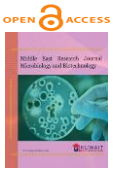

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A Distribution Comparison of ABO and Rh Blood Group Types and Chronic Diseases with Aging

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Abstract: ***Background*:** Understanding the ABO distribution among is important from epidemiological viewpoint. It may provide further insights into genetic and/or immunological studies associated with age-related disease susceptibility, and extend understanding of population genetics research. ***Materials and Methods*:** A total population study was 800 of Iraqi patients which comprised two distinct groups. The younger group consisted of 500 patients aged ≤40 years and older (≥80) consisted of 300 number. Gender, residence and chronic diseases of all patients were also recorded, analyzed and included in the present study. ***Results*:** It was found that blood group type O+ was the most prevalent and each geriatric group was complaining from at least one chronic disease. A statistically significant association was observed ($p < 0.05$), indicating differences in frequency distribution between males and females. It was concluded that 8.9 and 5.4% of ≤ 40 and ≥ 80 years old age groups were of O+ blood group but this blood type distributed almost evenly among both ages of urban area. ***Conclusions*:** O+ blood type demonstrated the dominant number among total population studied with frequency of 30.8%. The present study showed that positive rhesus factor was dominant among population under study compared to rhesus negative type and Rh+ was higher among under 40 years old A significant interaction indicated that age-related changes in blood-group composition differed between rural and urban populations, supporting an environmental–demographic influence on phenotype distribution. Interaction analysis revealed that age amplifies the association between specific blood groups and chronic diseases.

Keywords: ABO Types, Geriatrics, Age, Gender, Residence, Chronic Diseases.

Research Paper

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INTRODUCTION

Human blood is subdivided into different groups depending on the difference of specific antigens on the surface of erythrocytes. The significant grouping system of human blood is the ABO and Rh system. This system reveals four main blood types like A, B, AB, and O. A further classification of the blood shows two types which are Rh-positive (Rh+) or Rh-negative (Rh-) depending on the presence or absence of the RhD antigen. While numerous other antigenic structures contribute to a more granular classification of blood groups [1, 2]. The ABO and Rh system still the cornerstone of clinical practice particularly in hospital particularly in safe blood transfusions.

It has been that the distribution of different blood groups among blood donors was A (38.90%), B (17.00%), O (37.10%), and AB (6.90%), with 89.90% prevalence of Rh positivity [1, 2]. In a another similar it was found that the distribution of blood groups among donors was A Rh+ (38.1%), O Rh+ (30.2%), B Rh+ (10.5%), A Rh- (6.2%), AB Rh+ (6.2%), O Rh- (5.6%), B Rh- (2.1%) and AB Rh- (1.3%) [3].

The interrelationship between blood groups and aging has been investigated elsewhere who observed a decrease in the frequency of blood type B with aging [1-4], but a study revealed a different manner of B blood group in relation to longevity [5]. It has been demonstrated no significant differences in ABO allele between centenarians and a younger control group [6].

Understanding the ABO distribution among is important from epidemiological viewpoint. It may provide further insights into genetic and/or immunological studies associated with age-related disease susceptibility, and extend understanding of population genetics research [6, 7]. It has been expected that one-fifth of the population of our globe will be ≥65 years of age which is indicating a serious concern public health issue related to age and aging [1-8]. Aging could be considered as a major etiological agent for incidence by most chronic diseases [2-9]. It is quite difficult to define aging in universal acceptable manner. Some attempts of definition emphasize a progressing losing physiological functions like physical activity, fitness, health and function [4]. It has been suspected that the aging population has recently increased but the expectancy of healthy life was different [10, 11]. Aging can be define as an accumulation of cellular and molecular damage [8-10]. Aging process might be define as a gradual decline of cellular and biological activity of human body cells [11, 12]. Telomere shortening along with genome damaging would be the biological processes leading to aging [11]. Aging could be accelerate aging as a result of higher rate of biological aging associated with risk of death, quality of life (QoL) and physical performance [13,14]. Blood cells are responsible for oxygen transport, hemostasis and immunity [15-18]. In addition, blood cells iron metabolism, clearance of toxic metabolites, function of endothelial cells, and responses to external environment [19, 20]. Any abnormal changes in morphology and function of these cells are indicating health risks like blood disorders, immunological compromisation, congenital complications and carcinogenesis predisposition [21-23]. All these pathological features are probably connected with red blood cells types. Most of facts underlying these changes correlated with ages still obscure.

