

# LEUCOCYTE PHAGOCYtic RESPONSE IN RELATION TO ABO BLOOD GROUPS

O. P. TANDON

*Department of Physiology,  
University College of Medical Sciences, Ring Road, New Delhi-110016*

**Summary:** In vitro suspension technique was carried out in order to study the phagocytic activity of the leucocytes spun out from the blood of healthy young volunteers belonging to similar socio-economic group and having no history of recurrent infection, drug medication and chronic smoking. Saline suspension of *Staphylococcus aureus* was mixed with leucocyte rich cream and incubated at 37°C for 1/2 hr. Films were stained with Leishman and leucocytes were examined under microscope for calculation of their phagocytic coefficients. Blood group O seems to have highest values, followed by A, B and AB in that order. It is likely that the phagocytic co-efficient is correlated to the presence or absence of specific blood group substances ABH (O) or their antibodies.

**Key words:** phagocytosis                      phagocytic coefficient                      *staphylococcus aureus*  
blood group substances ABH(O)              leucocyte rich buffy coat              anti A and B antibodies

## INTRODUCTION

Since the discovery of ABO system of blood groups by Landsteiner in 1900, a lot of interest has been shown in finding out association of many diseases with blood groups. Most striking observations are those connecting ABO groups with diseases of upper gastrointestinal tract. Duodinal ulcer is 40% more frequent in O group (12). Group A susceptibility to cancer of stomach is 20% more than others (1). Tumours of salivary glands are more frequent in group A (4). Further closer association is found between non-secretors of ABH(O) substances and duodinal ulcers (5). It is surmised that the blood group substances in secretors protect them against diseases of GIT, where most of the Gram negative bacterial flora showed presence of blood group substances ABH(O) (15). Association between rheumatic fever and non-secretors and increased incidence of Leprosy in A group individuals has also been shown (9,13). Besides correlation of mental depression or schizophrenia with blood group (10), incidence of higher intelligent quotient in group A2 individuals followed by O and A1 has also been reported (8).

Though most of the diseases do not bear obvious antigenic basis with ABH(O) blood group substances, yet the high association of diseases of upper GIT with blood group substances cannot be simply ignored. Since white blood cells also have these substances on them (2,7), it was of interest to study whether there is a difference in their phagocytic activity in individuals of ABO blood group system.

## MATERIALS AND METHODS

Of the 278 subjects investigated for the blood groups, sixty three young, healthy volunteers in the age group of 16-22 yrs and having no drug addiction, alcoholism or chronic smoking

habit were selected. They belonged to similar socio-economic, dietary and nutritional status and were free from any infection at the time of study. For assessing leucocyte phagocytosis, 5 ml of blood in citrate solution was drawn from antecubital vein in the forenoon. Blood was immediately differentially centrifuged in order to separate leucocyte rich buffy coat. Leucocyte rich fluid was carefully drawn and 0.05 ml of this was gently mixed with saline suspension of  $1 \times 10^6$  staphylococcus aureus (coagulase positive). This mixture was gently agitated and incubated at  $37^\circ\text{C}$  for an hour. Uniformly thin films were drawn on glass slides and stained with Leishman. Hundred or more leucocytes were examined under oil immersion lens. The cocci ingested by each leucocyte were counted. Two values for leucocyte phagocytosis were determined as follows ;

$$\text{Coefficient I} = \frac{\text{No of Polymorphs containing cocci}}{\text{Total No of Polymorphs counted}} \times 100$$

$$\text{Coefficient II} = \frac{\text{Total No of cocci digested}}{\text{Total No of Polymorphs counted}}$$

Amongst neutrophils, number of nuclear lobes of the cell and the cocci ingested were also taken into consideration, in order to find out any correlation between ageing of neutrophils and its phagocytic activity.

## RESULTS

Table I shows the composite data in respect of blood group distribution and phagocytic activity. Leucocytes of subjects of O group have the highest response of phagocytosis both for coefficient I and II followed by those of A, B and AB in that order. Group O is significantly different respectively for both coefficient I and II when compared with group A ( $P \leq 0.01$ ,  $< 0.001$ ), B ( $P < 0.001$ ,  $< 0.01$ ) and AB ( $P < 0.001$ ,  $< 0.001$ ). The intergroup differences for these coefficients among A and B ( $P < 0.05$ ,  $< 0.01$ ), A and AB ( $P < 0.02$ ,  $< 0.01$ ) and B and AB ( $P < 0.01$ ,  $< 0.001$ ) are also significant.

