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A Study of Association of ABO and Rh Blood Group with Colorectal Cancer in Khuzestan Province, Iran

Hosein Jodat[1,2], Javad Jodat[1,2], Ali Khodadadi[3,4], Abdolhassan Talaiezadeh[4,5], Nazanin Joudaki[6,7], Ali Asadirad[3,4]

[1]Student Research Committee, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[2]Department of Laboratory Sciences, School of Allied Medical Sciences, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[3]Department of Immunology, Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[4]Cancer Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[5]Department of Surgery, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[6] Department of Immunology, School of Medicine, Mazandaran University of Medical Sciences, Sari, Iran
[7]Student Research Committee, Mazandaran University of Medical Sciences, Sari, Iran

Corresponding Author: Ali Asadirad, Department of Immunology, Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
E-mail: asadirad-a@ajums.ac.ir

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ABSTRACT

Background: Colorectal cancer, a solid tumor with a high prevalence, contributes significantly to annual mortality rates. Various factors, including blood groups, may influence cancer risk. Multiple studies have suggested a potential connection between ABO and Rh blood groups and colorectal cancer risk. This study aims to investigate the role of ABO and Rh blood groups as risk factors in colorectal cancer patients.

Materials and Methods: We conducted a retrospective study involving 71 colorectal cancer patients diagnosed between 2018 and 2020 in Khuzestan province, Iran, with known ABO blood types. Large-scale data from 29,922 blood donors in Khuzestan served as the healthy population control. The study analyzed the distribution of ABO blood groups among the blood donors.

Results: Our findings revealed that the distribution of blood groups among colorectal cancer patients was as follows: O (31.0%), A (29.6%), B (29.6%), and AB (9.8%). However, our analysis did not establish a significant association between colorectal cancer risk and ABO antigens (P-value = 0.636) or Rh blood group (P = 0.198). Additionally, no significant differences in ABO blood types were observed concerning gender (P = 0.802), cancer type (P = 0.338), or tumor type (P = 0.207) among colorectal cancer patients.

Conclusion: This study does not support a significant correlation between ABO and Rh blood groups and the risk of colorectal cancer, nor does it find associations with cancer type or tumor type.

Keywords: ABO blood-group system; Rh-Hr blood-group system; Colorectal neoplasms; Risk factors; Solid tumors

INTRODUCTION

Solid tumors represent a significant public health concern worldwide, posing a substantial threat to human health and contributing to a high annual mortality rate. The diagnosis, management, and treatment of cancer are areas of extensive research focus, to identify risk factors that include biological biomarkers and demographic factors. Such factors can provide valuable insights into risk rates,

prognosis, treatment responses, and overall cancer outcomes, aiding in clinical decision-making.

Colorectal cancer ranks as the second most common cancer among women and the third most common among men[1,2]. It stands among the top six cancers with the highest mortality rates[3]. While curative surgery offers the possibility of long-term survival, rectal cancer can potentially metastasize to thoracic organs, bones, and the nervous system[2]. Although hereditary cancers are relatively rare, certain inherited characteristics, such as blood group systems, may be associated with cancer risk[4]. Among these factors, blood groups play a pivotal role.

The blood group system serves as a distinctive marker of identity, forming an integral part of an individual's personality and uniqueness[3]. The ABO gene encodes glycosyltransferases responsible for transferring nucleotide donor sugars to the H antigen, resulting in the formation of ABO blood group antigens. These antigens are expressed on the surface of red blood cells and various other tissue types, including those in the gastrointestinal tract[1].

Numerous studies have explored the relationship between different blood groups and the risk, prognosis, and outcomes of various cancers, including breast cancer, thyroid cancer, ovarian and vulvar cancer, skin cancer, cervix carcinoma, and gastrointestinal cancers[5-11]. Some earlier studies have indicated a connection between blood group systems and colorectal cancer risk, although others have not reported significant associations. Furthermore, studies reporting associations have identified different blood groups as correlated with colorectal cancer risk. Given these conflicting findings, this study seeks to investigate a potential link between the ABO Blood-Group System, Rh-Hr Blood-Group System, and the risk of colorectal cancer.

