ABO and Rh blood groups as factors increase breast cancer risk, modified by age and sex.

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Abstract

Cancer is one of the leading causes of death worldwide, a malignant disease that occurs due to abnormal growth of some body cells and their spread to other parts of the body. It is divided into types according to the affected organ (colon, liver, lung, bone cancer... etc.). One of the most common types, especially among women, is breast cancer. Many risk factors associated with the likelihood of many researchers, and some research has shown a link between blood type and increased risk. Blood is divided into four groups; A, B, AB and O Based on the presence or absence of two types of antigens, which are anti A and anti B. This study aimed to investigate the association between blood type and Rh factor with increased risk of breast, as well as to determine the relationship between age, sex, and geographic distribution of breast cancer cases in the study area. The study was conducted on patients attending the African Institute for Cancer Treatment in Sabratha, reviewing data from 125 cases diagnosed in 2020-2021 at the center, and comparing the study sample with a control group of 100 blood donors without cancer. The study lasted from April 2022 to May of the same year. Results showed that there was strong correlation of blood type with positive rate in breast cancer. The most frequent patient population blood type was A+ (39.3%), followed by O+. The study also showed a correlation between sex and age, with 97.6% of the

patients being females especially among those who are aged 40-50 years. The study revealed that IR were higher in northern coastal areas notably Zawiya (35.2%).than those in the south (5.6%). Studies in the past have delivered mixed findings on this relation. Based on the study, it could be inferred that blood type, sex and age increase the chances of having breast cancer. It suggested to conduct more precise investigation with larger population and monitoring of A+ blood groups especially female individuals.

Keywords: breast cancer, blood type, Rh factor.

فصائل الدم والعامل الريزيسي كعوامل تزيد من خطر الإصابة بسرطان الثدي، متأثرة بمتغير العمر والجنس

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2 & 3 – باحثتان في قسم علم الحيوان – كلية العلوم – جامعة صبراتة – ليبيا.

ملخص:

السرطان أحد الأسباب الرئيسية للوفاة حول العالم، وهو مرض خبيث يحدث نتيجة نمو بعض خلايا الجسم بشكل غير طبيعي وانتشارها الى أجزاء أخرى من الجسم وينقسم الى أنواع حسب العضو المصاب (سرطان القولون، الكبد، الرئة، العظام ...الخ ومن أحد انواعه الأكثر شيوعا خاصة بين النساء سرطان الثدي، وقد تم تحديد العديد من عوامل الخطر المرتبطة باحتمالية الإصابة به من قبل العديد من الباحثين، حيث اظهرت بعض الأبحاث وجود صلة بين نوع فصيلة الدم وزيادة خطر الإصابة. يقسم الدم الى أربع فصائل هي (A، B، AB، O). حسب وجود او عدم نوعين من المستضدات وهي مستضد A ومستضد B. هدفت هذه الدراسة الى الكشف عن ارتباط نوع فصيلة الدم والعامل الريزيسي(Rh) بزيادة خطر الإصابة كذلك الوقوف على مدى ارتباط العمر والجنس بزيادة احتمال الإصابة وتحديد التوزيع الجغرافي للحالات المصابة بسرطان الثدي في منطقة الدراسة. أجريت الدراسة على الحالات المترددة على المعهد الافريقي لعلاج الأورام بصبراتة، وذلك بالرجوع لبيانات 125 حالة تم تشخيصها سنتي 2020 – 2021

بالمركز، ومقارنة عينة الدراسة بمجموعة ضابطة تشمل 100 متبرع بالدم من غير المصابين. استمرت الدراسة من شهر ابريل 2022 الى شهر مايو من نفس السنة. اظهرت نتائج الدراسة وجود ارتباط قوي بين فصيلة الدم والعامل الريزيسي بارتفاع خطر الإصابة وأوضحت ان الفصيلة A+ التي مثلتِ 39.3% من المرضى ثم الفصيلة O+ كما أظهرت ارتباط الإصابة بعامل   الجنس والعمر حيث كانت نسبة الإناث المصابة 97.6% بمتوسط عمري 40 الى 50 سنة ، كما اوضحت الدراسة ان نسبة الإصابة في المناطق الشمالية الساحلية خاصة الزاوية 35.2% اعلى من مناطق الجنوب 5.6%، في حين تضاربت نتائج الدراسات السابقة في تأكيد او نفي وجود هذا الارتباط ،ولخصت النتائج ان نوع الفصيلة والجنس والعمر من العوامل التي تزيد من خطر الإصابة. واوصت بتكثيف البحث وزيادة حجم عينة الدراسة مستقبلا للوصول لنتائج مرضية ودقيقة ومتابعة حاملي الفصيلة ألف موجب A+ خاصة من الإناث.

