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HIGH PREVALENCE OF GINGIVITIS AND PERIODONTITIS AND TOOTH LOSS IN SAUDI ADULT MALE POPULATION AND THE POSSIBLE ASSOCIATION WITH THE INHERITANCE OF ABO BLOOD GROUPS

MOHAMMAD PARVAIZ FARSHORI [1, 2]*, ABDULLAH M ALANAZI[2], MAJED M ALSHAMMARI[2], ABDULRAHMAN M ALANAZI[2] AND IBRAHIM S ALFAWZAN[2]

1: Department of Physiology, College of Medicine (male side) University of Hail, Saudi Arabia

2: College of Dentistry, University of Hail, Saudi Arabia

***Corresponding author (Supervisor): Mohammad Parvaiz Farshori: pfarshori@yahoo.com**

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ABSTRACT

Background: Gingivitis and periodontitis cause significant damage to soft tissues and structures like periodontal ligament and alveolar bone. There is very high prevalence of obesity, diabetes, gingivitis, and periodontitis in Saudi adult population.

Aim of this study: Currently we are investigating the prevalence of gingivitis and chronic periodontitis in Saudi adult male diabetic population, and its consequences on oral health; additionally we analyzed any possible differences in the distribution of ABO and Rh (D) blood groups between adult male gingivitis and periodontitis patients.

Methods: Extensive oral exams were performed by dental interns on a total of 1000 randomly selected adult male subjects to record their blood type. Their oral cavities were thoroughly examined for presence of dental carries, gingivitis, periodontitis, tooth decay and, or tooth loss. Data was carefully recorded and statically analyzed using Z calculator.

Results: Gingivitis was more prevalent and statistically significantly higher in A^+ blood group as compared to periodontitis ($p < .01$). In contrast there was significantly lower distribution of AB^+ blood groups among male gingivitis patients in comparison to periodontitis patients at ($p < .01$). Although there was no significant change in distribution of B^+ or O^+ blood groups between male

gingivitis and periodontitis patients, there was still a statistically significant increase in distribution of O blood groups in male periodontitis patients as compared to non-O blood group distribution. Overall there was a significant increase in Rh^+ individuals and significant corresponding reduction in Rh^- individuals in male gingivitis patients as compared to male periodontitis patients at $p < .01$.

Conclusions: There are statistically significant differences in ABO blood group distributions between the male gingivitis and male periodontitis patients.

Key words: ABO and Rh blood groups, diabetes mellitus (T2DM), HbA1c, Obesity, gingivitis, periodontitis

INTRODUCTION

It has been previously shown that there is high prevalence of diabetes in Saudi adult population (Farshori et al 2016, 2017, Alotaibi et al 2017). We also know that uncontrolled blood sugar levels (diabetes) may lead to gum disease because diabetic patients are more likely to get gum infection due to reduce blood supply to the gum tissue. According to international diabetes federation (IDF) of Middle East and North Africa (MENA) region, there are 35 million adults who are living with diabetes in MENA region with the regional prevalence of 9.2%. According to IDF-MENA in 2017 in Saudi Arabia, (one of the 19 members) with a population of 20,770,000 there were 3.852,000 cases of diabetes showing prevalence of 18.5% (IDF diabetes atlas 8th edition, 2017). These statistics suggests that there is more than double prevalence of diabetes in Saudi Arabia. There is high prevalence of periodontal disease in Saudi school children [1] and the adult population [2.] If not treated it could lead to severe damage to the periodontium. We previously showed a possible association between diabetes and the inheritance of blood groups in male and female diabetic (Farshori et al 2016, 2017) and male and female myocardial infarction patients of Hail region of Saudi Arabia (Farshori et.al 2017, 2018). Additionally.several.studies.have.shown.association.of.ABO blood groups and the prevalence of gingivitis and chronic periodontitis (Demir et al, 2007, Ghamadi 2009, Koregol et al 2010) however the results have not been very consistent. According to Demir et al and Koregol et al, gingivitis was more prevalent among A blood group patients and relatively high percentage of O blood type was found among the.periodontitis.patients. According to another small study, the severity of chronic periodo-

ntitis was more prevalent among patients with blood groups B (Ghamadi, 2009), however long-term studies with larger size were recommended by the authors to confirm their findings. According to yet another study (Gautam et al, 2017) there was greater prevalence of gingivitis among O blood group and periodontitis was more prevalent with blood group B. Additionally this study found high prevalence of gingivitis and periodontitis among the Rhesus positive group. Since the results of these studies have been inconsistent at best, we decided to study the correlation between the inheritance of ABO and Rh blood groups and the prevalence of gingivitis and periodontitis in Saudi adult male population. We also decided to do a comparative analysis of ABO and Rh blood group distribution between gingivitis and periodontitis Saudi adult patients.

Aim of the study

The major goal of this study was to determine if there was any relationship between the onset of gingivitis or periodontitis and inheritance of ABO and Rh blood groups in Saudi adult population. Additionally we also compared the differences in ABO and Rh blood group distributions between adult male gingivitis patients and the periodontitis patients.

METHODS

For quantifying the tooth decay and the tooth loss associated with the periodontal disease oral exams were performed by 5th and 6th year male and female dental students and interns under the close supervision of trained faculty member on randomly selected 200 male control non diabetic subjects (age range 17-68 years, mean age 31.31 years) and 100 type 2 diabetes male and female patients (age range 13-90 years, mean age 52.91 years). Special attention was paid to dental carries, gingivitis, periodontitis, and tooth decay and or tooth loss. Data was carefully recorded and analyzed.

For the next phase of ABO blood group studies, we selected 791 adult male subjects who registered at various dental clinics in Hail for their dental exams. With their oral and written consent, we enquired about their general health such as if they had weight gain recently, if they or any one in their family was diabetic, their smoking habits before performing a general oral survey on them. Data collection was initiated through a preprepared questionnaire along with the thoroughly conducted periodontal exams on every subject.

