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CORRELATIVE ASSOCIATION OF ELEVATED BLOOD PRESSURE AND BLOOD GLUCOSE IN THE VARIOUS ABO BLOOD GROUPS IN THE PRESENCE OF PERIODONTAL DISEASE - A PILOT PROJECT IN THE WESTERN REGION OF SAUDI ARABIA.

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Conflicts of Interest: Nil

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Abstract:

Background: Numerous reports have suggested an association between diabetes and hypertension, the most prevalent systemic conditions affecting mankind today. The prevalence of these conditions has been linked to certain blood groups as also to periodontal disease. The objective of this study was to explore a possible association of the ABO blood groups with these conditions.

Materials and Methods: In this pilot project, a total of 400 subjects were screened initially, of which, 366 subjects (226 males and 140 females) with mean age range of 34.5 years from various ABO blood groups, were randomly selected and their systolic and diastolic blood pressure (SBP & DBP), random blood glucose(RBS) and gingival blood glucose(GBS) were measured in a standardized manner with a digital automated equipment. Subjects with any systemic disease or condition or consuming any kind of medications and smokers were excluded from the study. Data obtained was statistically analyzed with correlation analysis to assess possible associations.

Results: A strong positive correlation was observed in blood group AB between elevated RBS, GBS, SBP & DBP values ($P<0.01$) in gingivitis and periodontitis subjects as well as in the overall study population. In addition, a strong positive correlation in blood group B between high RBS and DBP ($P < 0.001$) and GBS & SBP and DBP values ($P<0.05$), in the periodontally healthy group was observed.

Conclusion: Subjects with blood group AB in the Saudi population may be predisposed to an increased risk for diabetes and hypertension in the presence of periodontal disease.

Keywords: ABO blood groups, blood pressure, blood glucose, gingivitis, periodontitis.

Introduction

Associations between ABO blood groups and various medical conditions [1] [2] have been explored abundantly. One of the most significant disease associations described is the non-O (subjects of group A, B, or AB) versus O subjects' susceptibility to arterial and venous thromboembolism (VTE) [3]. Hypertension[1] and diabetes[2] have been linked to ABO blood groups as also periodontal disease.[4] [5]

Weber and Pastern [6] were the first to study the association of ABO blood groups with periodontal disease. Koregol et al [5] in a study on 1220 subjects in South India concluded that blood group A formed a significantly higher percentage in the gingivitis group and blood group O formed a higher percentage in the

periodontitis group. The blood group AB showed the least percentage of periodontal diseases.

Majority of the researchers [4], [7], [8] have claimed that different ABO blood groups constitute an increased risk for the development of periodontal and oral diseases; whereas one study [9] failed to find such an association.

Our objective in this study was to find an association, if any, exists between ABO blood groups, blood glucose and blood pressure; and periodontal disease in systemically healthy individuals. Understanding these associations, and their effects, with the severity of periodontal diseases might be vital in the early periodontal management of exceptionally susceptible individuals.

MATERIALS & METHODS:

This cross-sectional study was reviewed and approved by the Ethical Committee of Ibn Sina National College of medical sciences, Jeddah, KSA. The approved project intends to cover wide regions in the country. This preliminary pilot project was carried out in the western region and consisted of 400 patients who were screened initially. 34 patients were excluded on the basis of the exclusion criteria. The final sample size comprised of 366 patients, 226 males and 140 females with ages ranging from 21-45 years.

The selected patients were then made to sign on a consent form, following which the following parameters were assessed: (n=366)

1. ABO blood group type with Rh .
2. Blood pressure.
3. Random blood glucose and gingival blood glucose.
4. Periodontal status including gingival bleeding index, plaque index, pocket depth, clinical attachment loss.
5. Radiographs in the form of panoramic x rays were also used as adjunctive diagnostic aids.

The following patients were excluded from the study sample (n=34):

1- Patients with any systemic diseases.

2- Patients on any kind of medications.