الكلمات المفتاحية: سرطان الثدي، فصيلة الدم، العامل الريزيسي (Rh).

Introduction

Cancer is characterized by uncontrollable cell growth and invasion of healthy tissues, with breast cancer being a leading cause of death among women globally, particularly in the 45–85 age group (1). It originates from breast cells, often in the milk ducts or lobules, and can spread to lymph nodes or other organs (2). Numerous risk factors, including lifestyle, age, genetics (notably BRCA1 and BRCA2 mutations), and environment, influence its development (1). While early diagnosis and healthy lifestyle choices are key preventive measures (10), recent research has explored the association between ABO/Rh blood groups and cancer risk (12). The ABO system, essential for transfusions and transplants, has been linked to various diseases, including tumors and cardiovascular disorders (3,4). Studies suggest that ABO antigens may influence tumor occurrence and progression, though they are not the primary cause (5,6,7,8).

Historical data from 1974 found no significant link between blood types and breast cancer (9), but a 1980 Tunisian study noted a slight increase in type A patient (2). Anderson et al. suggested that blood type A might influence breast cancer susceptibility (1), a finding supported by studies in Egypt (10,13,16), Kirkuk (11), and Saudi

Arabia (8). Conversely, research in the United States (6), Iran (12), Turkey (7), and Croatia (9) found no significant association. In Libya, studies have documented age distributions and geographic patterns, with a master's thesis at Zawia University reporting a higher incidence among individuals with blood type A Rh-positive, particularly in the Zawia region and the 40–59 age group (14,15).

Aim of study: The present study aimed to:
1. Examine the relationship between ABO and Rh blood groups and breast cancer risk.
2. Examine the association of age and sex with the probability of breast cancer.
3. Locate the geographic distribution of breast cancer cases in the study region.
Significance of study: With the number of new breast cancer cases rising annually-especially in women-more research and effort must be applied in order to understand what causes and accelerates the risk for breast cancer

Materials and Methods:
Study design: This study was designed as a retrospective comparative study.
Study setting and sample size: The study was conducted at the African Oncology Institute in Sabratha and included 125 patients diagnosed with breast cancer during the period 2020–2021. For comparative purposes, a control group of 100 healthy blood donors with no history of cancer was included.

Data collection:
Data were retrospectively collected from patient medical records during April to May 2022. Demographic and clinical data, including age, sex, place of residence, ABO blood group, and Rh factor, were recorded using a structured data collection form. Blood group testing was additionally performed for patients who were still under follow-up and lacked documented blood group result.

Blood group examination:
Blood samples were obtained by finger-prick after disinfecting the puncture site with medical alcohol. Three drops of blood were

placed on clean glass slides. One drop of each antiserum (anti-A, anti-B, and anti-D) was added to the blood drops and mixed thoroughly using sterile wooden sticks. Agglutination reactions were observed within approximately two minutes

Agglutination with anti-A indicated blood group A, agglutination with anti-B indicated blood group B, agglutination with both antisera indicated blood group AB, while absence of agglutination indicated blood group O. Agglutination with anti-D indicated Rh-positive, whereas absence of agglutination indicated Rh-negative status.

Ethical approval:

Ethical approval was obtained from the administration of the National Center for Oncology in Sabratha. Permission was granted to access patient medical records, and all data were handled confidentially with no risk or harm to patient information.

Statistical Analysis:

The primary data were analyzed using Statistical Package for the Social Sciences (SPSS) software. Measures of central tendency included the mean, while measures of dispersion included standard deviation. To analyze the strength of relationships, correlation coefficient and Chi-square tests were used.

