SURVEY OF PUBLIC AWARENESS IN SAUDI ARABIA ABOUT THE LINK BETWEEN BLOOD TYPE AND RISK FOR ACQUIRING CERTAIN DISEASES

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Abstract. Some blood types have been reported to be associated with certain diseases but public awareness of these associations in Saudi Arabia is unclear. In this study we aimed to assess awareness of the association between blood types and certain diseases among adults in Saudi Arabia in order to inform efforts to improve this awareness. Study subjects were recruited from the general population of Saudi Arabia using a convenience sampling method via an online questionnaire distributed through social media platforms. Inclusion criteria for study subjects were being aged ≥18 years, living in Saudi Arabia and completing a study questionnaire. Exclusion criteria for study subjects were not meeting inclusion criteria and incompletely filling out the questionnaire. The questionnaire was reviewed by experts and pilot-tested to ensure clarity and validity. The minimum number of study subjects determined to be needed for the study was 440 subjects. Each subject was asked to complete a questionnaire asking about demographic characteristics, current health status, beliefs about the relationship between blood type and certain diseases, awareness of these associations and whether they could name the associated diseases. We evaluated potential associations between gender, age, marital status, family history of chronic disease and subject awareness about these associations using the chi-square test. A knowledge score was given based on answers to the questions on the questionnaire, giving 1 point for each correct answer with a potential score of 0-7 points. Knowledge scores were categorized as poor (0-2 points), average (3-4 points) or good (≥5 points). 1,191 subjects were included in the study, 871 (73.1%) females. 495 subjects (41.6%) believed there could be an association between blood type and certain diseases; 332 subjects (27.9%) were aware of such associations. The mean (±standard deviation)

knowledge score among study subjects regarding the association was 1.94 (±1.55) points; 765 subjects (64.2%) had a poor knowledge level, 337 (28.3%) had an average knowledge level and 89 (7.5%) had a good knowledge level. When subjects were asked to indicate which specific diseases were associated with blood type (multiple selections allowed), 410 (34.4%) mentioned stroke, 322 (27.0%) mentioned diabetes mellitus type 2, 273 (22.9%) mentioned hyperlipidemia and 238 (20.0%) mentioned hypertension. Awareness was significantly higher (p-value = 0.001) among females (n = 387, 44.4%) than males (n = 108, 33.8%). There were significant differences in subject awareness by blood type. The greatest (p-value = 0.01) awareness among subjects about the association between blood type and certain diseases was among subjects aged 18-24 years (n = 296, 45.1%) followed by those aged 25-50 years (n = 182, 37.7%) and those aged >50 years (n = 17, 32.7%) (p-value = 0.01). Significantly more (p-value = 0.02) single subjects (n = 348, 44.0%) were aware of the association between blood type and certain disease than married subjects (n = 147, 36.8%). Significantly more (p-value <0.001) subjects with a family history of chronic disease (n = 318, 45.8%) had awareness of the association between blood type and certain diseases than subjects without a family history of chronic disease (n = 177, 35.6%). 180 subjects (15.1%) stated they had adopted a preventive lifestyle based on their blood type in order to reduce their risk for developing the disease associated with their blood type. In summary, the proportion of subjects who were aware of the associations between blood type and certain diseases was low and few reported making lifestyle changes based on such associations. We conclude, given the modest strength of most associations and the absence of evidence for blood type-based preventive interventions, the public health relevance of these findings is unclear but there is a need to educate the study population regarding the association between blood type and certain disease. Further studies are needed to determine if adopting a healthy lifestyle can reduce the risk for developing these blood type disease associations and whether knowledge of these associations will result in a change in preventive lifestyle activities.

Keywords: blood types, public awareness, Saudi

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INTRODUCTION

The ABO and Rhesus (Rh) blood type systems are important for their clinical significance in transfusion medicine (Eltayeb, 2024). These blood type antigens are expressed on the surface of erythrocytes, leukocytes, epithelial cells and, in soluble form, in bodily secretions, including saliva, sweat, gastric secretions and breast milk (Abegaz, 2021).