3- Patients with any mental or physical disability

4- Patients who were smokers or consuming any similar kind of substances.

Blood group detection was done using blood detecting agents and RH factor kits(*BioRad, Jeddah, KSA)*.The Patient's blood pressure was measured in the daytime only, by using portable automatic blood pressure monitor(*Omron Healthcare company ltd, Kyoto, Japan)*, standardizing the procedure, using only the right hand while the patients were in an upright sitting position. An average of 3 readings by 3 different calibrators taken at intervals of 5 minutes each, was considered the final value, making sure the patient was at ease and completely relaxed during each measurement, to eliminate the white coat effect. Values above 120mm Hg (systolic) and 80mm Hg (diastolic) were considered high.[10]

Blood glucose values were obtained using digital glucose monitor (*Accu-Chek, Roche Laboratories, KSA)* ensuring a gap of at least 3 hours after the subjects' last meal.

1. Random blood glucose (RBS) - Random blood glucose was measured using the finger prick device and recording the reading obtained directly on the digital monitor. To maintain uniformity, only the index finger of the left hand was used for all the subjects.
2. Gingival blood glucose(GBS) - Gingival blood glucose was measured in a similar way but obtaining blood from the oral cavity by pricking the incisive papilla and allowing the drop of blood to fall on the device without touching any other adjacent areas to avoid contamination.

Values above 130 mg/dl were considered as high.

Data obtained was statistically analyzed using SPPSSV 19.0 software and Pearson correlation analysis.

RESULTS:

Characteristics of the study sample **(**TABLE 1) revealed males comprising 61.75% and females constituting about 38.25% of the study sample. About 39.89% of the study samples belonged to group O, followed by group B and A (27%), whereas only 5.19% belonged to group AB respectively. Healthy periodontium was observed in 26.23% of the study population, gingivitis in 24.59% and periodontitis in 49.18%.

Blood group O was the prevalent one in all the 3 periodontal subgroups followed by B and A. Blood group AB comprised of a small portion in all three groups.(TABLE 2)

Pearson correlation analysis revealed strong positive correlations between RBS & GBS and SBP& DBP in all the blood groups among the periodontally healthy subjects(TABLE 3), subjects with gingivitis(TABLE 4) and periodontitis(TABLE 5) as well as in the overall study population.(table 6) (P<0.001).

However, blood group B revealed strong positive correlation between RBS &DBP and GBS &SBP &DBP among the periodontally healthy subjects (P<0.05)(TABLE 3). Blood group AB also revealed strong positive correlation between RBS & DBP (P<0.05) in the gingivitis group (TABLE 4) and between RBS, GBS, SBP & DBP (P<0.01) in the periodontitis group(TABLE 5) and also in the overall study population (TABLE 6)

TABLE 1: CHARACTERISTICS OF THE STUDY SAMPLE:

BLOOD GROUPS		N		%	
A	A -	14	100	3.83%	**27.32%**
	A +	86		23.5%	
AB	AB+	19	19	3.35%	**5.19%**
B	B -	31	101	8.47%	**27.6%**
	B +	70		19.13%	
O	O -	40	146	10.93%	**39.89%**
	O+	106		28.96%	
	TOTAL	366	366	100%	100%
GENDER					
MALES		226		61.75%	
FEMALES		140		38.25%	
DISEASE					
HEALTHY		96		26.23%	
GINGIVITIS		90		24.59%	
PERIODONTITIS		180		49.18%	

TABLE 2: DISTRIBUTION OF THE ABO BLOOD GROUPS IN THE PERIODONTAL POPULATION :

DISEASE	BLOOD GROUP							
	A		**B**		**AB**		**O**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
HEALTHY	28	**7.65%**	20	**5.46%**	10	**2.73%**	38	**10.38%**
GINGIVITIS	20	**5.46%**	28	**7.65%**	6	**1.64%**	36	**9.84%**
PERIODONTITIS	52	**14.21%**	53	**14.48%**	3	**0.82%**	72	**19.67%**