The oral cavity examination of these subjects was performed by dental interns under close supervision of clinical supervisors in the

College of Dentistry clinic at University of Hail and a few examinations were performed as out clinic exams. Initial gingivitis diagnosis was made by asking patients if they had bleeding gums while they brushed their teeth as well as the extent of the bleeding. If they responded in positive then a thorough oral cavity exam was performed and their gums were checked for any indication of a swollen gingiva, swollen marginal gingiva, inflamed red gingiva, bad breathe and tender gingiva before diagnosing gingivitis. Diagnosis of periodontitis was only made after finding any gingival recession, loose attachment, mobile teeth, spaces between the teeth, or for any furcation involvement and the loose interdental papilla, ABO blood group data was collected and analyzed. Images of their oral cavity were taken only after receiving their verbal and written consent. These examinations for our first survey were performed between, August 2015 through December 2016 and the examinations of our second survey were performed between October 18, 2018 through November 20th 2018.

RESULTS

Prevalence of gingivitis and periodontitis in Saudi adult male population:

There is high prevalence of diabetes in Saudi population. In this cross sectional study we wanted to study the prevalence of gingivitis and periodontitis among the adult diabetic subjects in comparison to non diabetic subjects. In control subjects, age range 17- 68 years (mean age 31.3 years) we found 63% subjects to be positive for gingivitis and 37% had more serious periodontitis (Table 1). It was difficult to find subjects without gingivitis or periodontitis.

In contrast we found only 35% of the diabetic patients to have gingivitis and 65% of these subjects had more serious condition the periodontitis (Table 2). Statistical analysis of this data using the Z calculator for two population proportions showed a significant difference in the prevalence of gingivitis between the control and the diabetic patients at $p < 0.01$. The Z- score was -4.56 and the p-value was < .00001. The prevalence of gingivitis was statistically significantly higher in randomly selected controls as compared to the diabetic patients. Patients with early gingivitis, showed moderate to high plaque accumulation, swelling gingiva and bleeding upon periodontal probing (Figure 1a and b).

We found significantly higher incidences of serious chronic periodontitis among diabetic patients in comparison to the controls (Table 2). The Z value was -4.58 at $P < 0.01$. We also found a significant increase in tooth loss in diabetic male patients as compared to the randomly selected non diabetic subjects at $p < 0.01$ (Table 2, Figures 2a and b). These results

clearly show a statistically significant increase in the cases of chronic periodontitis and a significant increase in tooth loss among the diabetic periodontitis positive patients as compared to our control subjects.

Comparison of incisors, canine, premolars or molar tooth loss between the non-diabetic controls and the diabetic patients:

Since, our community survey revealed a significant tooth loss among the diabetic male patients in comparison to the randomly selected control group (Table 1, 2), next we compared the percentage of subjects with full intact teeth, partial or complete edentulism. Our results show 47.5 % controls to have partial edentulous as compared to the 73% among the diabetics (Figure 3 black arrowhead). Additionally we found 52.5% of control subjects with all intact teeth as compared to only 27% among the diabetic patients (Figure 3 red arrowhead). When compared with control group our results show a significant reduction in presence of hundred percent intact teeth among the diabetics. The Z value was -4.566 at p <00026 (Figure 2). In control subjects a total of 20.05% teeth were lost as compared to 66.2% teeth loss among the diabetic population (Figure 3 blue arrowhead). We did not find complete edentulous in any of our subjects of this survey.

Next we analyzed the tooth loss in each category (incisors, canine, premolar, molars) among controls and compared it with diabetic group. We found a similar pattern of dramatic increase in tooth loss among the diabetics. As expected there was more than threefold increase in total tooth loss among diabetic patients (66.2%) as compared to the controls ((20.05%), (blue arrowhead, Figure 3). When we analyzed each group of teeth separately we found 3.5% incisors were lost among controls as compared to the 14.36% incisor loss among the diabetic patients. Similarly in controls only 2.8% of canines were lost as compared to 11.24% lost among the diabetics. Likewise, 5.71% premolars were lost in control group and 18.1% were lost among the diabetics. This pattern of significant increase in tooth loss among diabetics continued with molars also. While 8.04% molars were lost among controls, we found 22.5% of molars loss among diabetic patients (Figure 4). Overall among control and diabetics molars were lost in significantly higher percentage as compared to other group of teeth.

Distribution of O verses Non-O blood groups in male gingivitis and male periodontitis patients

In our second survey of 709 male subjects with gingivitis or periodontitis, we analyzed

the ABO and the Rh (Antigen D) blood group distribution to determine if there was any possible association between the inheritance of blood groups and onset of the gum disease as well as to see if there were any specific differences in the ABO and Rh blood group distributions between male gingivitis and male periodontitis patients. For blood group distribution studies we had a total of 507 male gingivitis patients and a total of 202 male periodontitis patients. First we compared our data as O versus non-O blood group (A, B. AB) prevalence among gingivitis and periodontitis patients. Our data analysis on gingivitis patients showed no significant difference between the O versus non-O blood group distribution. The data was not significant at the $p < 0.05$. The Z value was 0.1884 and the p value was .8493. Similarly there was no major difference between the distributions of O blood groups in gingivitis versus periodontitis patients at $p<0.01$, likewise there was no significant difference in the distribution of non-O blood groups between male gingivitis and male periodontitis patients at $p < 01$. However when we compared the distribution of O versus non-O blood groups in the male periodontitis patients, we found O blood group distribution to be statistically significantly higher (56.4%) as compared to non-O blood group distribution (43.5%), (Figure 5). The p value was 0.096 at ($p < 01$). Therefore, our results show a statistically significant increase in the distribution of O blood groups (56.4%) and a significant reduction in the distribution of non-O blood group (43.56%) in male periodontitis patients as compared to their comparative distribution in male gingivitis patients (Figure 5).

Distribution of ABO blood groups in male gingivitis and male periodontitis patients

Since we saw a statistically significant increase in the distribution of O blood groups in periodontitis male patients, as compared to non-O blood group distribution and a dramatic but not statistically significant rise in non-O blood groups among gingivitis patients (49.70%) as compared to the non-O blood group distribution in the periodontitis patients (43.56%) (Figure 5), we next analyzed and compared the distributions of individual blood groups between gingivitis and periodontitis male patients. Out of 507 male gingivitis patients and 202 male periodontitis patients we found a significant increase in prevalence of A blood groups among the gingivitis patients (25.6%) as compared to 15.8% in the male periodontitis patients (Figure 6, blue arrowhead). There was a statistically significant increase in distribution of A blood type in male

gingivitis patients as compared to the male periodontitis patients at $p < .01$. Although, the B blood group also showed a comparative higher percentage of distribution among the gingivitis patients however, it was not significantly higher at $p < .05$ (Figure 6). The p value was 0.105. In contrast the blood group AB showed a statistically significant reduction in prevalence among gingivitis patients (4.5%) as compared to the periodontitis male patients (13.36%). The results were significant at $p < .01$ (Figure 6, red arrowhead) Although like AB, O blood group also showed a comparative increase in their distribution among periodontitis patients as compared to the gingivitis male patients, however it was not statistically significant increase at $p < .05$ (Figure 6).