Results:

A pilot sample of 225 individuals was taken, consisting of 23 males and 202 females. The number of patients in the sample was 3 males and 122 females, while the number of healthy individuals was 20 males and 80 females.

Table (1): Shows sample distribution by sex.

Percentage	Frequency	sex
% 10.22	23	Males
% 89.78	202	Females
%100	225	Total

Table 1 indicates that 10.22% of the sample are males and 89.78% are female.
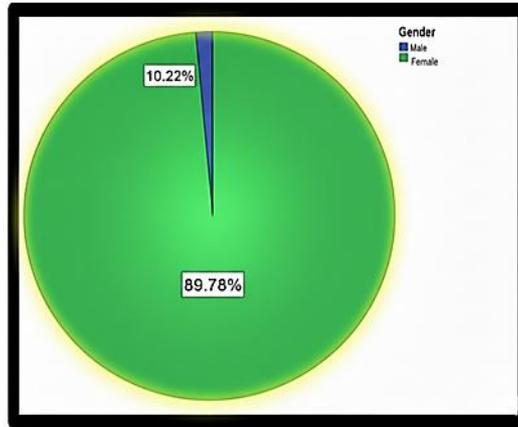
Figure (1): shows sample distribution by sex.

Table (2): shows sample age distribution by sex.

Total		Females		Males		
%	Frequency	%	Frequency	%	Frequency	Age
%4.4	10	5%	10	0%	0	< 20 years
%14.2	32	%13.9	28	% 17.4	4	20-30
%16.9	38	%16.3	33	%21.7	5	31-40
%27.1	61	%27.7	56	%21.7	5	41-50
%21.8	49	%23.3	47	5%8.7	2	51-60
%10.2	23	%9.9	20	%13	3	61-70
%4.9	11	%4	8	%13	3	71-80
%0.4	1	0%	0	% 4.3	1	.> 80 years
99.9%	225	% 100	202	99.9%	23	Total

From Table 2, it is observed that the highest percentage of females (27.7%) falls within the age group of 40-50 years, while the lowest percentage (0%) is in the age group of 80 years and above. For males, the highest percentage (21.7%) is in the age groups of 40-50 years and 30-40 years, while the lowest percentage (0%) is in the age group of less than 20 years.
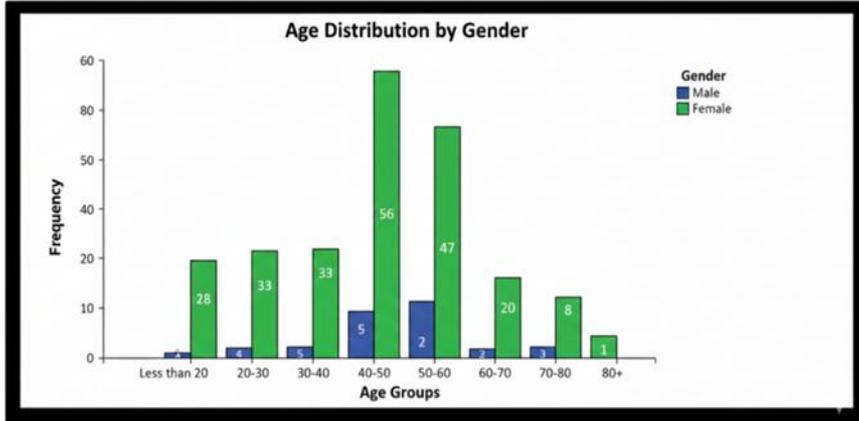
Figure. (2): Shows sample age distribution by sex

Table (3): Shows sample blood type distribution by sex.