MATERIALS AND METHODS

Study design

A retrospective study encompassed 71 patients diagnosed with colorectal cancer, with known ABO blood types, between 2018 and 2020 in Khuzestan province, Iran. Demographic data, ABO blood groups, and pathological status were collected from the Cancer Research Center of Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran. Among the patients, 60.6% were male, and 39.4% were female, with a mean age of 56.73 years (ranging from 21 to 89 years). To compare the distribution of ABO blood groups between the cancer patients' group and the healthy population, we utilized data from a large-scale study that reported the distribution of ABO blood groups in 29,922 blood donors in Khuzestan province[12]. Furthermore, this research received approval from the ethics committee of Ahvaz Jundishapur University, with the ethics code for this study being IR.AJUMS.REC.1400.344.

Statistical analysis

All data were analyzed using SPSS version 26.0 software (IBM, Chicago, IL, USA). We employed the Chi-square ($\chi 2$) test or Fisher's exact test to assess the frequency distributions of data and potential associations with ABO blood groups. Graphs were generated using GraphPad Prism 8.0 software.

RESULTS

Colorectal cancer vs Health population

The findings of this study indicated a higher prevalence of blood group O in colorectal cancer patients (31.0%) (Table 1). Additionally, the distribution of ABO blood groups in patients with colorectal cancer resembled that of the healthy population (P = 0.636) (Figure 1).

The prevalence of Rh-positive individuals in colorectal cancer and healthy populations was high at 97.2% and 92.38%, respectively (Table 2). However, we did not observe any significant difference between the two groups (P = 0.198) (Figure 2).

Clinicopathological Characteristics and ABO Blood Type

As demonstrated in Table 3, no significant differences were found in ABO blood types concerning gender (P-value = 0.802), cancer type (P-value = 0.338), and tumor type (P-value = 0.207).

Clinicopathological Characteristics and Rh Type

The results revealed that the prevalence of the Rh factor did not significantly differ across different

cancer types (P = 1.000), tumor types (P = 0.340), or genders (P = 0.152) (Table 4).

Table 1: Distribution of ABO blood groups in colorectal cancer patients and healthy population

Blood type	A	B	AB	O	P
Colorectal cancer (%)	29.6%	29.6%	9.8%	31.0%	0.636
Healthy population (%)	28.0%	25.0%	7.0%	40.0%	

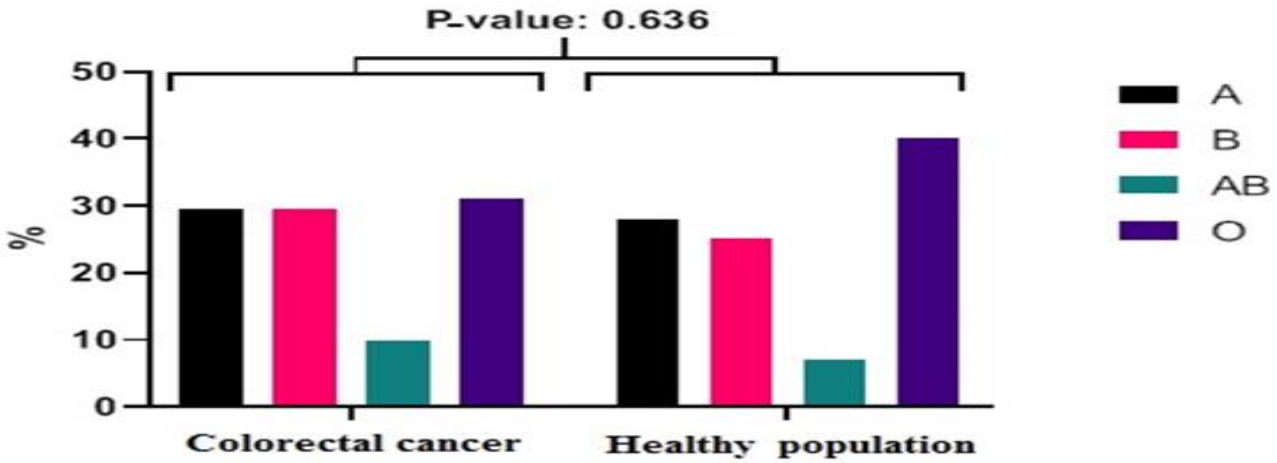

Figure 1. Frequency of different blood groups between colorectal cancer and healthy population, P < 0.05 indicate statistical significance.