Distribution of ABO and Rh blood groups in male gingivitis and male periodontitis patients:

Since our results showed significant differences in the ABO distribution patterns between the male gingivitis and periodontitis patients, next we looked at our results more closely in terms of Rh^+ or Rh^- distribution among gingivitis and periodontitis patients. Collectively we found 92.1% gingivitis patients to be Rh^+ as compared to 83.66% Rh^+ individuals among periodontitis patients (Figure 7). These results suggest a significant increase in Rh^+ distribution among the male gingivitis patients as compared to the male periodontitis patients at $p < .01$. The p value was .00084 and Z value was -3.34. Likewise we saw a statistically significant increase in Rh^- individuals among male periodontitis patients as compared to the male gingivitis patients at $p < .01$. The p value was .00084.

Since we saw a significant increase in Rh^+ distribution among the male gingivitis patients as compared to the male periodontitis patients at $p < .01$, next we decided to analyze and compare our data more closely in terms of ABO blood group being Rh^+ or Rh^-. Among the male gingivitis patients 2.56% were found to be A^-, 23.07% were A^+, 1.77% were B^- and 17.75% were B^+. We found 0.6% to be AB^- and 3.9% were AB^+. 2.9% were O^- and 47.33% were O^+. Overall among gingivitis patients 92.1% were Rh^+ and 7.8% were Rh^-. When we compared the ABO blood group distribution among the male periodontitis patients we found 5.44 % to be A^- and 10.39% to be A^+ (total 15.83% A blood group); 0.49% were B^- and 13.86% were B^+ (total 14.35% B blood group). 2.47% subjects were found to be AB^- and 10.89% were AB^+ (total 13.36% AB blood type). We found 7.92% % to be O^- and 48.51% were O^+ (total 56.43% O blood type). Overall 83.66% were Rh^+ and 16.33% were Rh^- (Figure 7).

Table 1: Control male profile

Number (n)	Age Range	Mean Age	Gingivitis (%)	Periodontitis (%)	Total Tooth Loss
200	17-68 years	31.31 years	63 %	37 %	20.05%

Table 2: Diabetic patient profile

Number (n)	Age Range	Mean Age	Gingivitis	Periodontitis	ToothHbA1closs
100	13-90 years	52.91 years	35 %	65 %	66.2%7.2 mM/L

Figure 1: A) 18 years old male patient with O^+ blood group non-smoker, diagnosed with early gingivitis which has plaque accumulation, swelling gingiva and bleeding on periodontal probing. B) A 25 years old male patient with O^+ blood group, non-smoker diagnosed with late stage of gingivitis showing more plaque accumulation than early stage, swelling gingiva and redness more prominent with bleeding upon brushing and periodontal probing

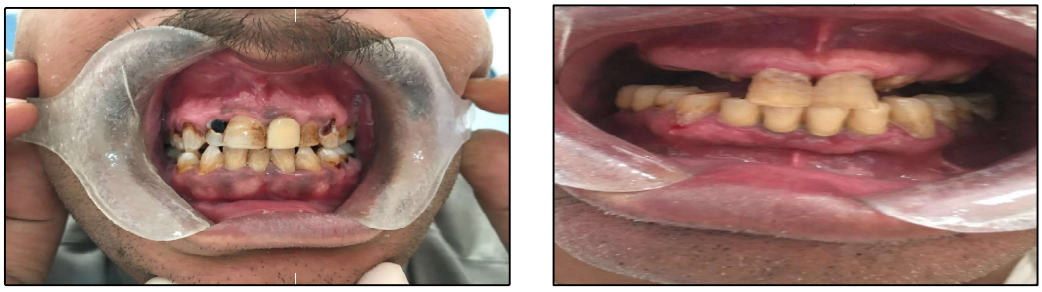

Figure 2: A) A 34 year old male diabetic smoker, showing severe tooth mobility, also showing recession of gingiva due to severe inflammation and diabetes. Soften edematous gingiva with periodontitis. Decay of teeth. Xerostomia or dry mouth may be responsible for producing cavities and severe tooth decay. B) A 51 year old male with severe periodontitis who is diabetic and heavy smoker. Note the loss of most of the upper teeth except numbers 11, 12, 14, 16, 21, 22, 26.