Some diseases have been reported to be associated with certain blood types (Abegaz, 2021). For example, individuals with an O blood type have lower odds of contracting severe malaria, since their red blood cells lack certain receptors the malaria parasite uses to enter the red blood cell (Nain and Sharma, 2022). Blood type O has also been associated with greater odds of developing peptic ulcers, possibly because expression of the H antigen enhances adhesion of Helicobacter pylori to the gastric epithelium (Teshome *et al*, 2019). Individuals with blood groups A and AB have moderately elevated odds of developing certain cancers, such as gastric cancer, which may be related to specific antigen expression (Mao *et al*, 2019). Individuals with non-O blood types have approximately 25% higher levels of factor VIII and von Willebrand factor, which results in greater odds of developing venous thromboembolism, myocardial infarction and ischemic stroke (Dentali *et al*, 2014; Groot *et al*, 2020; Jenkins and O'Donnell, 2006). However, these associations are usually modest and often outweighed by modifiable risk factors, such as diet, physical activity and smoking (Dentali *et al*, 2014; Ng *et al*, 2020; Zhang *et al*, 2014).

Public awareness of the association between blood type and certain diseases in Saudi Arabia remains unclear. In this study we aimed to assess awareness of these associations between blood type and odds of developing certain diseases among adults in Saudi Arabia in order to inform efforts to improve this awareness.

MATERIALS AND METHODS

Study design and study population

We used a cross-sectional survey to conduct this study. This study was conducted in Saudi Arabia during 25 August-20 September 2024. Study subjects were selected from the general population using non-probability convenience sampling. We sent invitations to potential study subjects via multiple social media platforms (WhatsApp, Twitter (X), Telegram and LinkedIn). We actively promoted the survey in all five geographic regions of Saudi Arabia (southern, western, central, eastern and northern) to minimize regional selection bias and recruit subjects from a wide range of demographic backgrounds, ages, both genders and a variety of socioeconomic statuses.

Inclusion criteria for study subjects were being aged ≥18 years, residing in Saudi Arabia and completing the questionnaire.

Exclusion criteria for study subjects were not meeting inclusion criteria and incompletely filling out the questionnaire.

The minimum number of subjects needed for our study was calculated using Cochran's formula for estimating a population proportion

$$n = z^2 \times p \times (1- p) / e^2$$

where n = The required sample size;

z = The z-score representing the confidence level;

p = The estimated proportion of the attribute present in the population;

e = The margin of error (precision level).

We used a 95% confidence interval. z was set at 1.96 and p at 0.50. We assumed a 5% margin of error (e = 0.05). This resulted in 384 subjects, to which an additional 15% were added to account for incomplete questionnaires, giving a total minimum number of 440 subjects needed for the study.

Data collection tool

Each subject was asked to

complete a self-administered questionnaire in Arabic (the local language) created using Google Forms. The questionnaire was reviewed by experts and pilot-tested to ensure clarity and validity.

The questionnaire consisted of 15 items divided into 3 sections.

The first section consisted of 6 questions about demographics: subject age, gender, marital status, nationality, region of Saudi Arabia living in and occupation.

The second section consisted of 4 questions on overall health status (excellent, good, fair and poor), blood type and personal and family history of chronic disease.

The third section consisted of 5 questions asking about their beliefs, knowledge and practices about the association between blood type and certain diseases. Subjects were asked whether they believed a relationship exists between blood type and certain diseases and whether they believed there was an association between blood type and diet. Subjects were also asked whether they were aware of any associations between blood type and certain diseases and whether they could identify the diseases associated with blood types (multiple selections allowed). Subjects were also asked whether they had adopted any lifestyle practices based on their blood type to prevent diseases associated with that blood type.

Statistical analysis

Data were entered into and analyzed with GraphPad Prism version 10.6.1.799 (GraphPad Software, San Diego, CA) and Microsoft Excel Version 16.106.3 (Microsoft, Redmond, WA). Descriptive statistics were used to summarize subject demographic characteristics and survey responses. Categorical variables are reported as frequencies and percentages. Awareness of the association between blood type and certain diseases and selected demographic variables (gender, age, occupation, marital status, personal history of chronic disease, family history of chronic disease

and knowing their own blood type) were assessed using the chi-square test. These results are presented as numbers and percentages by category. A *p*-value <0.05 was considered statistically significant. Subject knowledge level regarding the association between blood type and certain disease was assess with a knowledge questionnaire consisting of 7 questions where the total possible score varied from 0-7 points. The questionnaire asked if the subjected believed there was a blood type-disease relationship, subjects were asked about their awareness of the association and were asked about each of the 5 scientifically supported disease associations. Subject knowledge was classified based on the results of this knowledge questionnaire as poor (0-2 points), moderate (3-4 points) and good (5-7 points).