The present study is an attempt to examine the frequency of ABO and Rh blood types within a geriatric population aged ≥80 years in comparison with a younger age group of ≤40 age group along with demographic considerations.

Materials and Methods

A total of 800 hundred patients attended Kirkuk general hospital and medical laboratories in Kirkuk city were included in the present study. A total population study was 800 patients which comprised two distinct groups. The younger group consisted of 500 patients aged ≤40 years and older (≥80) consisted of 300 number Gender, residence and chronic diseases of all patients were also recorded, analyzed and included in the present study [1-7].

Statistical Analysis

A comparative analysis of the study groups was considered. The distribution of blood groups (ABO) and rhesus factor (Rh) was assessed within each study group and their statistical analyses for statistical significance was calculated utilizing different programs [24-26].

Results

Age

The present study revealed that more that blood group O+ was the most common among the age group under 40 years and age group over 80 years old and the frequency was 17.6 and 13.1% respectively (Table 1). Table 1 also shows that positive rhesus factor was dominant among population under study compared to rhesus negative type and Rh+ was higher among under 40 years old (Table 1, Figure 1). Duncan's multiple range test showed a highly significant difference among blood group frequencies ($p < 0.05$). The O^+ group revealed the greatest dominance forming a distinct statistical subset, whereas B^- and AB^- blood groups represented the lowest homogeneous group. Intermediate clustering was observed for A^+ and B^+ showing comparable prevalence within the studied population.

Table 1: Distribution of blood groups according to age

Age (year)	Blood group No.(%)								Rhesus factor		Total
	A+	A-	B+	B-	AB+	AB-	O+	O-	Rh+	Rh-	
Under 40	125 (15.6)	22 (2.8)	103 (12.9)	14 (1.8)	64 (8)	9 (1.1)	141 (17.6)	22 (2.8)	433 (54.1)	67 (8.4)	500 (62.5)
Over 70	51 (6.4)	11 (1.4)	72 (9)	11 (1.4)	27 (3.4)	7 (0.9)	105 (13.1)	16 (2)	255 (31.9)	45 (5.6)	300 (37.5)
Total	176 (22)	33 (4.1)	185 (23.1)	25 (3.1)	91 (11.4)	16 (2)	246 (30.8)	38 (4.8)	688 (86)	112 (14)	800 (100)