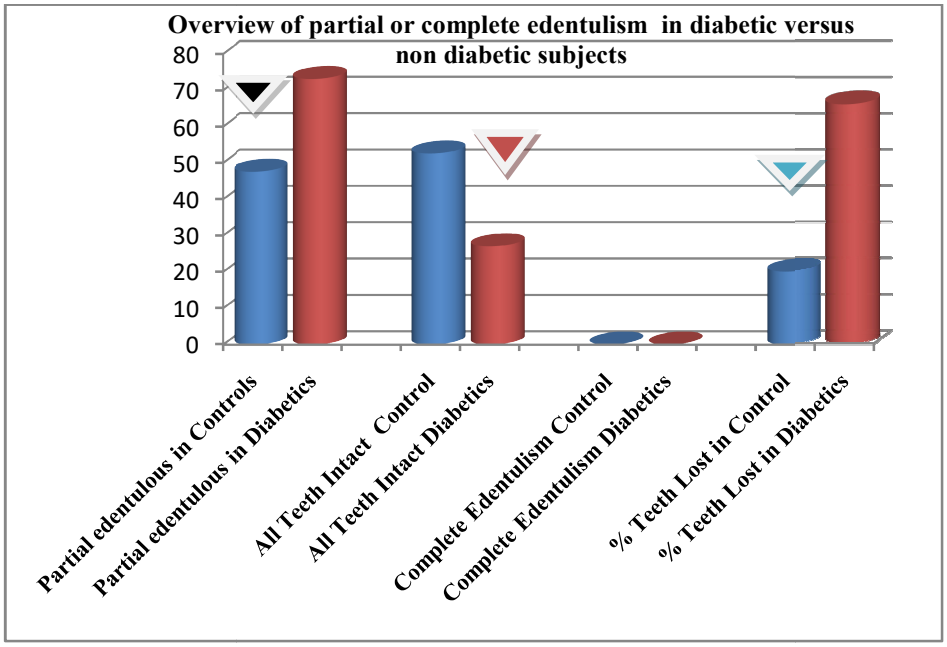

Figure 3: Percentage of subjects with partial edentulous (black arrowhead) or all teeth intact (red arrowhead) in control (blue bars) versus diabetic patients (red bars). Note a significant increase in percentage of diabetic patients with partial edentulous (red bar) as compared to the control subjects (blue bars, black arrowhead), and a corresponding significant decrease in percentage of diabetic patients with full intact teeth (red arrowhead and red bar) when compared with the control subjects (blue bar) and an overall percentage of total or combine tooth loss of 20.05% (blue arrowhead) among the control population (blue bars) versus 66.2% among the diabetic patients (red bars). Again note a significant increase in total tooth loss among the diabetics as compared to the controls (blue arrow head). In this survey we found no complete edentulous

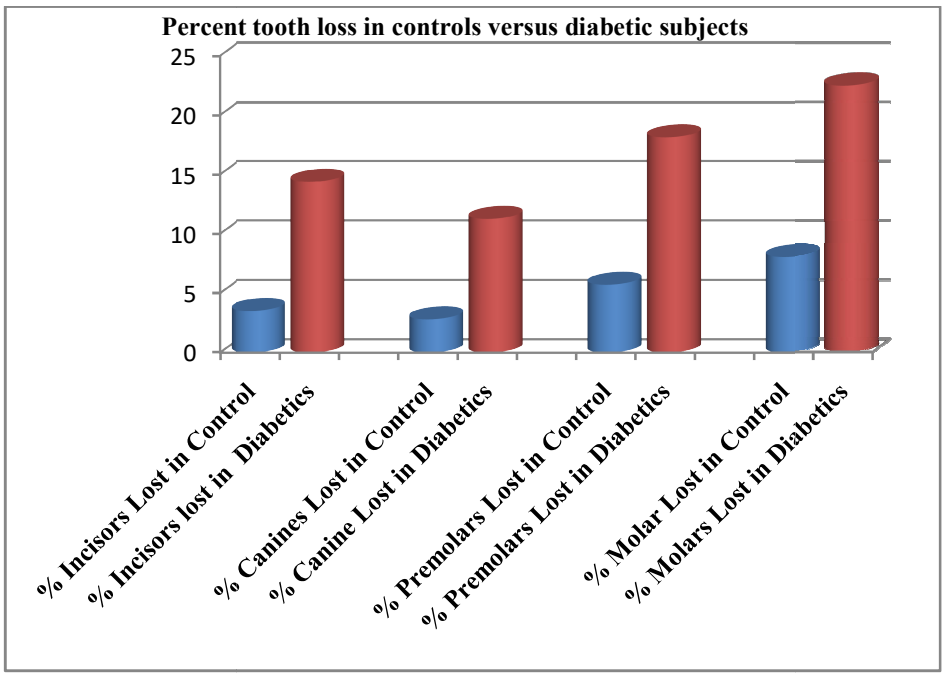

Figure 4: Percent tooth loss in controls versus diabetic subjects: A significant increase in loss of incisors, canines, premolars and molars among diabetics (red bars) as compared to the control subjects (blue bars)

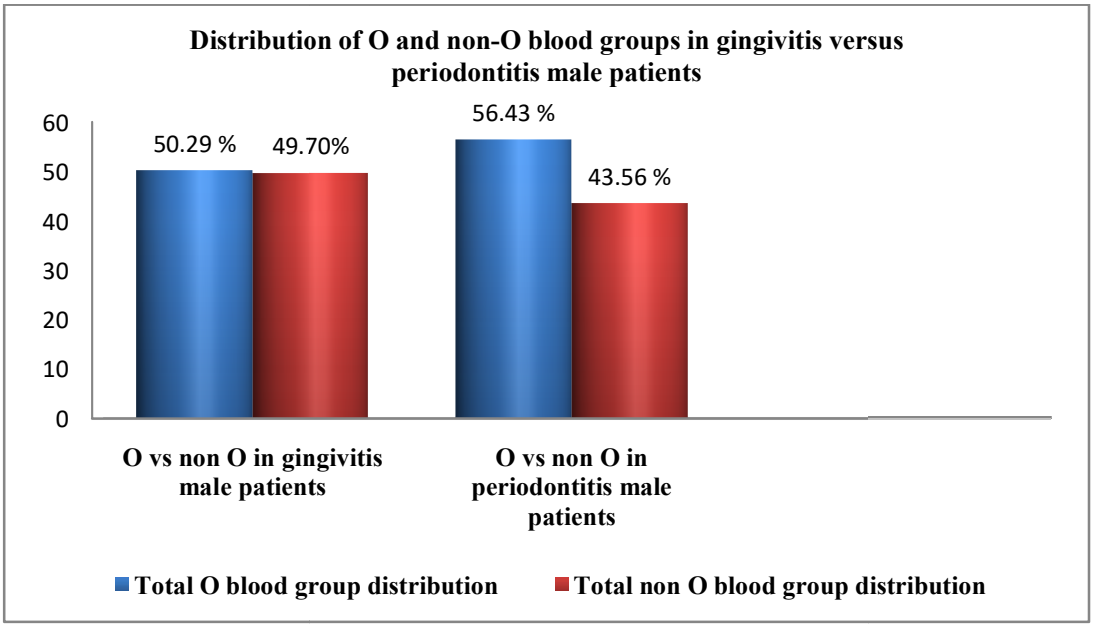

Figure 5: Distribution of O and non-O blood groups in gingivitis versus periodontitis male patients: Statistically there is no significant difference between the O (50.3%) versus non-O blood group (49.7%) distribution among male gingivitis patients. The results are not significant at p < 0. 01or at, p value of < 0. 05. However, there is statistically significant increase in the distribution of O blood groups (56.43%) in male periodontitis patients as compared to their non-O blood group distribution (43.56%). The results are significant at p < 0. 01