Total		Females		Males		B. G
%	Frequency	%	Frequency	%	Frequency	
% 3.6	8	% 4	8	% 0	0	A-
% 39.6	89	% 89	77	% 52.2	12	A+
% 6.7	15	% 5.4	11	% 17.4	4	AB+
% 14.7	33	% 13.9	28	% 21.7	5	B+
% 32.4	73	% 35.1	71	%8.7	2	O+
% 3.1	7	% 3.5	7	2.3%	0	O-
% 100	225	% 100	202	100%	23	Total

From Table 3, it is observed that the highest percentage of females (89%) have blood type A+, while the lowest percentage (3.5%) have blood type O-. For males, the highest percentage (52.2%) have blood type A+, and the lowest percentage (0%) have blood type A-.
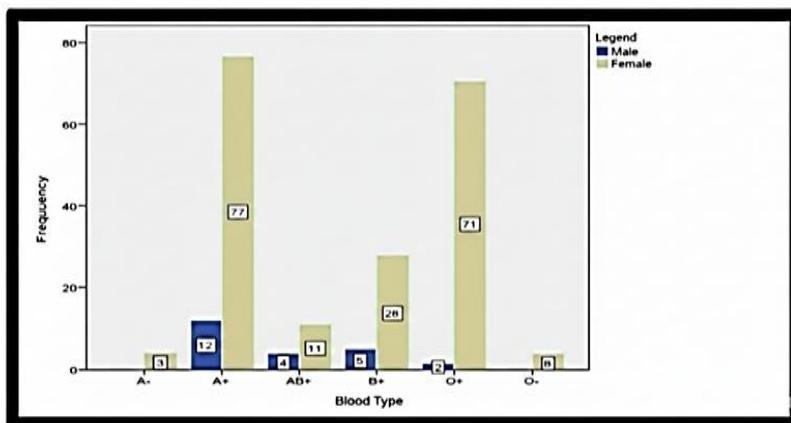
Figure (3): Shows sample blood type distribution by sex.

Table (4): Shows patient and non-patient distribution in the sample by sex.

Total		Patient		Non - patient		
%	frequency	%	frequency	%	frequency	sex
%10.2	23	%2.4	3	%20	20	Males
%89.8	202	%97.6	122	%80	80	Females
%100	225	%100	125	%100	100	Total

From Table 4, we observe that the percentage of healthy males is 20%, while healthy females is 80%. As for the sick individuals, males account for 2.4%, and females account for 97.6%.

Table (5): Shows patient distribution by sex.

Total		Females		Males	
%	Frequency	%	Frequency	%	Frequency
%100	125	%97.6	123	%2.4	3

From Table 5, we observe that males account for 2.4% of the sample size of sick individuals, while females account for 97.6% of the sample size of sick individuals.

Table. (6): Shows patient age distribution by sex.

Total		Females		Males		
%	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**Age**
3.2 %	4	3.3 %	4	0 %	0	..< 20 year
2.4 %	3	2.5 %	3	0 %	0	20–30
12 %	15	12.3 %	15	0 %	0	31–40
33.6 %	42	34.4 %	42	0 %	0	41–50
31.2 %	39	31.1 %	38	33.3 %	1	51–60
12 %	15	12.3 %	15	0 %	0	61–70
4.8 %	6	4.1 %	5	33.35%	1	71–80
0.8 %	1	1.2 %	0	33.3 %	1	....>80 year
100 %	125	100 %	122	100 %	3	Total

From table 6, we observe that the highest percentage of the sample size for females was in the age group (40-50) years, with a percentage of 34.4%, followed by the age group (50-60) years, with a percentage of 31.1%. The lowest percentage was in the age group (80 years and above), with a percentage of 0%. As for males, the highest percentage was in the age groups (50-60) years, (70-80) years, and (80 years and above), with a percentage of 33.3%.

Table (7): Shows blood type distribution by sex.

Total		Females		Males		B G
%	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	
0 %	0	0 %	0	0 %	0	A-
46.4%	58	46.7%	57	3.33%	1	A+
3.2%	4	2.5%	3	3.33%	1	AB+
12%	15	11.5%	14	3.33%	1	B+
38.4%	48	39.3%	48	0 %	0	O+
0 %	0	0 %	0	0 %	0	O-
100%	125	100%	122	100 %	3	Total