Table 2: Prevalence of Rh type between colorectal cancer and healthy population

Blood type	Positive	Negative	P
Colorectal cancer (%)	97.2%	2.8%	0.198
Healthy population (%)	92.38%	7.62%	

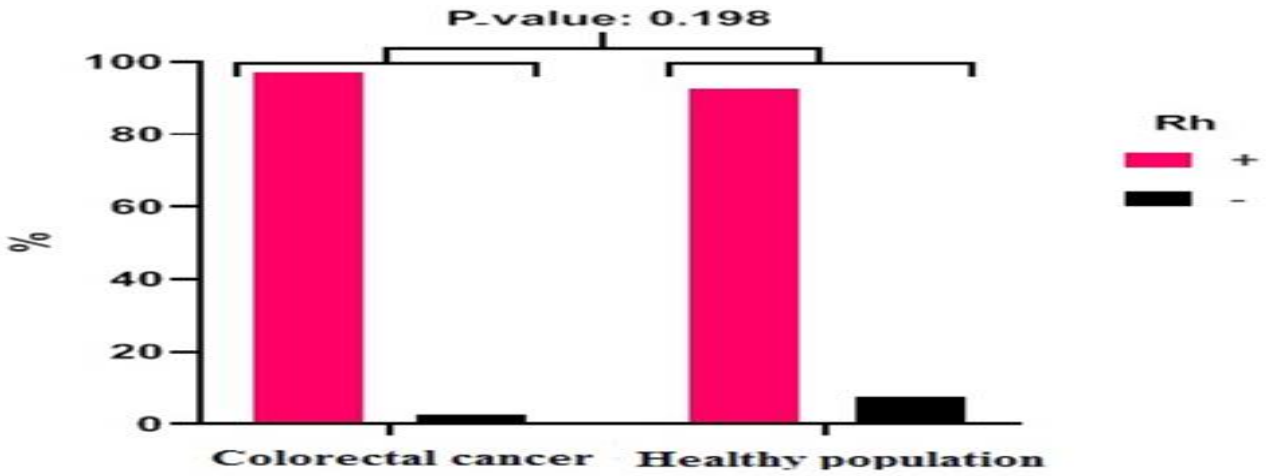

Figure 2. Distribution of Rh blood groups between colorectal cancer patients and healthy population. The highest frequency in both groups belonged to Rh-positive. P < 0.05 indicate statistical significance.

Table 3: Clinicopathological characteristics colorectal cancer patients according to ABO blood type

Blood type		A	B	AB	O	P
Total [N, (%)]		21 (29.6)	21 (29.6)	7 (9.8)	22 (31.0)	
Cancer type [N, (%)]	Colon	11 (22.9)	14 (29.2)	5 (10.4)	18 (37.5)	0.338
	Rectosigmoid	3 (42.9)	2 (28.6)	1 (14.3)	1 (14.3)	
	Rectum	6 (46.2)	5 (38.5)	1 (7.7)	1 (7.7)	
	Sigmoid	1 (33.3)	0 (0.0)	0 (0.0)	2 (66.7)	
Tumor type [N, (%)]	adenocarcinoma	12 (29.3)	15 (36.6)	5 (12.2)	9 (22.0)	0.207
	squamous cell carcinoma	1 (33.3)	1 (33.3)	0 (0.0)	1 (33.3)	
	Others	2 (28.6)	3 (42.9)	1 (14.3)	1 (14.3)	
	Missing*	6 (30.0)	2 (10.0)	1 (5.0)	11 (55.0)	
Gender [N, (%)]	Male	13 (30.2)	13 (30.2)	3 (7.0)	14 (32.6)	0.802
	Female	8 (28.6)	8 (28.6)	4 (14.2)	8 (28.6)	

