Research Article

Influence of the *O-A-B* System of Antigens and the *Rh* System on Dental Decay among the 2nd Stage Dental Students

Shurooq Wesam Al-Shaibani[1], Maha Hatem Abdul Wahid[2], Hayfaa Jaber Hussein[1] and Sana'a Abdulrazzaq Ibrahim Alrubaie[2]*

[1]*Faculty of Dentistry, Basic Science Department, University of Kufa, Al-Najaf, Iraq*
[2]*Department of Basic Sciences, Faculty of Dentistry, University of Kufa, Iraq*

*Corresponding Author: Sana'a Abdulrazzaq Ibrahim Alrubaie, Department of Basic Sciences, Faculty of Dentistry, University of Kufa, Iraq.

Abstract

Background: Dental caries is the most common problem of the stomatognathic system. Formation of the dental plaque, diet related factors, and oral hygiene are presumed to be major etiological factors. The relationship between some systemic diseases and A-B-O blood group is a well-documented fact. The Aim: This study was to investigate the relation between A-B-O blood group and the prevalence of dental caries.

Materials and Methods: A total of 65 dental students participated in the study aged between 19-21 years. The participants were attended to the medical physiology laboratory/Faculty of Dentistry/University of Kufa. They were randomly selected for the study. Dental caries in the study was scored by using the Decay, Missing, and Filled Teeth (DMFT) score index according to WHO criteria.

Results: Blood group (B) was found to be more prevalent among the subjects and (B) blood group patients had the highest mean DMFT score and blood group (AB) the lowest among. The results among all groups were not statistically significant.

Conclusion: In spite of the study limitations, it could be concluded that: higher percentage of A-B-O blood groups have dental caries, but the difference was calculated as a statistically non-significant.

Furthermore, studies were needed to be conducted on a larger population, in order to derive any conclusive results on whether the A-B-O blood group system has any influence on the prevalence of dental caries or non.

Keywords: Dental Caries; ABO; DMFT; Rh Factor

Abbreviations

WHO: World Health Organization; DMFT: Decayed, Missed and Filled Teeth Index; RBC: Red Blood Cell; Rh: Rhesus Factor

Introduction

The health of oral cavity is a measure of overall health and play a vital role in preserving life functions [1]. The caries of dental is the most dominant infectious disorder international. A persistent, advanced disease can occur in initial or constant dentition and can have an effect on the tooth apparent of the crown or root [2]. Decay of tooth is a multi-factorial disorder that occupies numerous environment and genetics every one play essential tasks [3]. The caries of dental is a universal community health problem. Furthermore, if dental caries left untreated, it can result in critical complications which including pain/infection, abscess, in addition to loss of teeth [4]. There are at least two billion of people comprehensively pretentious with caries of the permanent dentition. More than three major aspects causing dental decay, including host factors, diet, and microorganism [5]. Environmental risk factors have a role in producing of dental caries, for instance; lack of fluoride, poor oral hygiene, patients age (elderly people having higher risks), dry mouth (xerostomia), fracture fillings, and consuming a diet with elevated in sucrose [6,7].

Each person has his/her own blood group likeable with the caries index [8]. The process of tooth decay, has been famous from one-hundred years to be caused by bacteria that fermenting the foods, yielding the acids and mineral had dissolved tooth [9]. The Decayed, Missed and Filled Teeth index (DMFT) developed by the World Health Organization (WHO) is the common used index in caries appraisal [10,11]. DMFT has been used for evaluation and monitoring of the oral health interventions in the community by developing related strategies [12].