Table (8): Shows patients distribution according to residential areas

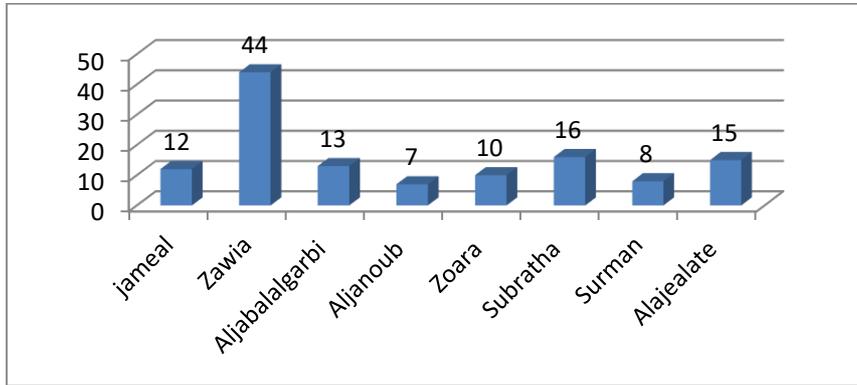| %	Frequency	Residence
9.6 %	12	Jameal
35.2 %	44	Zawia
10.4 %	13	Aljabal algarbi
5.6 %	7	Aljnoub
8 %	10	Zoara
12.8 %	16	Sabratha
6.4 %	8	Surman
12 %	15	Alajegat
100 %	125	Total

Figure (4): Shows patient distribution by residence areas.

B-Regarding healthy individuals:
Table (9): Shows non-patient distribution by sex.

Total		Females		Males	
%	Frequency	%	Frequency	%	Frequency
100%	100	80%	80	20%	20

From table (9), it is noted that the percentage of males was 20% of the sample size of healthy individuals, while the percentage of females was 80% of the sample size of healthy individuals.

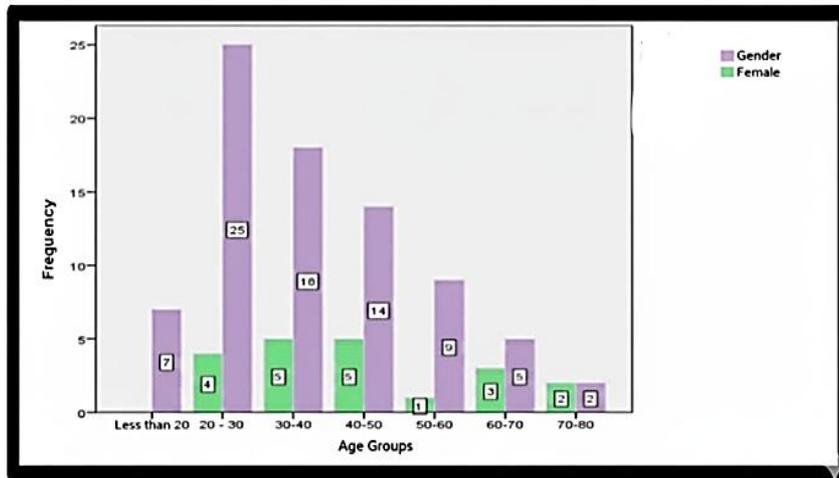Figure (5): Shows patient age distribution by sex.

Figure (5): Shows patient age distribution by sex.

حقوق الطبع محفوظة
للمجلة الدولية للعلوم والتقنية

And from figure (5), it is observed that the highest percentage of the female sample was in the age group (20-30) years, with a percentage of 31.2%, followed by the age group (30-40) years, with a percentage of 22.5%, and the lowest percentage was in the age group (70-80) years, with a percentage of 2.5%. For males, the highest percentage was in the age groups (30-40) years and (40-50) years, with a percentage of 25%, and the lowest percentage was in the age group less than 20 years, with a percentage of 0%.
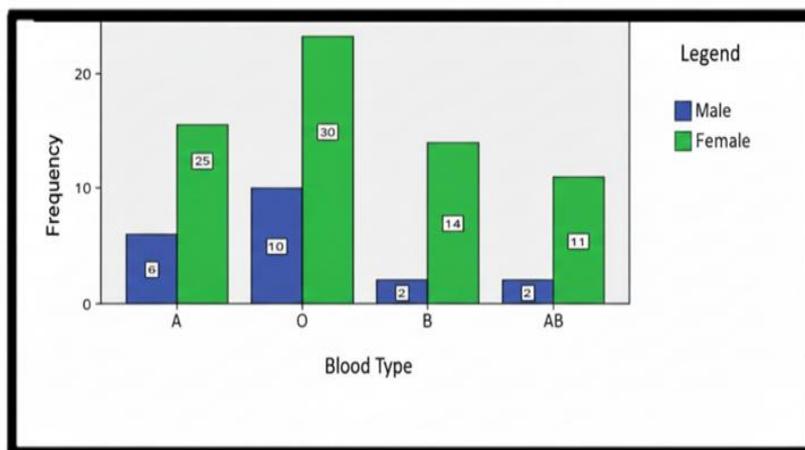