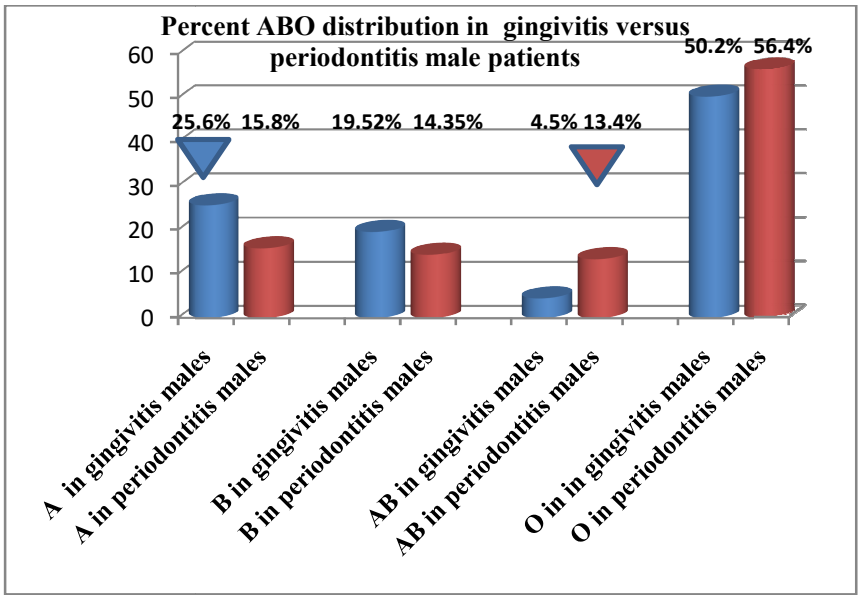

Figure 6: Percent ABO distribution among gingivitis versus periodontitis patients: We had 507 male gingivitis patients and 202 male periodontitis patients. We found 25.36% gingivitis patients to have A, blood type while only 15.83% male periodontitis patients were A blood type. Gingivitis was highly prevalent and statistically significantly higher in A blood group (blue arrowhead) as compared to the periodontitis (p < .01). However among male periodontitis patients AB blood group distribution was significantly higher (red arrowhead) as compared to the gingivitis patients (p < .01). Although as compared to gingivitis patients O blood group distribution was comparatively higher among male periodontitis patients however the increase was not significant at (p < .05)

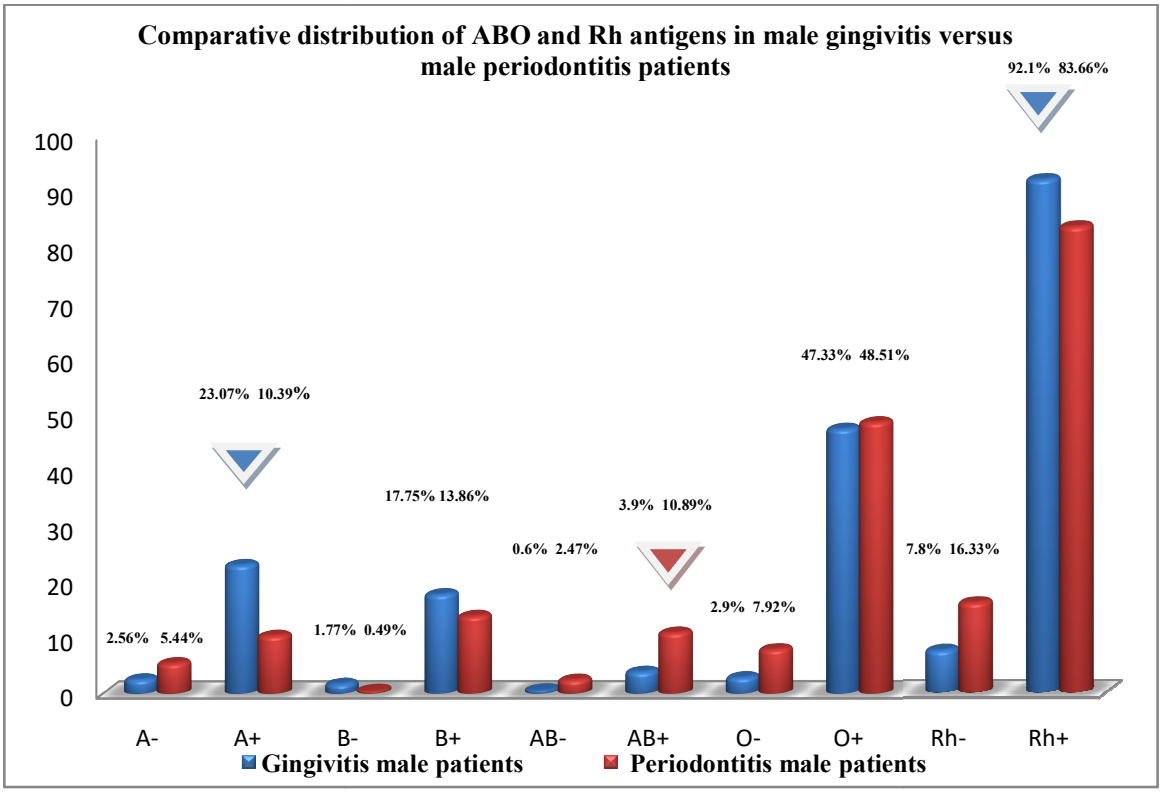

Figure 7: Comparative distribution of ABO and Rh antigens in male gingivitis versus male periodontitis patients: Total male gingivitis patients 507 and total male periodontitis patients 202. More than 23% patients were gingivitis positive in A^+ (blue bars) while only 10.3% male periodontitis patients were A^+ (red bars). Gingivitis was highly prevalent and statistically significantly higher in A^+ blood group (blue arrowhead) as compared to the periodontitis ($p < .001$). The Z value was 3.8494 at $p < .00012$. In contrast we found 10.89% male AB^+ with periodontitis as compared to 3.9% AB^+ patients who were gingivitis positive (blue bars, red arrow heads). Gingivitis was more prevalent and statistically significantly higher in A^+ blood group as compared to male periodontitis patients ($p < .001$). The Z value was 3.849at $p < .00012$. Therefore we see significantly high distribution of A^+ blood groups in male gingivitis patients and significantly lower distribution of AB^+ blood group among Saudi male gingivitis patients (blue arrow heads) as compared to the male periodontitis patients at ($p < .001$). However as previously reported we did not find any significant change in the distribution of blood group O between male gingivitis and periodontitis patients. Similarly, the Rh^+ blood group showed statistically significantly higher percentage of expression among the gingivitis patients (blue arrowhead) as compared to the periodontitis patients ($p < .001$). The Z value was 3.34 and the p value was $p < .00084$