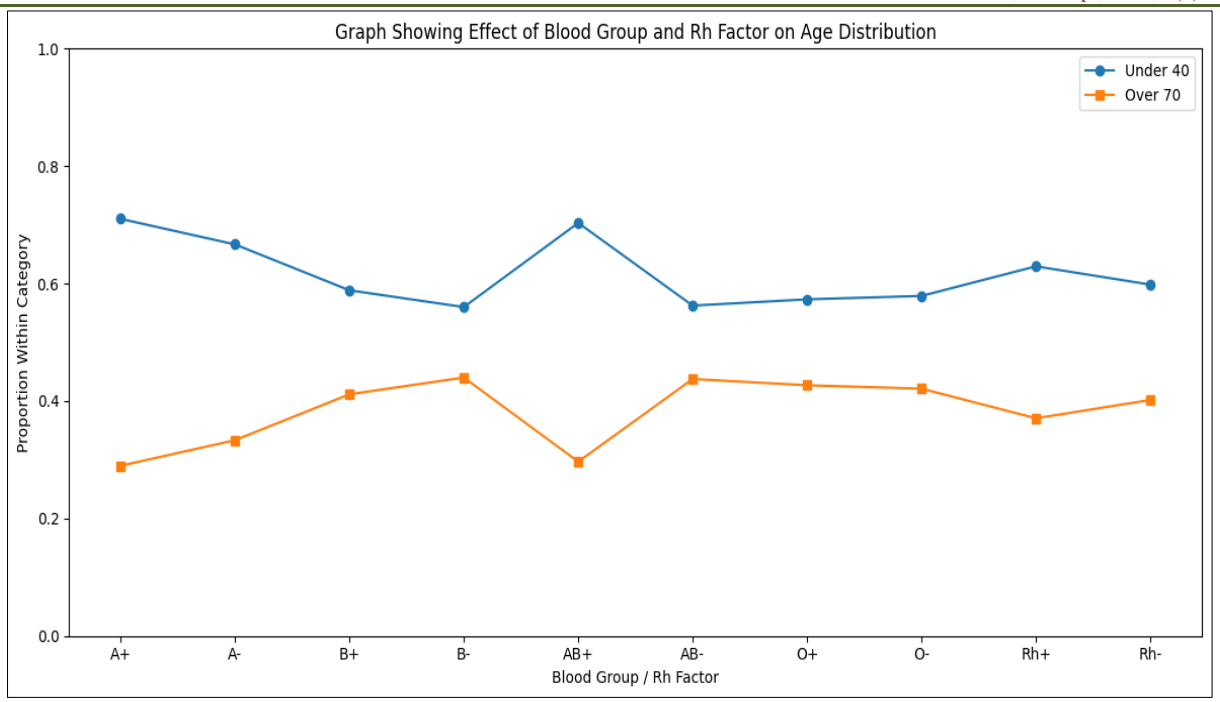

Figure 1: The proportional age distribution among each ABO blood group and Rh factor.

Gender

The present study demonstrated that A+ blood type was more prevalent among more than 80 years age group compared to less than 40 years age group and their frequencies were 8.9 and 5% respectively (Table 2). Rh+ was much higher among more than 80 years old compared to what was found among age group 40 years old or less and their frequencies were 17.9 and 1.8% respectively. O+ blood type demonstrated the dominant number among total population studied with frequency of 30.8% (Table 2, Figure 2). The distribution of blood groups according to gender was analyzed using the Chi-square test of independence. A statistically significant association was observed ($p < 0.05$), indicating differences in frequency distribution between males and females. The Mann–Whitney U test was not considered appropriate due to the categorical nature of the data.

Table 2: Distribution of blood groups according to gender

Gender	Age Yrs)	Blood group No.(%)								Rhesus factor		Total
		A+	A-	B+	B-	AB+	AB-	O+	O-	Rh+	Rh-	
Male	≤ 40	40 (5)	3 (0.4)	36 (4.5)	3 (0.4)	23 (2.9)	2 (0.3)	45 (5.6)	2 (0.3)	14 (1.8)	10 (1.3)	154 (19.3)
	≥70	31 (8.9)	1 (0.1)	38 (4.8)	8 (1)	13 (1.6)	2 (0.3)	61 (7.6)	8 (1)	143 (17.9)	19 (2.4)	162 (20.3)
	Total	71 (8.9)	4 (0.5)	74 (9.3)	11 (1.4)	36 (4.5)	4 (0.5)	106 (13.3)	10 (1.3)	157 (19.6)	29 (3.6)	316 (39.5)
Female	≤40	85 (10.6)	19 (2.4)	67 (8.4)	11 (1.4)	41 (5.1)	7 (0.9)	96 (12)	20 (2.5)	289 (36.1)	57 (7.1)	346 (43,3)
	≥ 70	20 (13.1)	10 (1.3)	34 4.3)	3 (0.4)	14 (1.8)	5 (0.6)	44 (5.5)	8 (1)	112 (14)	26 (3.3)	138 (17.3)
	Total	105 (13.1)	29 (3.6)	101 (12.6)	14 (1.8)	55 (6.9)	12 (1.5)	140 (17.5)	28 (3.5)	401 (50.1)	83 (10.4)	484 (60.5)
Overall		176 (22)	33 (4.1)	175 (21.9)	25 (3.1)	91 (11.4)	16 (2)	246 (30.8)	38 (4.8)	558 (69.8)	112 (14)	800 (100)