Figure (6): Shows non-patient blood type distribution by sex.

It can be seen from figure (6) that the most common blood group of the female sample was A+ by percentage of 36.3% where the least was O- with a percentage of 8.8%. For male, the most common type was blood group A(+) 55% and the least common types were A(-) and O(-) 0 %.

Discussion:

This study examined the association between ABO blood groups, Rh factor, and breast cancer risk, in addition to the role of age, sex, and geographic distribution among a Libyan population.

The ABO blood group system and Rh factor are highly related to the incidence of diseases, bring about increased susceptibility or lower prevalence in population samples, rendering them as risk factors. Statistical analysis showed that the most common age incidence of breast cancer in women was 40-50 years old, which is also similar to what has been reported from Libya in 2020 (14). The

most frequent blood group in breast cancer cases was A Rh-positive, which corresponds to Mourali N et al. 's 1980 (2).

 A significant association was also observed between breast cancer and blood group (p=0.015), with Chi-square analysis suggesting that the susceptible blood types were A and Rh-positive. The findings further revealed that the Zawia area residents (35.2%) were the most affected and those in southern areas had the least frequency of a 2020 master thesis at Zawia University (15).

The findings revealed a clear predominance of blood group A Rh-positive among breast cancer patients, as well as a markedly higher incidence among females, particularly within the age group of 40–50 years.

The higher frequency of blood group A Rh-positive observed in the present study supports the hypothesis that ABO blood group antigens may be associated with susceptibility to certain malignancies, including breast cancer. Similar findings have been reported in previous studies conducted in Tunisia, Saudi Arabia, and Egypt, where blood group A was more prevalent among breast cancer patients. These associations have been attributed to the role of ABO antigens in cell adhesion, immune response modulation, and tumor cell recognition, which may influence cancer development and progression.

Regarding sex distribution, the overwhelming predominance of female patients is consistent with the established epidemiology of breast cancer worldwide. The low proportion of male cases observed in this study aligns with global and regional reports indicating that male breast cancer remains rare. Hormonal factors, genetic predisposition, and reproductive history are widely recognized contributors to the higher incidence among females.

Age-specific analysis demonstrated that breast cancer occurrence peaked in the 40–50 year age group. This finding is in agreement with several regional studies from Libya and neighboring countries, which reported a relatively younger age at diagnosis compared to Western populations. This pattern may reflect differences in genetic background, lifestyle factors, reproductive behavior, and access to early screening programs.

The geographic distribution of cases showed a higher concentration in northern coastal areas, particularly Zawiya. This variation may be related to population density, environmental

exposures, lifestyle differences, or improved access to diagnostic and oncology services in urban regions compared to southern areas. However, this observation should be interpreted cautiously, as underreporting and limited healthcare access in remote regions may influence the observed distribution.

Although this study provides valuable insights, certain limitations should be acknowledged. The retrospective design and the relatively limited sample size may restrict the generalizability of the findings. In addition, other potential confounding factors, such as family history, hormonal status, and lifestyle variables, were not included in the analysis.

Conclusion:

The risks of suffering breast cancer in relation with the presence of A, Rh positive increased, however it is higher when both characteristics are combined. The research verified the relations between breast cancer and sex and age, and it has been proven that the females suffered more from this disease.

Recommendations:

The study advises that breast examinations should be conducted regularly, particularly for women over 40, with type A blood and Rh-positive antibody or residents in high-incidence areas. These findings need validation in future studies.

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14

حقوق الطبع محفوظة
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