistair J and Antonetti David A, (2003). IOVS, 44, (12), pp.5410-5416. | | 3. Singh M, Shin S (2009). Change in erythrocyte aggregation and deformability in diabetes: a brief review, Indian J Exp Biol 47 (1) pp.7-15. | | 4. Babu N, Singh M (2004). Influence of hyperglycemia on aggregation, deformability and shape parameter of erythrocytes, Clin Hemorheol Microcirc, 31 (4) pp.273-280. | | 5. Kamada T, Baba Y and Otsuji S (1990). 'Biological changes in membrane related to rheological properties of diabetic erythrocytes', Monographs on Atherosclerosis, 15, pp. 198-208. | | 6. Lowe GDO, Lowe JM et al, (1980). 'Blood viscosity in young male diabetics with and without retinopathy', Diabetologia, 18 pp. 359-363. | 7. Lowe GDO, (1988). 'Nature and clinical importance of blood rheology', Clinical Blood Rheology, 1, pp.1-10. | 8. Roseneranz R. and Bogen SA, (2006). 'Clinical laboratory measurement of serum, plasma and blood viscosity', AMJ Clin pathol, 25, pp.578-586. |