Ethical considerations

This study was conducted in accordance with the principles of the Declaration of Helsinki and approved by the Standing Ethical Committee in the Deanship of Scientific Research at King Khalid University, approval # KKU-96-2025-28. Informed consent was obtained from all study subjects prior to inclusion in the study.

RESULTS

1,191 subjects were included in the study, 871 (73.1%) females. 1,154 subjects (96.9%) were Saudi.

782 subjects (65.7%) were from southern Saudi Arabia, 217 (18.2%) from central Saudi Arabia, 120 (10.1%) from western Saudi Arabia, 35 (2.9%) from eastern Saudi Arabia and 37 (3.1%) from northern Saudi Arabia.

656 subjects (55.10%) were aged 18-24 years, 483 (40.6%) were aged 25-50 years and 52 (4.4%) were aged >50 years.

631 subjects (53%) were students, 299 (25.1%) were employees and 261 (21.9%) were unemployed. 791 subjects (66.4%) were single and 400 (33.6%) were married (Table 1).

552 subjects (46.3%) had type O blood, 308 (25.9%) had type A,

Table 1

Sociodemographic characteristics of the study subjects (N = 1,191)

Characteristics	Frequency *n* (%)
Gender	
Male	320 (26.9)
Female	871 (73.1)
Nationality	
Saudi	1154 (96.9)
Non-Saudi	37 (3.1)
Region	
Southern	782 (65.7)
Central	217 (18.2)
Western	120 (10.1)
Eastern	35 (2.9)
Northern	37 (3.1)
Age group	
18-24 years	656 (55.0)
25-50 years	483 (40.6)
>50 years	52 (4.4)
Occupation	
Student	631 (53.0)
Employed	299 (25.1)
Unemployed	261 (21.9)
Marital status	
Single	791 (66.4)
Married	400 (33.6)

96 (8%) had type B and 57 (4.8%) had type AB. 178 subjects (15.0%) stated they did not know their blood type.

609 subjects (51.1%) stated their health was excellent, 506 (42.5%) stated it was good, 68 (5.7%) stated it was fair and 8 (0.7%) stated it was poor.

The most commonly reported health condition among study subjects was vitamin D deficiency (*n* = 520, 43.7%), followed by digestive disorders (*n* = 228, 19.1%), obesity (*n* = 183, 15.4%) and asthma (*n* = 115, 9.7%), hyperlipidemia (*n* = 113, 9.5%), diabetes (*n* = 70, 5.9%), hypertension (*n* = 63, 5.3%), chronic kidney disease (*n* = 41, 3.4%), previous stroke (*n* = 18, 1.5%) and cancer (*n* = 9, 0.8%). 355 subjects (29.8%) reported they had no chronic disease conditions (Table 2)

The most common diseases reported among family were diabetes (*n* = 487, 40.9%) and hypertension (*n* = 396, 33.2%), followed by respiratory disease (*n* = 132, 11.1%), cardiovascular disease (*n* = 117, 9.8%), cancer (*n* = 74, 6.2%) and autoimmune disease (*n* = 34, 2.9%). 586 subjects (49.2%) reported no history of disease in the family.

495 subjects (41.6%) believed there was an association between blood type and certain diseases, 465 (39.0%) believed there might be and association and only 231 (19.4%) believed there was no association.

320 subjects (26.9%) believed there was an association between blood type and diet, while the rest (*n* = 871, 73.1%) did not.

332 subjects (27.9%) stated they were aware of an association between blood type and certain diseases and 859 (72.1%) stated they were aware that there was no such association.