TABLE 3: CORRELATION BETWEEN BLOOD GROUPS AND VARIOUS BIOLOGICAL PARAMETERS IN THE PERIODONTALLY HEALTHY GROUP

BLOOD GROUP	PARAMETER	CORRELATED PARAMETER	r	P
A	RBS	GBS	0.96	**0.0001***
		SBP	-0.03	0.8
		DBP	-0.21	0.2
	GBS	SBP	0.01	0.9
		DBP	-0.2	0.3
	SBP	DBP	0.48	**0.001***
B	RBS	GBS	0.91	**0.0001***
		SBP	0.36	0.1
		DBP	0.55	**0.001***
	GBS	SBP	0.46	**0.03***
		DBP	0.62	**0.01***
	SBP	DBP	0.72	**0.001***
AB	RBS	GBS	0.76	**0.0001***
		SBP	-0.16	0.3
		DBP	-0.31	0.5
	GBS	SBP	-0.14	0.6
		DBP	-0.39	0.2
	SBP	DBP	-0.08	0.9
O	RBS	GBS	0.8	**0.0001***
		SBP	-0.17	0.3
		DBP	-0.1	0.5
	GBS	SBP	-0.1	0.5
		DBP	-0.06	0.6
	SBP	DBP	0.70	**0.001***

TABLE 4: CORRELATION BETWEEN BLOOD GROUPS AND VARIOUS BIOLOGICAL PARAMETERS IN THE GINGIVITIS GROUP

BLOOD GROUP	PARAMETER	CORRELATED PARAMETER	r	P
A	RBS	GBS	0.90	**0.0001***
		SBP	0.16	0.4
		DBP	-0.09	**0.4**
	GBS	SBP	0.07	**0.7**
		DBP	-0.17	0.5
	SBP	DBP	0.57	**0.05***
B	RBS	GBS	0.90	**0.0001***
		SBP	-0.32	0.1
		DBP	-0.21	**0.3**
	GBS	SBP	-0.12	**0.5**
		DBP	-0.12	0.5
	SBP	DBP	0.73	**0.0001***
AB	RBS	GBS	0.95	**0.0001***
		SBP	0.36	0.4
		DBP	0.77	**0.05***
	GBS	SBP	0.54	**0.2**
		DBP	0.66	0.1
	SBP	DBP	0.34	**0.5**
O	RBS	GBS	0.92	**0.0001***
		SBP	0.007	0.9
		DBP	0.04	**0.8**
	GBS	SBP	-0.007	**0.9**
		DBP	0.11	0.5
	SBP	DBP	0.39	**0.01***

TABLE 5: CORRELATION BETWEEN BLOOD GROUPS AND VARIOUS BIOLOGICAL PARAMETERS IN THE PERIODONTITIS GROUP

BLOOD GROUP	PARAMETER	CORRELATED PARAMETER	r	P
A	RBS	GBS	0.57	**0.0001***
		SBP	0.17	0.2
		DBP	-0.1	0.2
	GBS	SBP	0.39	**0.0001***
		DBP	-0.009	0.9
	SBP	DBP	0.64	**0.0001***
B	RBS	GBS	0.80	**0.0001***
		SBP	-0.25	0.06
		DBP	-0.17	0.2
	GBS	SBP	-0.03	**0.8**
		DBP	0.05	0.7

	SBP	DBP	0.59	**0.0001***
AB	RBS	GBS	1.0	**0.0001***
		SBP	0.92	**0.05***
		DBP	0.9	**0.05***
	GBS	SBP	0.91	**0.05***
		DBP	0.93	**0.05***
	SBP	DBP	0.99	**0.05***
O	RBS	GBS	0.80	**0.0001***
		SBP	-0.07	0.5
		DBP	-0.1	0.3
	GBS	SBP	-0.01	0.8
		DBP	0.01	0.8
	SBP	DBP	0.7	**0.0001***