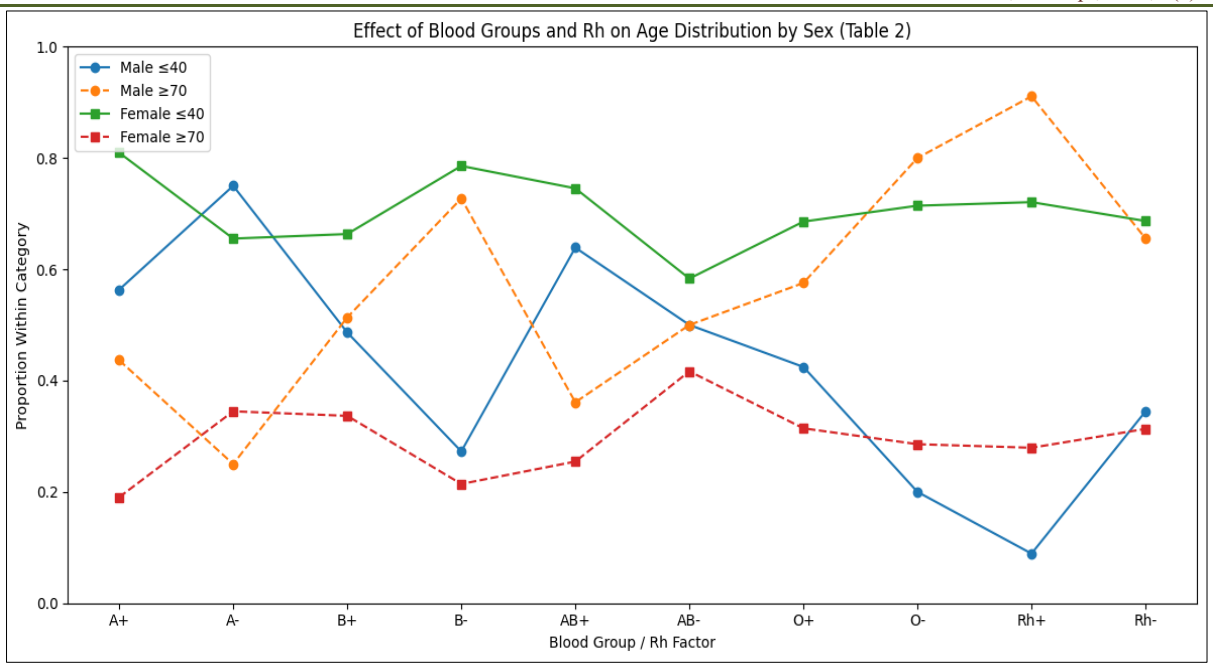

Figure 2: Age distribution among ABO blood groups and Rh factor with references to sex

Residence

The present study revealed that 51.4% and 16.5% of rural and urban population studied were O+ blood type respectively. With respect to age of rural population it was concluded that 8.9 and 5.4% of ≤ 40 and ≥ 80 years old age groups were of O+ blood group but this blood type distributed almost evenly among both ages of urban area. It was found that the population of A+ type residented in urban area were different in number and their frequencies were 8.1 and 2.8 % for ≤ 40 and ≥ 80 years age groups respectively(Table 3, Figure 3). Duncan's multiple range test revealed that Rh^+ constituted a statistically distinct dominant subset, whereas O^+, B^+, and A^+ formed a homogeneous intermediate group. Negative phenotypes clustered within the lowest subset, indicating minimal contribution to residence- or age-related variation. Multivariate analysis of variance demonstrated that the combined ABO–Rh structure varied according to residence and age. A significant interaction indicated that age-related changes in blood-group composition differed between rural and urban populations, supporting an environmental–demographic influence on phenotype distribution.

Table 3: Distribution of blood groups according to residence

Residence	Age (Yrs)	Blood group No.(%)								Rhesus factor		Total
		A+	A-	B+	B-	AB+	AB-	O+	O-	Rh+	Rh-	
Rural	≤40	60 (7.5)	16 (2)	60 (7.5)	10 (1.3)	36 (4.5)	4 (0.5)	71 (8.9)	11 (1.4)	227 (28.4)	41 (5.1)	268 (33.5)
	≥70	29 (3.6)	4 (0.5)	23 (2.9)	6 (0.8)	16 (2)	4 (0.5)	43 (5.4)	8 (1)	111 (13.9)	22 (2.8)	133 (16.6)
	Total	89 (11.1)	20 (2.5)	83 (10.4)	16 (2)	52 (6.5)	8 (1)	411 (51.4)	19 (2.4)	338 (42.3)	63 (7.9)	401 (50.1)
Urban	≤40	65 (8.1)	6 (0.8)	43 (5.4)	4 (0.5)	28 (3.5)	5 (0.6)	70 (8.8)	11 (1.4)	206 (25.8)	25 (3.1)	232 (29)
	≥70	22 (2.8)	7 (0.9)	49 (6.1)	5 (0.6)	11 (1.4)	3 (0.4)	62 7.8)	8 (1)	144 (18)	23 (2.9)	167 (20.9)
	Total	87 (17.3)	13 (1.6)	92 (11.5)	9 (1.1)	39 (4.9)	8 (1)	132 (16.5)	19 (2.4)	350 (43.8)	48 (6)	399 (49.9)
Overall		176 (22)	33 (4.1)	175 (21.9)	25 (3.1)	91 (11.4)	16 (2)	543 (67.9)	38 (4.8)	688 (86)	111 (13.9)	800 (100)

