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## Original article

## Association of ABO and Rh blood groups with breast cancer

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## ABSTRACT

**Objectives:** The aim of this study was to determine the association of “ABO” and “Rhesus” blood groups with incidence of breast cancer.**Methods:** In this study, we identified 70 research documents from data based search engines including “PubMed”, “ISI-Web of Knowledge”, “Embase” and “Google Scholar”. The research papers were selected by using the primary key-terms including “ABO blood type”, “Rhesus” blood type and “breast cancer”. The research documents in which “ABO” and “Rhesus” blood types and breast cancer was debated were included. After screening, we reviewed 32 papers and finally we selected 25 research papers which met the inclusion criteria and remaining documents were excluded.**Results:** Blood group “A” has high incidence of breast cancer (45.88%), blood group “O” has (31.69%); “B” (16.16%) and blood group “AB” has (6.27%) incidence of breast cancer. Blood group “A” has highest and blood group “AB” has least association with breast cancer. Furthermore, “Rhesus +ve” blood group has high incidence of breast cancer (88.31%) and “Rhesus –ve” blood group has least association with breast cancer (11.68%).**Conclusion:** Blood group “A” and “Rhesus +ve” have high risk of breast cancer, while blood type “AB” and “Rhesus –ve” are at low peril of breast cancer. Physicians should carefully monitor the females with blood group “A” and “Rh +ve” as these females are more prone to develop breast cancer. To reduce breast cancer incidence and its burden, preventive and screening programs for breast cancer especially in young women are highly recommended.© 2017 The Authors. Production and hosting by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

“ABO” blood types are polymorphic, antigenic, genetic substances which are established on the Red Blood Cells (RBCs) surface and some other cells and tissues. In 1900, Karl Landsteiner discovered the “ABO” blood group. “ABO” and “Rhesus” blood types are the major human blood type system with principal importance in

transfusion medicine (Siransy et al., 2015). Blood groups are characterized by small carbohydrate epitopes depending on the presence or absence of gene “A” and “B” positioned on 9q34 chromosome (Farhud and Yeganeh, 2013). “ABO” blood type system comprises of four major “ABO” phenotypes “A”, “B”, “O”, and “AB”. The “ABO” blood type system is allied with a number of illnesses including stomach and duodenal ulcer (Tanikawa et al., 2012), Hepatitis-B (Siransy et al., 2015), vascular diseases (Zakai et al., 2014), abdominal aortic aneurism (Fatic et al., 2015) and type 2 diabetes mellitus (Meo et al., 2016) and cancers (Gates et al., 2011; Wolpin et al., 2009). The epidemiological literature established the liaison among “ABO blood group” and the risk of breast cancer, although, conclusions were inconsistent and were not evidently clarified. Breast cancer occurrence rates are increasing among Asian women (Huang et al., 2016). Breast cancer is most common type of malignancy and the main cause of mortality in women globally. The high-

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**Table 1**

Association of “ABO” blood groups with breast cancer.

Authors and year	Study type	Blood groups	Breast cancer (%)
Cihan (2014)	Retrospective	“Blood group-A”	63
		“Blood Group-O”	17.6
		“Blood Group-B”	14.3
Sahar et al. (2013)	Cross sectional	“Blood group-AB”	5.1
		“Blood Group-A”	64
		“Blood Group-O”	18
Akhtar et al. (2010)	Cross sectional	“Blood Group-B”	9.6
		“Blood Group-AB”	8.4
		“Blood group-A “	42.4
Stamatakis et al. (2009)	Cross sectional	“Blood group-B”	30.3
		“Blood group-O”	21.2
		“Blood group-AB”	6.1
Yuksel et al. (2012)	Cross sectional	“Blood group-A”	47.59
		“Blood group-O”	33.13
		“Blood group-B”	13.85
Aly et al. (2014)	Cross sectional	“Blood group-B”	5.42
		“Blood group-A”	44
		“Blood group-O”	32
Ronco et al. (2009)	Cross sectional	“Blood group-B”	16
		“Blood group-AB”	8
		“Blood group-A”	53.1
Flavarjani et al. (2014)	Case–control study	“Blood group-O”	21.8
		“Blood group-B”	17.5
		“Blood group-AB”	7.5
Shiryazdi et al. (2015)	Cross sectional	“Blood group-O”	54.4
		“Blood group-A”	36.9
		“Blood group-AB”	6.7
Gates et al. (2012)	Cross sectional	“Blood group-B”	2.00
		“Blood group-O”	42.20
		“Blood group-A”	28.9
Yu et al. (2012)	Cross sectional	“Blood group-B”	23.70
		“Blood group-AB”	5.20
		“Blood group-A”	65.5
Payandeh et al. (2015)	Cross sectional	“Blood group-O”	21.4
		“Blood group-B”	9.0
		“Blood group-AB”	4.0
Saxena et al. (2015)	Retrospective	“Blood group-O”	43
		“Blood group-A”	36
		“Blood group-B”	13
Solak et al. (2011)	Retrospective	“Blood group-AB”	8
		“Blood group-O”	43
		“Blood group-A”	38
		“Blood group-B”	14
		“Blood group-AB”	5
		“Blood group-A”	43.42
		“Blood group-O”	31.57
		“Blood group-B”	15.78
		“Blood group-AB”	9.21
		“Blood group-A”	36.89
		“Blood group-B”	32.52
		“Blood group-O”	23.30
		“Blood group-AB”	7.28
		“Blood group-A”	28.8
		“Blood group-O”	31.57
		“Blood group-B”	9.8