TABLE 6: OVERALL CORRELATION BETWEEN BLOOD GROUPS AND VARIOUS BIOLOGICAL PARAMETERS

BLOOD GROUP	PARAMETER	CORRELATED PARAMETER	r	P
A	RBS	GBS	0.62	**0.0001***
		SBP	0.18	0.1
		DBP	-0.08	0.5
	GBS	SBP	0.36	**0.001***
		DBP	0.01	0.6
	SBP	DBP	0.63	**0.0001***
B	RBS	GBS	0.84	**0.0001***
		SBP	-0.02	0.7
		DBP	-0.19	0.3
	GBS	SBP	-0.04	0.6
		DBP	0.07	0.5
	SBP	DBP	0.60	**0.0001***
AB	RBS	GBS	0.97	**0.0001***
		SBP	0.75	**0.01***
		DBP	0.81	**0.01***
	GBS	SBP	0.81	**0.01***
		DBP	0.83	**0.01***
	SBP	DBP	0.94	**0.0001***
O	RBS	GBS	0.83	**0.0001***
		SBP	-0.03	0.7
		DBP	-0.06	0.5
	GBS	SBP	0.006	0.9
		DBP	0.04	0.6
	SBP	DBP	0.75	**0.0001***

DISCUSSION:

World Health organization reports suggest about 17 million deaths a year are caused by cardiovascular diseases, of which, one-third are caused by complications related to hypertension[11]. Reports in 2008 claimed that about 40% of the adults above 25 years had hypertension, which translates to about 1 billion people worldwide. The total number is expected to increase by about 24% in the developed countries and about 80% in developing countries by the year 2025[12]. Hypertension is also considered the leading risk factor for morbidity and mortality in Saudi Arabia according to the Global Burden of Disease Study. There was also a considerable variation with regard to disease awareness with only 44.7% of the population being cognizant of the disease [13].

Diabetes Mellitus (DM) is a growing global health concern with about an estimated 171 million people affected worldwide in the year 2000. By 2011, this number had increased to more than 366 million, and it has been projected that the numbers are expected to exceed 552 million by 2030[14]. A similar pattern has also been observed in Saudi Arabia. According to a report by the Ministry of Health, the steep 2.7 fold rise in the number of diabetics from 0.9 million in 1992 to 2.5 million in 2010 within a span of 2 decades is alarming.[15]. This increasing burden of diabetes may be attributed to a rising obesity rate and an aging population among various other factors[16].

In addition, there is also an increasing prevalence of periodontal disease[17] in Saudi Arabia, which has in turn, also been linked to hypertension[18] and diabetes[19].

Currently, little is known about the knowledge of risk for periodontal disease and the awareness of oral health in diabetic patients. In various studies conducted, it was found that the majority of these diabetic patients lacked knowledge about the relationship between diabetes and periodontal health[20].

In the quest for potential risk factors in the prevalence of these conditions, a number of associations have emerged, an important link being the ABO blood groups. Certain blood groups have been found to be associated with hypertension, diabetes and periodontal disease. Moreover, evidence in Saudi Arabia also insinuate that certain blood groups may increase the risk of hypertension[21], diabetes[22] and periodontal disease[23]. Therefore, the objective of the present study was to determine if there was any possible correlation among these conditions in the various blood groups. To the authors' knowledge, no study of this nature has been carried out so far.

The subjects in our study consisted of randomly selected subjects visiting the dental clinics, which included periodontally healthy, gingivitis and periodontitis patients diagnosed following complete periodontal charting.

The ABO blood group and Rh system distributions show marked variation around the world. Some variations may even occur in different areas within the same country[24]. It has been reported that the blood group O is most common in American and Canadian individuals, the B type in Chinese and Indian individuals, and the A type in Eskimos[25]. In the Saudi population, it has been reported that the most common blood group was O and the least common was AB[26][27]. This was in accordance with our study, wherein 39.89 % (146 patients) belonged to group O; 27.32% (100 patients) to group A; 27.6% (101 patients) to group B, and only 5.19% (19 patients) belonged to group AB.