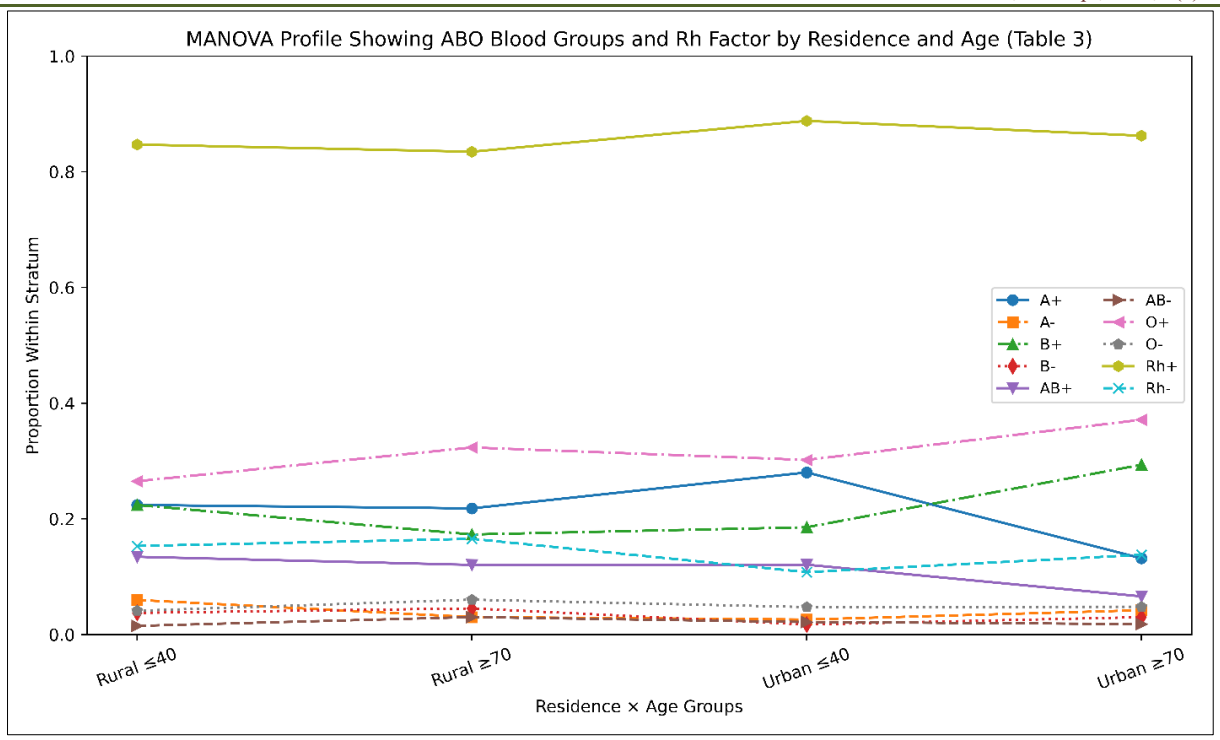

Figure 3: Multivariate analysis of variance (MANOVA) profile plot showing changes in ABO blood groups and Rh factor in relation to residence and age

Chronic Diseases

It was found that all individuals of ≥ 80 years old age group were suffered from one ore more than one chronic disease whereas only 17.5% of ≤ 40 years old population were of chronic disease to be associated(Table 4). Hypertension was the most common chronic disease distributed among the elder population. Alzheimer disease was not recorded among population of ≤ 40 years old but 9 cases of the same disease were seen among ≥ 80 years old population. Diabetes mellitus was prevalent among both age groups and its frequency was 3.2 and 25.5 for ≤ 40 and ≥ 80 years old age groups respectively. Statistical analysis using Mann-Whitney test shows that aging was the primary driver of disease burden and the Blood group plays a secondary/modifying role. Duncan multiple range test revealed significant differences among chronic diseases in elderly patients (≥80 years), where hypertension and diabetes formed the highest statistical group ($p < 0.05$). Blood group O+ showed significantly higher prevalence compared to other groups, indicating a potential epidemiological association. In contrast, younger individuals (≤40 years) demonstrated weaker statistical separation among disease categories. Hypertension and Diabetes dominate significantly in ≥80 population. Age is a major determinant of chronic disease prevalence. O+ dominates across almost all diseases Followed by B+ and A+. There is an interaction effect where age amplifies blood-group-associated disease patterns. A significant association was observed between age, blood group distribution, and chronic diseases (χ^2 test, $p < 0.001$). Elderly individuals (≥80 years) demonstrated markedly higher prevalence of hypertension and diabetes. Blood group O+ showed dominant representation across all disease categories. Cramér's V indicated a moderate-to-strong relationship, suggesting that both age and blood group contribute to disease distribution patterns. Interaction analysis revealed that age amplifies the association between specific blood groups and chronic diseases.