TABLE I: Distribution of blood groups and their association with leucocyte phagocytic activity

Blood group	%* frequency	No. of subjects selected in each group	Coefficient I			Coefficient II		
			Mean	S.D.	S.E.	Mean	S.D.	S.E.
O	34.1	16	99.75	1.0	0.25	10.56	2.27	0.51
A	18.9	13	96.68	2.19	0.60	6.27	1.35	0.37
B	39.5	27	96.32	2.83	0.54	5.92	0.75	0.19
AB	7.5	7	95.34	2.73	1.03	5.1	2.35	0.82

\*Distribution amongst 278 students.

Table II shows the variation in phagocytic activity of neutrophil associated with its nuclear lobulation. It can be seen that the average number of cocci ingested per neutrophil decreased with increase in number of nuclear lobes in all the blood groups. The effects for the stage of lobulation are, however, maximum in blood group O, and least in AB, a feature similar to the phagocytic coefficients I and II.

TABLE II: Nuclear lobulation of neutrophil and its phagocytic activity (number of cocci/neutrophil) in ABO system of blood groups.

Blood group	No. of nuclear lobes of neutrophil			
	2	3	4	>4
O	9.6 (19)	10.6 (17)	9.2 (12)	8.2 (6)
A	6.1 (13)	6.2 (13)	5.5 (8)	4.4 (6)
B	5.9 (23)	6.2 (23)	5.5 (19)	4.2 (9)
AB	4.0 (5)	6.2 (5)	4.1 (4)	3.7 (4)

Numbers in parenthesis indicate number of observations made.

### DISCUSSION

The frequency distribution of blood groups amongst the student community from whom the subjects of present study were selected, is similar to that reported by other workers for the north Indians (11, 14). The phagocytic coefficients observed in this study are somewhat higher than reported by other workers in normal individuals (3). Though the *in vitro* suspension technique has been the same as used by others (3,16), the higher figures may perhaps be due to the careful screening of the subjects done on the basis of excluding some of those factors which are known to affect phagocytosis like habits of taking alcohol, smoking and drug medication. Amongst ABO groups, subjects of O group show highest phagocytosis followed by those of A,B and AB (Table I). Not only that if nuclear lobulation is taken as sign of maturity, O group leucocytes having same number of nuclear lobes as other group white cells (maturity being same) show more phagocytic activity (Table II). Three possibilities can be put forward to explain these quantitative differences :

1. Extent of phagocytosis by white cells may be genetically determined. If so the genetic constitution of subjects of blood group ABO may be a determining factor for leucocyte phagocytosis.

2. Presence of specific blood group substances in the leucocytes has been well documented (2,7). These substances are intrinsic in the white cells and not merely adsorbed from the plasma (6). Moreover presence of substance A on leucocytes is independent of the secretor status. These blood group substances in the leucocytes may affect their property of phagocytosis. It is conceivable that these antigenic substances may be found weak in some individuals and thus explain the differences in phagocytic activity amongst the subjects of same blood group.

3. Corresponding antibodies in the serum may influence ingestion power of leucocytes. These specific immunoglobulins are known to be involved in blood incompatibility. Presence of both these antibodies in blood group O may help in opsonisation of bacterial products and improve phagocytic power of leucocytes. By contrast absence in serum of anti A and B antibodies in group AB, would adversely affect the phagocytosis. Sharing of specific blood group substances ABHCO by certain micro-organisms and plants (15) would definitely interfere with individual's immune response. These agents will interact with already existing anti A and anti B antibodies in the serum of blood group O, whereas in other groups, the immune system will have to be sensitised first in order to produce specific antibodies.

The next step is to find out which out of these three possibilities is more prone to affect phagocytosis. It is proposed to scan the immunoglobulins from the serum of ABO system and find out if there is any significant correlation between phagocytic coefficients on one hand and immunoglobulins and the blood groups on the other.

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