est incidence was observed in the age groups 45–65 and 80–85 (Rafiemaneh et al., 2016). The occurrence of breast cancer has been associated with many factors such as age, history of menopause, inherent, environment, diet and obesity. In the current biomedical literature, limited documents are present to establish correlation of “ABO” and “Rhesus” blood groups with breast cancer. Therefore, the aim of this study was to find out the potential link among “ABO” and “Rhesus” blood groups with breast cancer.

## 2. Research methodology

### 2.1. Selection of studies

We searched and identified 70 research papers from the databases including “PubMed”, “Institute of Scientific Information” (ISI) “Web of knowledge”, “EMBASE” and “Google Scholar”. Two

investigators searched, reviewed and collected the literature, using keywords “ABO blood groups”, “Blood group A”, “Blood group B”, “Blood group AB”, “Blood group O” “Rhesus +ve” “Rhesus –ve” and “breast cancer”. The abstracts of the research articles were reviewed to determine the aptness for the research articles. All articles in which “ABO”, “Rh+ve” and “Rh–ve” blood groups and breast cancer were reported were considered appropriate for inclusion without limitations on research documents and language of the publications. We reviewed the 32 papers and finally 25 publications that harmonized our criteria were comprised and remaining papers were excluded.

### 2.2. Data extraction

The eligibility of the research papers were considered by two investigators and differences were determined by another mem-

ber. Research documents which were included in the study were peer-reviewed cross sectional, cohort studies and all studies included 100 or more breast cancer cases.

### 2.3. Ethics approval

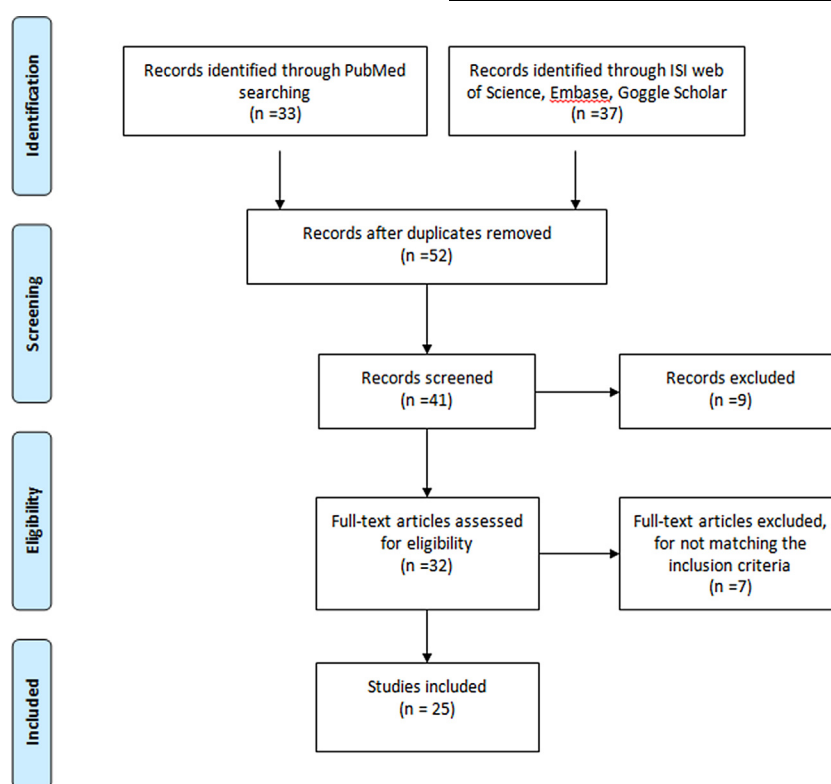
For this study, we collected data on “ABO” “Rhesus +ve” and “Rhesus –ve” blood types and breast cancer from research articles already published in databases, hence ethical approval was not required.