ABO groups had discovered more than 100 years ago. Recent indication proposes that the O-A-B system is clinically important

not only from a hematology, but also had been involved in the blood transfusion and organ transplantation [13], however had a role in the pathogenesis of several diseases [14,15]. Nobel Laureate Karl Landsteiner in 1900, illustrated that the O-A-B system containing four blood groups including: A, B, AB and O [16]. It was established depending on the absence/presence of certain antigens on the membrane of the human red blood cells (RBCs) [17]. The "universal donor" that it called on (O blood group), because it has no antigen that found in both A and B antibodies [18]. While a "universal recipient" that it called on (AB blood group) because it has no-antibodies, but it has both A and B antigen [19]. In addition to the O-A-B blood type system, Rhesus-system (Rh) is also important when transfusing blood has been occurred. Rh is the second most important parameter used after the O-A-B system [20]. The common differences between the two systems (O-A-B and Rh) are described in the following: in the O-A-B system; the plasma agglutinins involved in the transfusion reactions, which is developed spontaneously. Whereas in the Rh system; spontaneous agglutinins almost never occurred. The A-B-O system was determined by the presence of multiple proteins which were located on the surface of the RBCs [21].

Current investigation has presented major enhancements, indicating a great association between the different O-A-B blood type system and diseases varying from infertility to diabetes mellitus (DM) [22,23]. An association has been observed between the O-A-B blood type system and various diseases like: salivary gland tumors, dental caries, oral carcinoma. From another hand, there is other disorders associated with a further system in the human body like: chickenpox, hematological cancer, cardiac diseases, malaria, and cholera [24,25]. Also, there were many other associated disorders like; gallstones, tumors of the pancreas, colitis, as well as coronary artery disease [26].

There are many evidences indicate that the O-A-B blood system has played an important responsibility in the sensitivity or resistance to a mixture of infectious and non-infectious diseases [27].

Insufficient amount of efforts have been reported in the topic of dental investigation with the exception of few articles on periodontal diseases [28,29], salivary gland tumors, and dental caries [30]. Consequently, the current study was carried out to find any relation between the O-A-B blood system in compare with RH system for determination their relation with the dental caries.

Study proposal and participants

A cross-sectional study design was conducted to find the correlation between the O-A-B blood system rather than the RH system with dental caries. The participants were conducted in the Educational dental clinic at College of dentistry/University of Kufa.

The total number of participants was 115 which concluded the Sixty-five participants were enrolled in the study of an age ranged between [19-21]. The second-stage students had been enrolled in this study at the Dentistry Faculty/University of Kufa. The sample size at the beginning was large; then, those with developmental disorders of the teeth, systemic diseases, and mental disabilities were excluded from the study.

Material and Method

The blood grouping had carried out which based on the slide agglutination test. The blood grouping done by the slide method by dividing a microscope slide into three areas A, B and D, then pricking a finger of the student with a sterile lancet and placing one drop of blood in the determined areas A, B and D partitions. Then, adding one droplet of antisera which concluded the anti-a, anti-b and anti-d (Lorne, United Kingdom) onto each partition (A, B and D), correspondingly. Then, mixing of the (blood plus serum) separately was done with a clean match stick. Following two- minutes observe the area for the confirmation of agglutination of the RBCs. A positive agglutination test appears, when A-antigen was mixed with anti- A, or B antigen was mixed with anti-B [31].

The oral health assessment was performed by DMF-T index, which was based on WHO criteria. The concept of DMF-T index which was corresponded to the quantity or number of infected teeth for every person in population sets. The dental oral exam was achieved by the examiner dentist with utilizing a sterile dental mirror for determination of dental caries status. A tooth with more than one carious lesion was scored as "one decayed tooth". Whereas, a tooth with a filling and a separate carious lesion was scored as "one filled tooth".

The Results

In (Figure 1), it was showed that the B blood group was more frequent (35%), followed by O group (32.3%) and A group (25.8%), then the AB group (9.2%) was the less common.
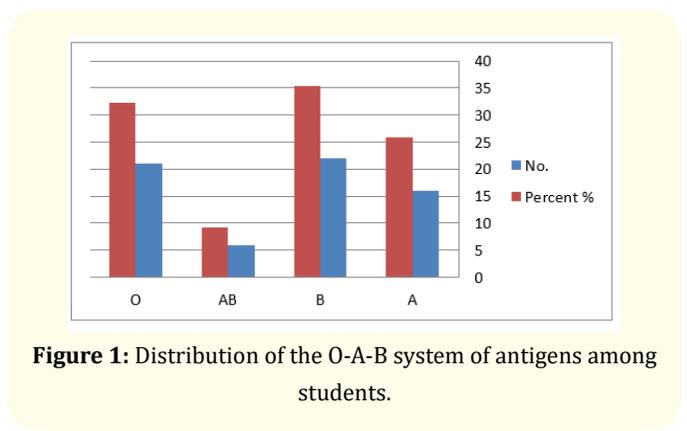

Figure 1: Distribution of the O-A-B system of antigens among students.