DISCUSSIONS

In the current epidemiological study we wanted to determine if there was any association between acquiring gingivitis and or periodontal diseases and the ABO blood groups in Saudi adult male population. As expected and as previously reported by us for Saudi female adult population (Farshori et al, 2018) we found similar shockingly high prevalence of gingivitis in Saudi adult male population. It was rare to find any young adult without gingivitis and or periodontitis (Table I and II). Our findings were in agreement with Al Qahtani et al 2017. If gingivitis is not properly controlled it can eventually lead to more serious periodontal disease. Although majority of our control non diabetic subjects had gingivitis (63%), about 37% of our subjects had periodontitis, a serious gum disease (Table 1). However this situation was reversed among the diabetic patients and 35% had gingivitis and

majority (65%) had the periodontitis (Table 2). We noticed a significant increase in the percentage of partial edentulous and a corresponding significant reduction in the percentage of full intact teeth among diabetic patients as compared to the control subjects. We also found overall percentage of total or combine tooth loss to be significantly higher among the diabetics in comparisons to the control population. Although we found significant increase in partial edentulous among the diabetics however in this survey we found no complete edentulous (Figure 3). As expected, there was a significant increase in the loss of incisors, canines, premolars and the molars among the diabetics as compared to the control subjects (Figure 4). These findings were in agreement with our previously published reports on female adult diabetic patients (Farshori et al 2018).

In our second survey, out of total 791 male subjects, we found 589 adult males (74.46%) to have early to late stages of gingivitis (Figure 1a and b). The age range was between 14 years to 34 years (mean age 23.95 years). Majority of patients with gingivitis showed plaque accumulation, gingival swelling and or bleeding on periodontal probing (Figure 1a and b). Gingivitis is the earliest stage of gum disease and may be reversible by thorough professional teeth cleaning and strict oral hygiene control such as regular brushing and flossing teeth. However if gingivitis is not controlled it eventually leads to more serious and irreversible gum disease the periodontitis, the major signs of which include tooth inflammation. By the fourth stage bacteria have most likely already invaded the deeper gum tissues in between the teeth and start damaging the teeth and the bones thus causing loose teeth which are the major cause of periodontitis. (Figure 2 a, b). Since there is high prevalence of gingivitis and periodontitis in Saudi population we next decided to look at if there were any possible differences in the distribution of ABO and Rh antigens among the male gingivitis patients as compared to the Saudi adult periodontitis patients. Association between various blood groups and periodontal disease has been suggested due to various blood group antigens might be working as receptors for pathogens associated with periodontal disease. (Pai et al 2012).

Several studies have shown correlation between ABO blood groups and various diseases such as diabetes (Fagherazzi et al 2015, Farshori et al 2016, 2017) cancer (Zhang et al 2014) and cardiovascular disease (Wazirali et al 2005, Zhang et al 2012, Biswas et al 2013, Sharif et al 2013,

Chen et al 2016, Farshori et al 2017, 2018) and to common oral disease such as gingivitis and periodontitis (Demir et al, 2007, Ghamdi et al, 2009, Koregol et al 2010, Pai et al 2012, Vivek et al 2013, Mortazvi et al 2015, Gautam et al 2017, Mostafa et al 2019)). Although these studies suggest susceptibility of adult population with certain blood types to periodontal disease, however at best, the results have been quite inconsistent. For example, according to some studies there was high prevalence of gingivitis in A blood type additionally they found significant relationship between the Rh factor and prevalence of gingivitis and they found high prevalence of periodontitis in blood group O (Demir et al 2007, Koregol et al 2013). However according to another study blood type B was more prevalent among the gingivitis patients and they saw no relationship with ABO blood groups with periodontitis (Mortazvi et al., (2015).

According to yet another study blood group O was more prevalent among gingivitis patients while they saw blood group B to be more prevalent among periodontitis patients. Although several studies found O blood group to be highly prevalent among the periodontitis patients (Koregol et al 2010, Vivek et al 2010, Mostafa et al 2019) however according to few studies blood type B was more prevalent among periodontitis patients (Kaslik et al 1971, Ghamdi et al 2009, Pai et al 2012). When we analyzed and compared our results as O versus non-O blood group distribution and made comparison between the gingivitis and periodontitis patients, we did not find any significant difference between the O versus the non-O blood group distribution among the male gingivitis patients. The results were not significant at $p < 0.05$. But we did find statistically significant increase in the distribution of O blood groups among the male periodontitis patients as compared to their non-O blood group distribution. The results were significant at $p < 0.01$. Thus our results suggest a statistically significant increase in the prevalence of O blood group as compared to non-O blood group among the Saudi adult periodontitis patients (Figure 5). These results are in agreement with some of the previously published studies (Demir et al, 2007, Koregol et al, 2010, Vivek et al 2013 and are also in agreement with the recently published study by Mostafa et al 2019). However our results are not in agreement with other studies (Kaslick et al 1971, Pai et al 2012, and Gautam et al 2017). These differences may be due to reported difference in the ABO blood group

distribution frequencies in different geographical regions of the world and between different ethnic groups within the same region (Liu et al 2017).

Since there was a significant increase in the distribution of O blood groups among the male periodontitis patients, in comparison to the non-O blood group distribution and since we saw a dramatic but not statistically significant increase in non-O blood groups among the gingivitis patients as compared to the non-O blood group distribution in the periodontitis patients (Figure 5), we next decided to analyze and compare the distribution of individual blood groups between the gingivitis and periodontitis male patients (Figure 6). We found a significant increase in the prevalence of A blood groups among gingivitis patients as compared to the male periodontitis patients. There was a statistically significant increase in the distribution of A blood type in male gingivitis patients as compared to the male periodontitis patients at $p < .01$ (Figure 6, blue arrowhead).