### 2.4. Statistical analysis

The data were computed into the computer; percentages were calculated and analyzed by using the Statistical Package for Social Sciences [SPSS for Windows, version 21.0].

nesses is not highly acknowledged in the scientific literature. Our results indicate that blood type “A” has high incidence of breast cancer and blood group “AB” has minimum association with breast cancer (Fig. 1). Moreover, females with “Rhesus +ve” blood group are at high peril of developing breast cancer (Fig. 2).

Yuksel et al., determined the role of “ABO” blood type and breast cancer risk. The overall frequency of breast cancer in females with blood group “A” was 44%, 32% “O”, 16% “B”, 8% “AB”, and 88% “Rh +”. Similarly, Aly et al., explored the relationships between blood groups with breast cancer risk. The incidence of breast cancer in females with “blood group A” was 53.1%, “O” 21.8%, “B” 17.5% and “AB” was 7.5%. The authors concluded that blood type “A” was positively linked with increased risk of breast cancer. Akhtar et al., conducted a research survey on the “ABO” blood group and incidence of different malignancies in India. The age, gender, “ABO” blood types of all the patients were recorded.



## 3. Results

Table 1 demonstrates the association of “ABO” blood groups and breast cancer. Blood group “A” is linked with high incidence of breast cancer (45.88%); blood group “O” (31.69%); “B” (16.16%); and blood group “AB” (6.27%). Blood group “A” has highest and blood group “AB” has least association with breast cancer (Fig. 1).

Table 2 shows a relationship of “Rhesus +ve” and “Rhesus –ve” blood groups and breast cancer. “Rhesus +ve” blood type is associated with high incidence of breast cancer (88.31%) and “Rhesus –ve” blood group has least association with breast cancer (11.68%) (Fig. 2).

## 4. Discussion

The “ABO” and “Rhesus” blood type system is the most important in transfusion medicine however vulnerability to some ill-

The occurrence of “blood group A” was significantly higher (42.4%) in breast cancer patients.

Stamatakis et al., studied the association between breast cancer and ABO blood groups in 166 Greek women. They found that the ductal nature of breast cancer was 49.6% in blood group “A” and was least common in patients with blood group AB 3.6%. Similarly, in the present study we found that the breast cancer was high in blood type A (45.88%) and lowest in blood group AB (6.27%). Zhang et al. (2014) investigated the association between ABO blood types and risk of numerous malignancies. They found that “blood group A” had high risk of breast cancer, ovarian, gastric, pancreatic and nasopharyngeal cancer. However, “blood group O” was linked with minimum risk to breast, ovarian, nasopharyngeal, esophagus, gastric, pancreatic and colorectal cancer. In addition, Solak et al. (2011) reported that the most frequent blood types in breast cancer were blood type A Rh +ve (28.8%), blood type O Rh +ve (21.3%) and blood type B Rh +ve (9.8%). Sahar et al. (2013) performed a study on 250 breast cancer patients. They classified the breast cancer patients according to their ABO blood types. They observed that