While in (Figure 2), it was showed that the Rh system among students with "blood group O" with a high percentage (95.2%), followed by B group (90.9) % and A group (87.5%), while in the AB group (83.3%) was the lowest percentage.
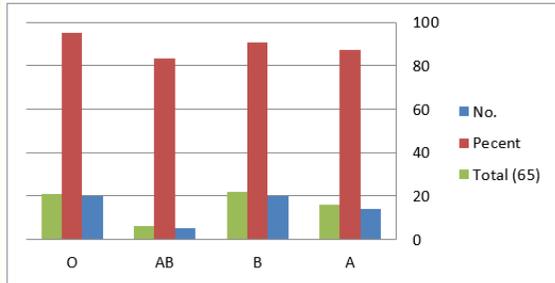

Figure 2: Distribution of the Rh system according to the O-A-B system of antigens among students.

Figure 3 showed that the dental decay percentage among students with (B blood group) was with a high percentage (92.3), followed by O group (44.6), and AB group (29.2), as compare with that found in A group (12.3) was the lowest percentage.
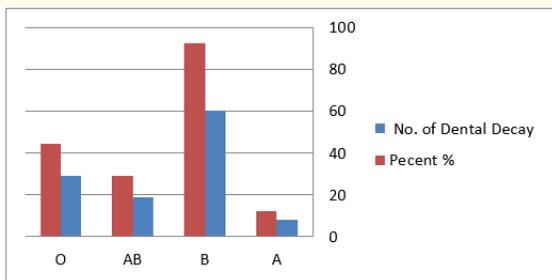

Figure 3: Distribution of Dental Decay according to the O-A-B system of antigens.

Figure 4 was showed that the dental missed percentage among students with A, B, AB and O group were having (6.1), (7.6), (9.2) and (10.7) %, respectively.
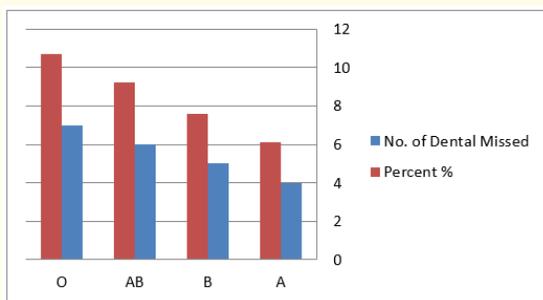

Figure 4: Distribution of Dental Missed according to the O-A-B system of antigens.

Figure 5 illustrated that the filled teeth percentage among students with "B group" was highest (72.3%) than the others O, A, and AB groups which had (32.3%), (24.6%) and (23.0%), respectively.
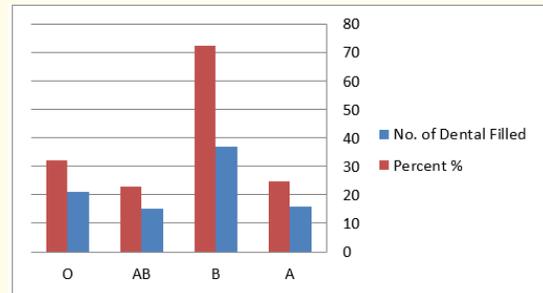

Figure 5: Distribution of Filled Teeth according to the O-A-B system.

Table 1 was illustrated the mean values and standard deviations (Mean ± SD), The least significant difference (L.S.D.) of caries prevalence which can be measured by three indicators: Decay, Missed, and Filled tooth surfaces. DMFT index count among the O-A-B system was documented as (29 ± 22.4), (5.5 ± 1.29), and (24.8 ± 15.1, respectively for (Mean ± SD). There was a significant difference among different blood groups in relation to the DMFT score because of the P- value is larger than 0.05.