* Others includes Tubular Adenoma with Low-Grade Dysplasia, Signet Ring Cell Carcinoma, Colonic Mucosa with High-Grade Dysplastic Change, Colonic Mucosa with Low-Grade Dysplastic Change, Adenomatous Polyp with Focal High-Grade Dysplasia, Villous Type Adenomatous Polyp with Focal High-Grade Dysplasia, Villous Type Adenomatous Polyp with Focal Low-Grade Dysplasia

Table 4: Clinicopathological characteristics colorectal cancer patients according to Rh type

Blood type		Positive	Negative	P
Total [N, (%)]		69 (97.2)	2 (2.8)	
Cancer type [N, (%)]	Colon	46 (95.8)	2 (4.2)	1.000
	Rectosigmoid	7 (100.0)	0 (0.0)	
	Rectum	13 (100.0)	0 (0.0)	
	Sigmoid	3 (100.0)	0 (0.0)	
Tumor type [N, (%)]	adenocarcinoma	40 (97.6)	1 (2.4)	0.340
	squamous cell carcinoma	3 (100.0)	0 (0.0)	
	Others	6 (85.7)	1 (14.3)	
	Missing*	20 (100.0)	0 (0.0)	
Gender [N, (%)]	Male	43 (100.0)	0 (0.0)	0.152
	Female	26 (92.9)	2 (7.1)	

DISCUSSION

This study aimed to investigate the relationship between the ABO Blood-Group System and Rh-Hr Blood-Group System and the risk of colorectal cancer. Our evaluation indicated that the O blood group had the highest frequency, followed by the A and B blood groups, with the AB blood group having the lowest proportion among colorectal cancer patients. These results align with findings from other studies [1, 4, 13]. However, some studies have reported different distributions of ABO blood groups in colorectal cancer patients, such as O, B, A, and AB[2,3]. Additionally, a recent study by Şahin Kahramanca et al. found the highest frequency related to the A blood group, followed by B, O, and AB in colorectal cancer patients[14]. Conversely, Ürün et al. reported that the ABO blood group in colorectal patients was A, O, B, and AB, respectively[15]. These discrepancies may be attributed to variations in the size of the study population and differences in the frequency of ABO blood groups across different regions.

We acknowledge that the distribution of ABO and Rh blood groups between colorectal cancer patients and the healthy population was similar. Our data do not support a significant association between ABO and Rh blood groups and colorectal cancer risk, a conclusion consistent with some studies[13-16]. However, a study reported an association between non-O blood groups and colorectal cancer risk[15]. Kashfi et al. demonstrated a relationship between the ABO blood group and colon cancer[3]. Ling-Tzu Hsiao et al. suggested that the presence of certain antigens might play a role in colon cancer development[4]. Other studies have indicated that blood group A is associated with increased risk and poorer survival in colorectal cancer patients[2,14]. Conversely, another study reported that non-AB blood groups might be linked to improved survival in colon cancer patients[1]. Our data aligns with another study that found no relationship between the Rh blood group and colorectal cancer[3]. However, a recent study has suggested an association between Rh and colorectal cancer [1].

Our results indicate that the ABO blood group has no association with clinicopathological features of colorectal cancer, including cancer type and tumor type. In this regard, our findings are consistent with other studies that reported no significant relationship between ABO and Rh blood groups and cancer stage and tumor pathological findings[1,2,14].

CONCLUSION

As evident from the above discussion, our study revealed no association between ABO and Rh blood groups and colorectal cancer. While our findings are inconsistent with some populations that demonstrate a positive relationship, it is important to recognize that various factors can influence different aspects of colorectal cancer. Further extensive studies involving larger populations are necessary to elucidate this relationship and its underlying mechanisms.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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Ethical approval

This research received approval from the ethics committee of Ahvaz Jundishapur University, with the ethics code for this study being IR.AJUMS.REC.1400.344.

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