Table 4: Distribution of blood groups among population of ≥ 80 years according to chronic diseases

Chronic Disease	Age (Yrs)	Blood group No.(%)								Rhesus factor		Total
		A+	A-	B+	B-	AB+	AB-	O+	O-	Rh+	Rh-	
Hypertension	≤ 40	6(1.6)	0	3(0.8)	0	1(0.3)	0	10(2.7)	0	20(5.4)	0	20(5.4)
	≥ 80	18(4.8)	4(1.1)	22(5.9)	2(0.5)	10(2.7)	4(1.1)	47(12.6)	5(1.3)	97(26.1)	15(4)	112(30.1)
Diabetes	≤ 40	4(1.1)	0	3(0.8)	0	1(0.3)	0	3(0.8)	1(0.3)	11(2)	1(0.3)	12(3.2)
	≥ 80	14(3.8)	2(0.5)	21(5.6)	2(0.5)	10(2.7)	2(0.5)	38(10.2)	6(1.6)	83(22.3)	12(3.2)	95(25.5)
Cardiac disease	≤ 40	2(0.5)	0	0	0	0	0	3(0.8)	0	5(1.3)	0	5(1.3)
	≥ 80	12(3.2)	3(0.8)	4(1.1)	2(0.5)	3(0.8)	2(0.5)	7(1.9)	3(0.8)	26(7)	10(2.7)	36(9.7)
Renal disease	≤ 40	0	0	1(0.3)	0	0	0	1(0.3)	0	2(0.5)	0	2(0.5)
	≥ 80	2(0.5)	1(0.3)	2(0.5)	1(0.3)	0	0	5(1.3)	0	9(2.4)	2(0.5)	11(3)
Epilepsy	≤ 40	0	0	0	0	0	0	1(0.3)	0	1(0.3)	0	1(0.3)
	≥	1(0.3)	1(0.3)	0	0	1(0.3)	0	3(0.8)	0	5(1.3)	1(0.3)	6(1.6)
Alzheimer	≤ 40	0	0	0	0	0	0	0	0	0	0	0

Chronic Disease	Age (Yrs)	Blood group No.(%)								Rhesus factor		Total
		A+	A-	B+	B-	AB+	AB-	O+	O-	Rh+	Rh-	
	≥ 80	1(0.3)	0	2(0.5)	1(0.3)	0	0	4(1.1)	1(0.3)	7(1.9)	2(0.5)	9(2.4)
Asthma	≤ 40	1(0.3)	0	2(0.5)	0	0	0	2(0.5)	0	5(1.3)	0	5(1.3)
	≥ 80	2(0.5)	0	8(2.2)	2(0.5)	0	0	8(2.2)	0	18(4.8)	2(0.5)	20(5.4)
Thalassemia	≤ 40	0	0	1(0.5)	0	0	0	3(0.8)	0	4(1.1)	0	4(1.1)
	≥ 80	1(0.3)	0	1(0.3)	0	1(0.3)	0	2(0/5)	0	5(1.3)	0	591.3)
Anemia	≤ 40	3(0.8)	0	0	1(0.3)	1(0.3)	0	4(1.1)	1(0.3)	8(2.2)	2(0.5)	10(2.7)
	≥ 80	2(0.5)	0	1(0.3)	0	0	0	3(0.8)	0	6(1.6)	0	6(1.6)
Cancer	≤ 40	0	0	2(0.5)	0	0	0	4(1.1)	0	6(1.6)	0	6(1.6)
	≥ 80	2(0.5)	1(0.3)	0	0	0	0	2(0.5)	2(0.5)	4(1.1)	3(0.8)	7(1.9)
Total	≤ 40	16(4.3)	0	12(3.2)	1(0.3)	3(0.8)	0	31(8.3)	2(0.5)	62(16.7)	3(0.8)	65(17.5)
	≥80	55(14.4)	12(3.2)	61(16.4)	10(2.7)	25(6.7)	8(2.2)	119(32)	17(4.60)	260(96.7)	47(12.6)	307(82.5)
Overall		71(19.1)	12(3.2))	73(19.6)	11(3)	28(7.5)	8(2.2)	150(40.2)	19(5.1)	322(86.6)	50(13.4)	372(100)