The following diseases were specified by subjects as being associated with blood type: stroke (*n* = 410, 34.4%), diabetes (*n* = 322, 27%), hyperlipidemia (*n* = 273, 22.9%), cancer (*n* = 243, 20.4%), hypertension (*n* = 238, 20%), viral infection (*n* = 234, 19.6%), bacterial infection (*n* = 231, 19.4%); obesity

(*n* = 189, 15.9%), kidney disease (*n* = 160, 13.4%), digestive disorders (*n* = 129, 10.8%), vitamin D deficiency (*n* = 126, 10.6%) and asthma (*n* = 98, 8.2%). 293 subjects (24.6%) stated no diseases were associated with blood type.

180 subjects (15.1%) stated they adopted a specific lifestyle based on their blood type in order to prevent the disease associated with that blood type, while the rest (*n* = 1,011, 84.9%) did not adopt such a lifestyle (Table 3).

Significantly more (*p*-value = 0.001) females (*n* = 87, 44.4%) than males (*n* = 108, 33.8%) were aware of the association between blood type

Table 2

Selected characteristics of study subjects (N = 1,191)

Variables	Frequency *n* (%)
How would you describe your general health status?	
Excellent	609 (51.1)
Good	506 (42.5)
Fair	68 (5.7)
Poor	8 (0.7)
What chronic diseases are in your family?*	
Diabetes	487 (40.9)
Hypertension	396 (33.2)
Cardiovascular disease	117 (9.8)
Respiratory disease	132 (11.1)
Autoimmune disease	34 (2.9)
Cancer	74 (6.2)
No family history	586 (39.2)

Table 2 (cont)

Variables	Frequency *n* (%)
Blood type	
A	308 (25.9)
B	96 (8.0)
AB	57 (4.8)
O	552 (46.3)
Don't know	178 (15.0)
What chronic diseases do you have?*	
Diabetes	70 (5.9)
Hypertension	63 (5.3)
Asthma	115 (9.7)
Previous strokes	18 (1.5)
hyperlipidemia	113 (9.5)
Vitamin D deficiency	520 (43.7)
Digestive disorders	228 (19.1)
Obesity	183 (15.4)
Cancer	9 (0.8)
Kidney diseases	41 (3.4)
No personal diseases	355 (29.8)

*More than one answer is allowed

and certain diseases. Subjects aged 18-24 years (n = 296, 45.1%) were significantly more likely (p-value = 0.017) to be aware of an association between blood type and certain diseases than subjects aged 25-50 years (n = 182, 37.7%) and subjects aged >50 years (n = 17, 32.7%).

Single subjects (n = 348, 44.0%) were significantly more likely (p-value = 0.020) to be aware of an association between blood type and certain diseases than married subjects (n = 147, 36.8%). Subjects with a family history of chronic disease (n = 318, 45.8%) were significantly more likely (p-value <0.001) to be aware of an association between blood type and certain diseases than subjects without a family history of chronic disease (n = 177, 35.6%). No significant associations (p-value >0.05) were found between awareness of an association between

Table 3

Knowledge, beliefs and practices regarding an association between blood type and certain diseases among study subjects (N = 1,191)

Variables	Frequency n (%)
Beliefs and awareness	
Do you believe there is an association between blood type and certain diseases?	
Yes	495 (41.6)
No	231 (19.4)
Maybe	465 (39.0)
Are you aware of the association between blood type and certain diseases?	
Yes	332 (27.9)
No	859 (72.1)
Do you believe there is an association between blood type and diet?	
Yes	320 (26.9)
No	871 (73.1)

Table 3 (cont)

Variables	Frequency *n* (%)
Specific diseases association knowledge	
What diseases are associated with blood type*	
Diabetes	322 (27.0)
Hypertension	238 (20.0)
Asthma	98 (8.2)
Strokes	410 (34.4)
hyperlipidemia	273 (22.9)
Vitamin D deficiency	126 (10.6)
Digestive disorders	129 (10.8)
Obesity	189 (15.9)
Cancers	243 (20.4)
Kidney diseases	160 (13.4)
Bacterial infection	231 (19.4)
Viral infection	234 (19.6)
No disease	293 (24.6)
Practice	
Do you follow a specific lifestyle prevent diseases associated with your blood type?	
Yes	180 (15.1)
No	1011 (84.9)

*More than one answer is allowed

blood type and certain diseases by occupation (Table 4).