Since O was the predominant blood group in the overall study population, a higher concentration of subjects with this blood group was observed in all the three periodontal subgroups. In a recent study, Demir et al[7] investigated the relationship between periodontal disease and ABO blood group. He found a higher percentage of blood type A in patients with gingivitis and a higher percentage of blood type O in patients with periodontitis which is in contrast to the findings of our study

wherein both gingivitis and periodontitis had a higher prevalence in blood group O. Gawrzewska[8], found that individuals with blood group O have a greater severity of periodontal disease, whereas individuals with blood group A have a greater resistance to periodontal disease.

Subjects in our study population showed a strong correlation overall, as well as when observed in the sub-groups of healthy periodontium, gingivitis and periodontitis among random and gingival blood glucose values and systolic and diastolic blood pressure; an expected finding. However, a striking variation with respect to blood group B was observed in the periodontally healthy group, where a strong positive correlation was observed between high random and gingival blood glucose as well as with blood glucose and systolic and diastolic blood pressure whereas no such correlation was observed in the gingivitis or periodontitis groups. Although no explanation seems reasonable, studies have suggested blood group B as the most prevalent blood group susceptible to hypertension, obesity and diabetes.[28][29]. Nonetheless, the lack of significant correlation in the other groups as well as the overall study population fails to support this. On the contrary, in a small section of the Saudi population, wherein significant relationships between ABO blood type and severity of periodontitis were determined; patients with blood group B appeared to be at greater risk of developing more severe forms of periodontitis[23].

Additionally, blood group AB also revealed interesting observations in both the gingivitis and periodontitis subjects as well as in the overall study population. Strong positive correlation between the elevated levels of random blood glucose and diastolic blood pressure in the gingivitis group and also between high RBS, GBS SBP and DBP in the periodontitis group and in the overall study group as well. Although the AB blood group formed a small proportion of the study population, and is also a relatively rare blood group, these findings strongly suggest a high predisposition of this blood group to diabetes and hypertension in the presence of periodontal disease.

Nevertheless, evidence analyzing the data by blood group showed that the levels of total cholesterol, glucose and systolic/diastolic blood pressure were all significantly higher in male and female patients in blood group O than other groups, with a decreasing trend from group A to B then AB[30]. Evidence linking ABO blood groups to hypertension and diabetes, reveal blood group B as the most prevalent blood group susceptible to both the conditions and blood group AB having the least risk[29]. In addition, blood group AB also appears to be the least affected blood group with regard to periodontitis[5] probably attributed to the low prevalence of this blood group in the population.

In spite of evidence indicating least susceptibility of blood group AB in all conditions, the results of our study suggest otherwise. The strong correlation seen with blood group AB emphasizes that although an uncommon group, subjects in this group may be at an enhanced risk of diabetes and hypertension in the presence of periodontal disease and may need careful screening and regular monitoring which does not rule out the fact that other blood groups may be relatively unaffected.

One limitation of this study is the sample size which, if much larger, may have probably yielded more significant results among other blood groups as well. Additionally, the study included subjects from only the Western region of the country only. Inclusion of other parts of the country's population, which has been planned subsequently, would possibly display a more broader picture in this association as individual variations do exist among people in different parts of the country.

CONCLUSION:

The AB blood group, although formed only 5.19% of the study population, exhibited strong correlation between elevated blood glucose and blood pressure values in the presence of

periodontal disease. As ABO blood groups are genetically determined and cannot be controlled; periodontal disease, diabetes and hypertension, which share multiple common risk factors, should be regulated.

In such susceptible blood group patients, it is reasonable to recommend a medical evaluation (including blood pressure, blood glucose) and comprehensive periodontal examination and gingival blood glucose measurement. Therefore, in the face of these highly prevalent diseases (or risk factors) in the population, it can be suggested that simple periodontal evaluation should be a new useful tool for assessing risk of diabetes and cardiovascular disease in such high risk blood groups.

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