Although, the B blood group also showed a comparative higher percentage of distribution among the gingivitis patients as has been reported recently (Mortazvi et al 2015), however, it was not significantly higher in comparison to the male periodontitis patients at $p < .05$ (Figure 6). The p value was .105 and was not significant. Interestingly we saw a statistically significant reduction in the prevalence of gingivitis in blood group AB (4.5%) as compared to the periodontitis male patients (13.36%). Therefore we saw a significant increase in the distribution of AB blood group among the male periodontitis patients as compared to male gingivitis patients. The results were significant at $p < .01$ (Figure 6, red arrowhead) Even though like AB blood group, O blood group also showed a comparative rise in its distribution among periodontitis patients as compared to the gingivitis male patients, however it was statistically not a significant increase at $p < .05$ (Figure 6).

When we analyzed our results more closely we found more than 23% patients were gingivitis positive in A^+ (blue bars) while only 10.39% of male periodontitis patients were A^+ (red bars). Gingivitis was highly prevalent and statistically significantly higher in A^+ blood group as compared to the periodontitis ($p < .001$). The Z value was 3.894 at $p < .00012$. On the other hand we found 10.89% male AB^+ with periodontitis as compared to only 3.9% AB^+ patients who were gingivitis positive (blue bars). Gingivitis was more prevalent and statistically significantly

higher in A^+ blood group as compared to the periodontitis ($p < .01$). The Z value was 3.85 and the p value is $p < .00012$. In summary, we found significantly higher distribution of A^+ in male gingivitis patients and significantly lower distribution of AB^+ blood groups among the Saudi adult male gingivitis patients in comparison to the male periodontitis patients at ($p < .01$). Although we did not find any significant change in the distribution of O^+ blood group between male gingivitis and periodontitis patients however we did find a high prevalence of blood group O versus the distribution of non-O blood groups in male periodontitis patients. We did not see such a difference in O versus non-O blood group distribution in gingivitis patients (Figure 5).

CONCLUSIONS

There was high prevalence of gingivitis in A and B blood group as compared to periodontitis patients; however prevalence of B blood group was not statistically significant. Among periodontitis patients AB blood group distribution was significantly higher as compared to the gingivitis patients. Additionally O blood group had high frequency of distribution as compared to non-O blood groups in male periodontitis patients. Therefore our results suggest that the ABO blood groups and the Rh factor may constitute a risk factor on the development of gingivitis and periodontal disease among the Saudi adult population, however, long term studies with larger sample size are needed to confirm these results.

Conflict of Interest:

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REFERENCES

[1] Gautam A, Mittal N, Singh TB, Srivastava R, Verma PK. Correlation of ABO blood group phenotype and rhesus factor with periodontal disease: An observational study. Contemp. Clin Dent 2017; 8:253-8

[2] Al Qahtani NA, Joseph B, Deepthi A, Vijayakumari BK. Prevalence of chronic periodontitis and its risk determinants among female patients

in the Aseer Region of KSA. J Taibah Univ Med Sc 2017; 12(3):241e248.

[3] Bashwari, L.A., Al-Mulhim, A.A., Ahmad, M.S., Ahmed, M.A. Frequency of ABO blood groups in the eastern region of Saudi Arabia. Saudi Medical Journal. 2001. 22 (11): 10081012.

[4] Biswas S, PK Ghoshal, B. Halder, and N Mandal. Distribution of ABO blood group and major cardiovascular risk factors with coronary heart disease. Biomed. Res. Int. 2013. 1-6.

[5] Demir, T., Tezel, A., Orbak, R., Eltas, A., Kara, C., & Kavrut, F. The Effect of ABO Blood Types on Periodontal Status. *European journal of dentistry*, 2007. *1*(3), 139-43.

[6] Fagherazzi G, Gusto G, Clavel CF, Balkau B, Bonnet F. ABO and Rhesus blood groups and risk of type 2 diabetes: evidence from the large E3N cohort study. Diabetologia; 1915. 58: 519- 522.

[7] Gautam A, Mittal N, Singh T B, Srivastava R, and Verma P K. Correlation of ABO Blood Group Phenotype and Rhesus Factor with Periodontal Disease: An Observational Study. Contemp Clin. Dent. 2017. 8 (2): 253–258.

[8] Al Ghamadi Ali. S. T. Association between ABO blood groups and severity of chronic periodontitis. JKAU: Med. Sci. 2009; 16 (3): 31-34.

[9] Diabetes in MENA. International Diabetes Federation (IDF), of Middle East and North Africa (MENA). 2017. IDF Diabetes Atlas 8th edition.

[10] Koreogol AC, Raghavendra M, Nainegali S, Kalburgi N, Verma S. ABO blood groups and Rhesus factor: An exploring link to periodontal diseases. 2010; 2, 3: 364-368.

[11] Diana Mostafa, Essam I. Elkhatat, Pradeep Koppolu, MunaMahgoub, Esam Dhaifullah1, Ahmed Hussein Hassan3. Correlation of ABO Blood Groups and Rh Factor with The Severity of Generalized Chronic Periodontitis: Across Sectional Study in Riyadh, Saudi Arabia. 2019; Open Access Maced J Med Sci.

[12] Umoh AO, Azodo CC. Prevalance of gingivitis and periodontitis in an adult male population in Nigeria. Niger J Basic Clin Sci. 2012; 9, 65-9.

[13] Kaslick RS, Chasens AL, Tuckman MA, Kaufman B: Investigation of periodontitis with periodontitis: Literature survey and findings based on ABO blood groups. J. Periodontal. 1971; 42, 420-27.

[14] Schulze A., Busse M. Gender differences in periodontal Status and oral hygiene of non-diabetic and type 2 diabetic patients. Open Dental J. 2016; 10: 287-97.

[15] Shjau HJ., Reynolds MA. Sex differences in destructive periodontal disease: a systematic review. J. Periodontol. 2010; 1379-89.

[16] Saima Sharif, N. Anwar, T Farasat, S. Naz. Group frequency in ischemic heart disease patients in Pakistani population. Pak. J. Med. Sci. 2014; 30 (3): 593-595.