Blood group	A	B	AB	O	Mean ± SD	P- values
Decay	8	58	19	31	29 ± 22.4	>0.05
Missed	4	5	6	7	5.5 ± 1.29	>0.05
Filled	16	44	15	29	24.8 ± 15.1	>0.05
Total	28	112	40	57	94.8 ± 37.1	>0.05

Table 1: Correlation between the O-A-B system of antigens and DMFT.

Table 2 explained the mean values and standard deviations (Mean ± SD), The least significant difference (L.S.D.) of caries experience measured by three indices (Decay, Missed and Filled) surfaces and the DMFT index score among the Rh factor for the O-A-B system, recording (27.8 ± 21.4), (5 ± 1.63), and (21.2 ± 9.52), respectively for (Mean ± SD). There was a significant difference among the different Rh factor for blood groups in relation to the DMFT score because of the p- value is larger than 0.05.

Discussion

The O-A-B system is a commonly considerable erythrocyte antigen system. Numerous reports had been investigated in the correlation between blood groups and different systemic diseases such

Rh factor	A	B	AB	O	Mean ± SD	P- values
Decay	6	56	18	31	27.8 ± 21.4	>0.05
Missed	3	5	5	7	5 ± 1.63	>0.05
Filled	11	33	15	29	21.2 ± 9.52	>0.05
Total	20	92	38	65	86 ± 31.5	>0.05

Table 2: Correlation between Rh System According to the blood group system of antigens and DMFT.

as: diabetes mellitus, heart disease, dermatological disease, genetic disease, and caries [9,32]. Distributions of the O-A-B system and Rh system showed an apparent diversity throughout the world also, the variety was documented within the same country.

Numerous confirmation proposes that the O-A-B system have a significant role in capacity/resistance to diverse infectious and non-infectious diseases. Llena-Puy in 2006 was suggested that the articulation of the O-A-B system antigens in saliva may alteration in the specific communication between microorganisms and their salivary glycoprotein receptors, which affected in the enhancement and prevention of oral infectious disorders [33].

The presented study found that the majority of contributors were obtained in (35%), (32%), and (25.8%) for the phenotype of B, O, and A phenotype, respectively. Whereas the minority of contributors were obtained in (9.2%) represented by AB phenotypes. Other report performed by Paromita, observed that the distribution of "B blood group" was the greatest followed by "O blood group" [34]. Also other study in Makkah City/Saudi Arabia was showed the same results of the current study [9]. As well as, other studies had been shown the same results [35,36]. On the other hand, other studies disagreed with current study, they showed the distribution of O-A-B system as (O > A > B > AB) [13]. Mondal, study also conducted that the "O blood group" was more prevalence, while the "AB blood group" was less prevalence [37]. An O-A-B system distribution was demonstrated by Mazumdar as (O > A > B > AB) [38]. Another report done by Rania., *et al*. was achieved that the distribution of O-A-B system as (A > B > AB > O) [34].

Meanwhile, infectious activities were correlated to the effect of the microbes on molecules that articulated in the host cells, probably the O-A-B system carbohydrate antigens was evolved to originate a polymorphic outline in the mucous membrane. This is a vital to change potential receptors of viruses, bacteria, and etc. Hence, a variety of these antigens was correlated to the receptiveness or conflicted to the infectious diseases and this appear likewise symbolizes a functional correlation between the O-A-B system and the immunity [39].

The current study showed that dental caries associated with "O blood group", then in "AB blood group", while "A blood group"

documented with low caries, some study agreed with the current result that showed high caries tendency with "O blood group" [13]. Further study disagreed with the current study result, when the "A blood group" percentage of dental caries presented the highest value among students [13].

The current result was demonstrated a positive relation between Rh and "O blood group", this coincided with the other study that showed the percentage of Rh system with "O blood group" was the highest value among students [13].

These findings further consolidate our opinion that yet the O-A-B system was proven crucial in correspondence with various disorders, it can quiet not be interrelated with diseases of dental like dental caries in a minor number of patients. Large epidemiological trials were required to realize the correspondence between the O-A-B system and dental disease, chiefly in the occurrence of dental caries. This study agreed with previous study by Mazumdar et.al. in 2014 which showed that there was no correspondence between the O-A-B system and dental caries [35,40].