765 subjects (64.2%) had a poor knowledge score regarding the association between blood type and certain diseases, 337 (28.3%) had an average knowledge score and 89 (7.5%) had a good knowledge score. The mean (±standard deviation) knowledge score was 1.94 (±1.55) points, indicating a poor overall knowledge level (Table 5).

DISCUSSION

In our study we found only 27.9% of subjects were aware of an association between blood type and certain diseases, indicating a low level of awareness. This finding is consistent with a previous study which reported >75% of subjects were unaware of an association between blood type and certain diseases (Vignesh *et al*, 2021). The low level of awareness found in our study may be due to the modest and inconsistent evidence showing an association between blood type and certain diseases and the association is not mentioned in most health communications. Differences in study subject characteristics, such as educational levels, varying accessibility to reliable health information and varying exposure to scientific content, may also have contributed to the observed findings.

In our study, the most common disease conditions mentioned by subjects as being associated with blood type were stroke, diabetes, hyperlipidemia and hypertension. Few subjects mentioned the association with cancer, gastrointestinal disorders and infectious diseases. Of the diseases listed, stroke has the greatest odds of being associated with non-O blood types (A, B, AB) (Lin *et al*, 2025). The association between blood type B and odds of developing type 2 diabetes is only modest (Sharjeel *et al*, 2021) as is the association with elevated total cholesterol and elevated LDL cholesterol levels (Lymperaki *et al*, 2022). There are inconsistent results for the association between blood type and hypertension (Shaikh *et al*, 2024).

Table 4

Subject characteristics associated with awareness of diseases associated with blood type (N = 1,191)

Variables	Aware *n* (%)	Unaware *n* (%)	χ^2	*p*-value*
Gender				
Male (N = 320)	108 (33.8)	212 (66.2)	10.56	0.001
Female (N =871)	387 (44.4)	484 (55.6)		
Age group				
18-24 years (N = 656)	296 (45.1)	360 (54.9)	8.10	0.017
25-50 years (N = 483)	182 (37.7)	301 (62.3)		
>50 years (N = 52)	17 (32.7)	35 (67.3)		
Occupation				
Student (N = 631)	273 (43.3)	358 (56.7)	1.61	0.447
Employed (N = 299)	118 (39.5)	181 (60.5)		
Unemployed (N = 261)	104 (39.8)	157 (60.2)		
Marital status				
Single (N = 791)	348 (44.0)	443 (56.0)	5.45	0.020
Married (N = 400)	147 (36.8)	253 (63.2)		
Personal history of chronic disease				
Yes (N = 187)	77 (41.2)	110 (58.8)	0.00	1.000
No (N = 1,004)	418 (41.7)	586 (58.3)		
Family history of chronic disease				
Yes (N = 694)	318 (45.8)	376 (54.2)	11.67	<0.001
No (N = 497)	177 (35.6)	320 (64.4)		
Knowing own blood type				
Yes (N = 1,015)	423 (41.7)	592 (58.3)	2.99	0.084
No (N = 176)	72 (40.4)	104 (59.6)		

*Statistically significant when *p*-value <0.05

Table 5

Knowledge scores and knowledge levels regarding the association between blood type and certain diseases among study subjects (N = 1,191)

Variables	Values
Knowledge score (mean ± SD)	1.94 ± 1.55
Knowledge level, *n* (%)	
Poor	765 (64.2)
Average	337 (28.3)
Good	89 (7.5)

Note: Knowledge score ranged from 0 to 7. Poor knowledge level was a score of 0-2 points, average was 3-4 points and good was 5-7 points.

SD: standard deviation

In our study, only a small proportion of subjects mentioned an association between blood type and cancer, gastrointestinal disorders and infectious diseases, despite evidence to support the associations with certain cancers (gastric and pancreatic cancers) and specific bacterial and viral infections (Abudouleh *et al*, 2025; Abegaz, 2021). Additionally, some subjects also stated there was no association between blood type and certain diseases.