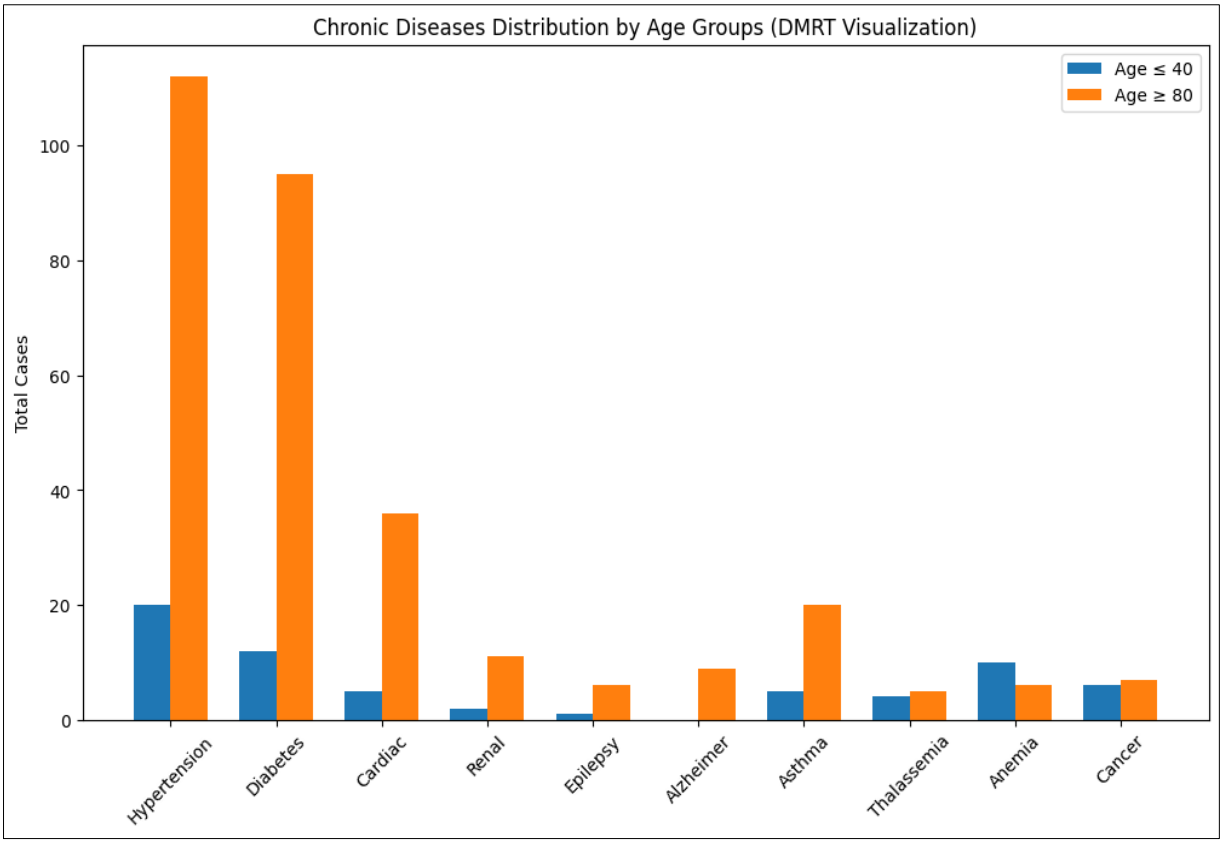

Figure 4: Distribution of chronic diseases among age Groups (≤40 vs ≥80 Years)

DISCUSSION

The present study revealed that more that blood group O+ was the most common among the age group under 40 years and age group over 80 years old with the frequency was 17.6 and 13.1% respectively. The present study also shows that positive rhesus factor was dominant among population under study compared to rhesus negative type and Rh+ was higher cross under 40 years old. The O^+ group represented the greatest dominance forming a distinct statistical subset, whereas B^- and AB^- blood groups represented the lowest group. Intermediate clustering was observed for A^+ and B^+ revealing comparable prevalence within the studied population. Australian study revealed a distribution of blood group types among patients as follows: O RhD+ (38.4%), A RhD+ (32%), B RhD+ (11.8%), O RhD- (6.5%), A RhD- (5.6%), AB RhD+ (3.7%), B RhD- (1.5%), and AB RhD- (0.5%) [13]. Moreover, the Rh positivity was more prevalent to be 85.9%of total blood types reported [13-27]. Furthermore, the study conducted in Isparta Province of Turkey, concluded that Rh+ as the most prevalent blood type which was almost similar to that found in Australian study [13-28]. Furthermore, it was found that Rh positivity among geriatric patients in Isparta Province (88.7%) which was in consistent findings with the study of Torun YA *et al.,* [19-30].