The Conclusion

The exhibit investigation exposed a strong correspondence between the dental caries and the positive correlation between Rh and the "O blood group". Finally, there was no important relationship between the DMFT score index and dental caries (p > 0.05).

Conflict of Interest

The authors declare that they have no conflict of interests.

Bibliography

1. Hamamcilar O and Sports A. "Effect of dental caries and the consequential variation in blood parameters on the anaerobic performance of rowing athletes". *Medical Journal of Islamic World Academy of Sciences* 27.2 (2019): 55-60.

2. Sawhney S., *et al*. "The Association between Root Caries , Xerostomia and Blood Glucose in a Patient with Type 2 Diabetes". *Diabetes Case Reports* 6 (2021): 1-7.

3. Rasha N Alotaibi., *et al*. "Genome-Wide Association Study (GWAS) of dental caries in diverse populations". *BMC Oral Health* 21 (2021): 377.

4. S C Leal., *et al*. "Untreated cavitated dentine lesions: impact on children's quality of life". *Caries Research* 46.2 (2012): 102-106.

5. Collaborators GD and II and P. "Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017". *Lancet* 392.10159 (2018): 1789-1858.

6. Shafer JR., *et al.* "Genetic susceptibility to dental caries on pit and fssure and smooth surfaces". *Caries Research* 46 (2012): 38-46.

7. Yadav K PS. "Dental caries: A microbiological approach". *Journal of Clinical Infectious Diseases and Practice* 2.1 (2017): 1-15.

8. AS A. "Association between ABO blood groups and severity of chronic periodontitis". *Journal of King Abdulaziz University - Medical Sciences* 16 (2009): 31-41.

9. Al-Sihli A-HA., *et al.* "Correlation of Dental Caries with ABO Blood Group and Salivary Secretor Status among Female Subjects, Makkah City, Saudi Arabia". *International Journal of Health Sciences and Research* 8 (2018): 185.

10. Ravi Kumar Gudipaneni and Ahmed Saud Alkuwaykibi KKG. "Assessment of caries diagnostic thresholds of DMFT, ICDAS II and CAST in the estimation of caries prevalence rate in first permanent molars in early permanent dentition-a cross-sectional study". *BMC Oral Health* 33 (2022): 133.

11. Ghobad MORADI and Amjad MOHAMADI BOLBANABAD AM. "Evaluation of Oral Health Status Based on the Decayed, Missing and Filled Teeth (DMFT) Index". *Iranian Journal of Public Health* 48.11 (2019): 2050-2057.

12. TM M. "Changes in dental caries 1953-2003". *Caries Research* 38.3 (2004): 173-181.

13. Alkhayoun JD., *et al.* "Dental Caries and Salivary Immunoglobulin A in Relation to ABO Blood Type and Rh Factor among Dental Students Aged 20-21 Years Old". *Journal of Research in Medical and Dental Science* 7.5 (2019): 123-128.

14. Itziar Lopetegi AM-L. "ABO blood group distributions in multiple sclerosis patients from Basque Country; O- as a protective factor". *Multiple Sclerosis Journal - Experimental, Translational and Clinical* (2019): 1-4.

15. M LG and F. "Beyond immunohaematology: the role of the ABO blood group in human diseases". *Blood transfusion* 11.4 (2013): 491-499.

16. Demir T., *et al.* "The effect of ABO blood types on periodontal status". *European Journal of Dentistry* 1 (2007): 139-143.

17. V Subramanian., *et al.* "ABO-incompatible organ transplantation". *International Journal of Immunogenetics* 39.4 (2012): 282-290.

18. Rahfeld P and Withers SG. "Toward universal donor blood: Enzymatic conversion of A and B to O type". *Journal of Biological Chemistry* 295.2 (2020): 325-334.