The results of our study show the majority of our subjects were not aware of associations that were strong, weak or not present. Our study results show responses may be influenced more by the perceived importance and prevalence of chronic diseases than scientific evidence. Overall, these findings show subjects attribute a variety of common conditions to blood type despite a lack of supporting evidence, indicating a lack of knowledge among study subjects regarding the actual associations between blood type and certain diseases.

In our study, one-fourth of subjects believed there was an association between blood type and diet. A previous study reported social media and internet sources may be a major cause of misinformation about this association (Paul and Headley-Johnson, 2025). This misinformation can lead to inappropriate diet and even cause health problems (Cusack *et al*, 2013).

A small proportion of our subjects reported adopting a specific lifestyle based on their blood type to prevent the diseases associated with that blood type. Lifestyle factors, such as a healthy diet, physical activity and stopping smoking can reduce the risk for developing some chronic diseases (Ng *et al*, 2020) but there is no evidence that these modifications can lower the odds of developing a disease associated with blood type. The effect of blood type and disease association is small but the effect of unhealthy lifestyle is large. However, the belief on the part of the public that because they have a certain blood type, they will inevitably develop a certain disease, so why put any effort into a healthy lifestyle, is erroneous and dangerous. The public needs to be encouraged to have a healthy lifestyle no matter what their blood type is or no matter what diseases are associated with their blood type.

In our study, awareness of the association between blood type and certain diseases was significantly associated with family history of chronic disease. In particular, subjects with a family history of chronic disease. This elevated awareness may be due to increased exposure to health information through medical encounters, medical consultations or educational materials, consistent with prior research indicating that individuals who interact repeatedly with healthcare services may have greater exposure to health-related information, including blood type associated diseases (Getie *et al*, 2024; Mussema *et al*, 2024).

In our study, awareness of the association between blood type and certain diseases was significantly associated with gender, which may reflect differences in health-information-seeking behavior between the sexes. Previous studies have reported that women are more likely to search for health-related preventive health information, such as the findings in a study thalassemia (Zamin *et al*, 2025).

In our study, awareness of the association between blood type and certain diseases was significantly associated with younger subject age. Younger individuals may have greater access to health information through digital platforms and educational institutions (Lupton, 2021).

In our study, there was a lack of awareness regarding the association between blood type and certain diseases. Although there is a belief in this association, the knowledge level was poor. Some thought unassociated factors were related to blood type, some thought the effect of this association was more than it was. This shows a need to educate the study population regarding the associations.

This study has several strengths. First, we had a large number of study subjects, allowing us to more easily identify study associations. Second, the study assessed beliefs, knowledge and practices. Third, the knowledge level was quantified allowing a better picture of the degree of the problem. Fourth, inclusion of multiple demographic and health-related variables enabled us to identify who had better and who had worse knowledge levels.

Our study had several limitations. First, the cross-sectional design limits the ability to infer causal relationships between awareness and adopting specific lifestyles. Second, the reliance on self-reported data introduces the possibility of bias, which can alter our conclusions. Third, although the sample was intended to be representative, this study may not adequately reflect the perspectives

of subjects from rural or remote areas and those who were not internet literate or did not have access to this. Therefore, the study is not generalizable to the whole population. Fourth, the use of an online convenience sampling approach can introduce selection bias, since those with internet access or who have a stronger interest in health topics may have been more inclined to participate. Fifth, the subjects were disproportionately female, younger, and residents of southern Saudi Arabia, again making the study population a poor representation of the general population of Saudi Arabia. Sixth, the reported rate of lifestyle modification based on blood type may be inflated, since more educated and health-conscious individuals may be over-represented in our study population. Finally, the knowledge score may not accurately reflect subject knowledge.

In summary, the proportion of subjects who were aware of the associations between blood type and certain diseases was low, and few reported making lifestyle changes based on such associations. We conclude, given the modest strength of most associations and the absence of evidence for blood type-based preventive interventions, the public health relevance of these findings is unclear but there is a need to educate the study population regarding the association between blood type and certain diseases. Further studies are needed to determine if adopting a healthy lifestyle can reduce the risk for developing these blood type diseases and whether knowledge of these associations will result in a change in preventive lifestyle activities.

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CONFLICT OF INTEREST DISCLOSURE

The authors declare no conflict of interest.

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