Duncan multiple range test of the data presented here revealed significant differences among chronic diseases in elderly patients (≥80 years), where hypertension and diabetes formed the highest statistical group ($p < 0.05$). Blood group O+ showed significantly

higher prevalence compared to other groups, indicating a potential epidemiological association. The potential relationship between blood group type and disease susceptibility, particularly for leading causes of mortality like cancer and cardiovascular disease, has been considering a scientific interest. This connection could indirectly a question of whether there is an association between blood group types and longevity. A meta-analysis carried out by He M *et al*., reported a significantly increased risk of coronary heart disease in individuals with non-O blood types as compared to those with blood type O [21]. However, Urun Y *et al*., concluded that there was concerned risk of lung cancer in individuals with non-O blood types and Rh negativity [23]. As far as gastric cancer is concerned, Yu H *et al*., observed a higher 5-year survival rate among patients with blood type O and a heightened risk of developing the disease in those with blood type A [25-32]. Data analysis of the present study showed that blood group O+ showed dominant representation across all disease categories. It was indicated a moderate-to-strong relationship, suggesting that both age and blood group type contribute to disease prevalence patterns. Interaction analysis showed that age amplifies the association between specific blood groups and chronic diseases. It was found in a study carried out elsewhere that findings reveal that blood cell traits such as eosinophil counts, MCV, and lymphocyte counts are causally related to aging indicators. Monitoring the changes of these traits with aging may provide valuable insights for assessing age-related health risks and promoting healthy aging [8-34].

The distribution of blood groups according to gender was analyzed using the Chi-square test of independence. A statistically significant association was observed ($p < 0.05$), indicating differences in frequency distribution between males and females. The Mann–Whitney U test was not considered appropriate due to the categorical nature of the data. In a study carried out in Iraq, it was found that cancer rate was very high in males and in blood group type O, according to age most cases recorded in age group (1-5) years [35, 36].

It was reported elsewhere that a study highlights a potential association between blood group B and a higher prevalence of obesity and hypertension. These findings suggested that individuals with blood group B may have an cardiovascular disorders. However, due to inconsistencies in existing literature and potential establish a definitive link between ABO blood groups, BMI, and hypertension.

Understanding these associations may provide valuable insights into personalized medicine and targeted prevention strategies for metabolic and cardiovascular diseases [37-42]. The present study revealed that 51.4% and 16.5% of rural and urban population studied were O+ blood type respectively. With respect to age of rural population it was concluded that 8.9 and 5.4% of ≤ 40 and ≥ 80 years old age groups were of O+ blood group but this blood type distributed almost evenly among both ages of urban area. A significant interaction indicated that age-related changes in blood-group composition differed between rural and urban populations, supporting an environmental–demographic influence on phenotype distribution. Our study provides valuable insights into the distinct demographic, socioeconomic, and biomarker profiles of centenarians compared to non-centenarians [43-45]. We observed that centenarians are characterized by higher rates of chronic conditions, a greater prevalence of socioeconomic disadvantage, and a stronger association with urban living and higher levels of neighbourhood inequality. These findings underline the interplay between individual and contextual factors that contribute to longevity. Understanding the factors contributing to the rise of centenarians is crucial for public health planning and providing insights into aging, population sustainability, and the future social and economic implications of an aging society. Such knowledge will offer insights not only for regional policymakers, but also for global longevity research. The findings could contribute to promoting healthy aging, improving quality of life, and better planning for the needs of an increasingly aging population. By integrating the effects of temporal variations and public health context on key biomarkers, our results offer a broader understanding of longevity and its determinants [37-53].

CONCLUSION

The present study demonstrated that A+ blood type was more prevalent among more than 80 years age group compared to less than 40 years age group and their frequencies were 8.9 and 5% respectively. The present study revealed that blood group O+ was the most common among the age group under 40 years and age group over 80 years old and the frequency was 17.6 and 13.1% respectively. Blood group O+ showed dominant representation across all disease categories. Cramér's V indicated a moderate-to-strong relationship, suggesting that both age and blood group contribute to disease distribution patterns. Interaction analysis revealed that age amplifies the association between specific blood groups and chronic diseases.

Statement of Ethics: All the procedures involving human participation were conducted in strict accordance with ethical standards of Institutional Research Committee, Department of Scientific Research, Tikrit University as well as the 1964 Helsinki Declaration and its subsequent amendments or equivalent ethical norms.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of Interest Statement: The author declares that he has no conflicts of interest, financial or otherwise.

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