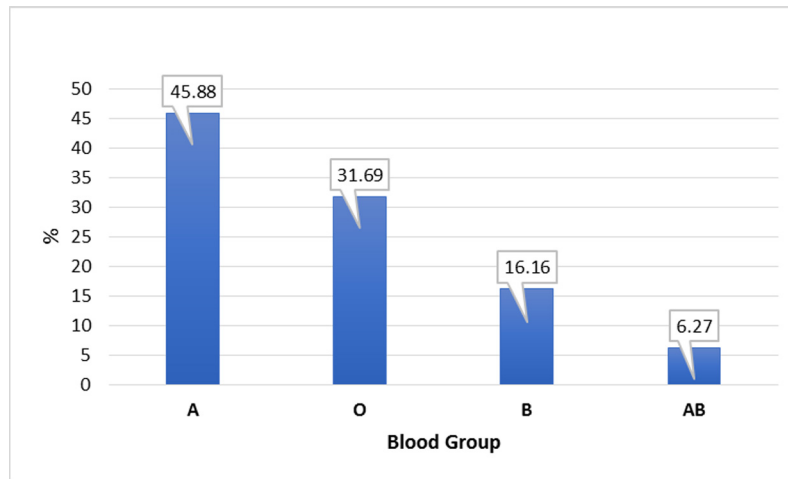


Fig. 1. "ABO" blood groups with breast cancer.

Table 2

Association of "Rh blood" groups with breast cancer.

Authors and year	Study type	Rh-blood groups	Breast cancer (%)
Cihan (2014)	Retrospective	Rh +ve Rh -ve	82 18
Stamatakis et al. (2009)	Cross sectional	Rh +ve Rh -ve	93.37 6.62
Yuksel et al. (2012)	Cross sectional	Rh +ve Rh -ve	88 12
Ronco et al. (2009)	Cross sectional	Rh +ve Rh -ve	70.2 29.8
Flavarjani et al. (2014)	Case-control study	Rh +ve Rh -ve	97.10 2.89
Shiryazdi et al. (2015)	Cross sectional	Rh +ve Rh -ve	93.4 6.6
Yu et al. (2012)	Descriptive analysis	Rh +ve Rh -ve	89 11
Payandeh et al. (2015)	Cross sectional	Rh +ve Rh -ve	93.42 6.57

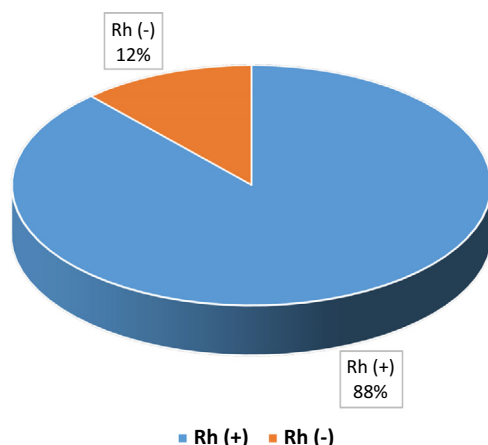


Fig. 2. "Rh-blood" groups and incidence with breast cancer.

blood type "A" was 64%; O 18%; B 9.6%; and blood type AB was 8.4%.

Gates et al. (2012) piloted a study on blood types and their association with breast cancer incidence among 67697 women. The authors did not find any linkage between the "ABO" blood

genotype and risk of breast cancer. Payandeh et al., evaluated the frequency of "ABO" blood groups and breast cancer incidence. The frequency of "A+" was 40.8%; "O+" 28.9%; "B+" 14.5% and "AB+" was 9.2%. The most likely mechanism in the progress of an association among "ABO" and "Rhesus" blood types and incidence of breast cancer has not been established yet. The current genome-wide association studies suggest that the "ABO" blood type antigen increases the incidence of breast cancer. The genetic factors are most probably involved in the etiology of breast cancer.

#### 4.1. Study limitations

This study has few limitations. No homogeneity in the included literature; study type, design and sample size. Moreover, there is dearth of blood group association studies in literature from the various corners of the globe.

## 5. Conclusion

Blood group "A" has high incidence of breast cancer and blood group "AB" has minimum occurrence of breast cancer. We also found that "Rh +ve" blood group has high incidence and "Rh -ve" blood type has less incidence of breast cancer. The current findings suggest that, physicians should carefully monitor the females with blood group "A" and "Rh +ve" as these females are more prone to

develop breast cancer. To reduce breast cancer incidence and its burden, preventive and screening programs for breast cancer especially in young women are highly recommended. Appropriate and affordable breast cancer preventive programs should be obligatory at primary, secondary and tertiary health care centers. Moreover, it is suggested that, females should be physically active, perform regular exercise, use fruits and vegetables in diet and maintain normal health weight, avoid smoking, alcohol, food additives, oral contraceptive pills, exposure to radiation and minimize the mental and emotional stress.

### Conflict of interest

The Authors declare that there are no conflicts of interest.

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