[17] Mostafa D, Elkhatat EI, Koppolu P, Mahgoub M, Dhaifullah E, Hassan AH. Correlation of ABO blood groups and Rh factor with the severity of generalized chronic periodontitis: Across sectional study in Riyadh, Saudi Arabia. Open Access Maced J Med Sci. 2019; 7(4); 617-622. https://doi.org/10.3889/oamjms.2019.044

[18] Liu, J., Zhang, S., Wang, Q., Shen, H., Zhang, Y., & Liu, M. Frequencies and ethnic distribution of ABO and RhD blood groups in China: a population-based cross-sectional study. *BMJ open*, 2017; *7*(12), e018476. doi:10.1136/bmjopen-2017-018476.

[19] Sanadi RM, Chelani LR, Suthar NJ, Khuller N, Basavaraj P. gender based differences in occurrence of gingival disease among dental students: A survey. Dent. Med. Res 2017; 5: 17-20.

[20] Wikipedia encyclopedia: 2019. Blood type distribution by country.

[21] Hamed Mortazavi, Ghogha Lotfi, Elnaz Fadavi, Shima Hajian, Maryam Baharv and, Siamak Sabour. Is ABO blood group a possible risk factor for periodontal disease? Dental Hypotheses. 2015; 6: 14-8.

[22] Pai, G. P., Dayakar, M. M., Shaila, M., & Dayakar, A. Correlation between "ABO" blood group phenotypes and periodontal disease: Prevalence in south Kanara district, Karnataka state, India. *Journal of Indian Society of Periodontology*, 2012; *16*(4), 519-23.

[23] El-Angbawi MF, Younes SA. Periodontal disease prevalence and dental needs among school children in Saudi Arabia. Community. Dent Oral Epidemiology. 1982; Apr; 10(2): 98-9.

[24] Vivek S, Jain J, Simon SP, Battur H, Supreetha S, Haridas R. Association of ABO Blood Group and Rh factor with Periodontal Disease in a Population of Virajpet, Karnataka: A Cross-Sectional Study. J Int Oral Health 2013; 5(4):30-34.

[25] Zhang BL, Na He, Yu-Bei Huang, Feng-Ju Song, Ke-Xin Chen. ABO blood groups and Risk of Cancer: A systematic review and meta analysis. Asian Pacific Journal of Cancer Prevention. 2015; 15: 11, 4643-50.

[26] Zhang H, C. J. Mooney and MP Reilly. ABO blood groups and cardiovascular diseases. International Journal of Vascular Diseases 2012; (1-8).

[27] Farshori, M.P.Q., Naif, Al-Tamimi., Turki, SA., Saad, M.A., Ashjan, M.A., Marram, N.A., Meshari, Y.A., Fahd, M.A., Abdulsalam, S.A., Abdelaziz, S.A., Humood, A.A. Rapidly rising rates of adult obesity and child obesity in schools of Hail region of Saudi Arabia: A comparative analysis. Integrative Obesity and Diabetes. 2105; 1: (5): 163-166. ISSN # 2056 8827.

[28] Mohammad Parvaiz Qamar Farshori, Ibrahim Hamad Al-Wakid, Ibrahim Khalil AL Ibrahim, Abdullah Faraj ALShammari, Minieaam Alduejieman, Ashjaan Muhammad Almhanaa, HawreyahJazza Alshammari, Sarah Sulaiman Alajlan and Abdulrahman Yousef AlMuzaini. Distribution of ABO and Rhesus (Rh) blood group antigens in male type 2 diabetes mellitus patients in Hail region of Saudi Arabia: High incidences of diabetes mellitus in males with B+ blood type. Integrative Obesity and Diabetes. 2016; 2: (3), 233-238. ISSN # 2056 8827.

[29] Mohammad Parvaiz Qamar Farshori, Abdulrahman Yousef AlMuzaini, Ibrahim Hamad Al-Wakid, Ibrahim Khalil AL Ibrahim, Abdullah Faraj ALShammari, Minieaam Alduejieman, Ashjaan Muhammad Almhanaa, HawreyahJazza Alshammari, Sarah Sulaiman Alajlan and Ibad M. Farshori. Frequency of Distribution of ABO and Rhesus (Rh) Blood Group Antigens in the Female Type 2 Diabetes Mellitus (T2DM) Patients in Hail Region of Saudi Arabia. . Integrative Obesity and Diabetes. 2017; 3 (1): 1-6. ISSN # 2056 8827.

[30] Mohammad Parvaiz Farshori, Maha Alnaafa, Ibrahim Khalil AL Ibrahim, Sarah Sularman Alajlan, Ibrahim S Alfawzan and Fahad alnasrallah. "Prevalence of gingivitis and periodontitis and a significant tooth loss in diabetic females of hail region in Saudi Arabia" International Journal of Current Research in Life Sciences, 2018; 7, (02), 1117-1123.

[31] Preshaw PM, Alba AL, Herrera D, Jepsen S, Konstantinidis, Makrilakis, Taylor. Periodontitis and diabetes: a two-way relationship. Diabetologia. 2012; 55 (1): 21-31.

[32] Alotaibi A, LinPerry, Leila Gholizadeh, AliAl-Ganm. Incidence and prevalence rates of diabetes mellitus in Saudi Arabia: An overview. 2017; 7 (4):211-218.

[33] Farshori MP, Alrashdan YG, Al Tamimi RKA, Alshammari HAH, Alshammari MS, Alageel AHS, et al. High prevalence of hypertension and myocardial infractions in Saudi adult female population with blood type A. Int J Community Med Public Health 2018; 5:4676-83.

[34] M. Parvaiz Farshori, Yasir Ghareeb, Ibrahim Alrashdan, Abdulmajeed Hamoud M. Alshammari, Raiya Khaled Ali AlTammimi, Hayam Abdullah Homood Alshammari, Abrar Hamad Saleh Alageel, Saleh Hadi Alharbi and Fayez Ammar S Alshammari. Frequency of expression and the distribution of ABO and Rh, blood group antigens in the myocardial infarction (MI) male patients of the Hail region in Saudi Arabia. Journal of Integrative Cardiology. 2017; 3 (4): 1-5. ISSN: 2058-3702.