19. Ajmani PS. "Blood Group and Immunology". In: Immunohematology and Blood banking (2020): 7-23.

20. Ranadhir Mitra and Nitasha Mishra GPR. "Blood groups systems". *Indian Journal of Anaesthesia* 58.5 (2014).

21. Azab Elsayed Azab HMMA. "Prevalence of Oral Health Problems and Distribution According to Socio-demographic Variables and Blood Groups among Patients in the Tripoli Region". *Journal of Dental Science Research* 1.1 (2022): 1-15.

22. Al-Waely SDA-AHAA. "Association of ABO and Rh blood Groups With Type 2 Diabetes". *Iraqi Journal of Biotechnology* 21.1 (2022).

23. S A Meo., *et al.* "Association of ABO and Rh blood groups with type 2 diabetes mellitus". *European Review for Medical and Pharmacological Sciences* 20.2 (2016): 237-242.

24. Pinkston JA CP. "ABO blood groups and salivary gland tumors (Alabama, United States)". *Cancer Causes Control* 7.6 (2006): 572-574.

25. Janardhana V PD. "ABO blood groups in hematolog1ic malignancies". *Cancer Genet Cytogenet* 51.1 (1991): 113-120.

26. Whincup PH and Cook DGPA. "Shaper AG. ABO blood group and ischaemic heart disease in British men". *BMJ* 300.6741 (1990): 1679-1682.

27. Salih KM., *et al.* "Frequency of ABO blood groups and secretor status and their relation with dental decay in sections of students and employees of Al-Mustansiriyiah University, Iraq" 3.2 (2005): 108-112.

28. ASAG. "Association between ABO blood groups and severity of chronic periodontitis". *Journal of King Abdulaziz University-Medical Sciences* 16.3 (2009): 31-34.

29. Gautam A and Mittal NST. "Correlation of ABO blood group phenotype and rhesus factor with periodontal disease: An observational study". *Contemporary Clinical Dentistry* 8.2 (2017): 253-258.

30. Demir T and Tezel AOR. "The effect of ABO blood types on periodontal status". *European Journal of Dentistry* 1.3 (2007): 139-143.

31. Kayal H., *et al.* "The distribution of blood groups in Erzurum". *Med J Ataturk Univ* 31 (1999): 20-22.

32. Rai P and Acharya SHK. "Assessment of ABO blood grouping and secretor status in the saliva of the patients with oral potentially malignant disorders". *Journal of Oral and Maxillofacial Pathology* 19.2 (2015): 64-69.

33. C L-P. "The role of saliva in maintaining oral health and as an aid to diagnosis". *Medicina Oral, Patologia Oral y Cirugia Bucal* 11 (2006): E449-455.

34. Kadhum RFDB. "ABO blood type in relation to caries experience and salivary physicochemical characteristic among college students at Al-Diwania governorate in Iraq". *Journal of Baghdad College of Dentistry* 27 (2015): 1-7.

35. Hatzimanouil D., *et al*. "ABO blood group phenotypes and dental disorders-Is there any relation? A cross sectional study in Haridwar, Uttarakhand, India". *Journal of Oral Health and Oral Epidemiology* 10.3 (2021): 25-32.

36. Kaluram Yadav. Corresponding author JITENDER SOLANKI CLD. "Association between different blood groups, depression and oral health status of dental students". *Clujul Medical* 91.3 (2018): 317-321.

37. Mondal B and Maiti S BB. "Prevalence of hemoglobinopathy, ABO and rhesus blood groups in rural areas of West Bengal, India". *Journal of Research in Medical Sciences* 17 (2012): 772-776.

38. Mazumdar P., *et al*. "RESEARCH ARTICLE 59 YEARS AGE GROUP OF SUBURBAN POPULATION OF NORTH KOLKATA , WEST BENGAL : A CROSS SECTIONAL STUDY". *International Journal of Current Research* 14.3 (2022): 1-4.

39. SM H. "Molecular diversity in the biosynthesis of GI tract glycoconjugates. A blood-group-related chart of microorganism receptors". *Transfusion Clinique et Biologique* 8 (2001): 226-230.

40. Mazumdar P and Das UK GS. "Correlation between blood group and dental caries in 20-60 years age group:A study". *IJAR* 2.11 (2014): 413-424.