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


ABSTRACT
ABO blood group and secretor status are important in clinical, forensic medicine and relation with some diseases. There are geographic and racial differences in their frequencies. This work focuses on determination of secretor status in different ABO blood group, in arabic and kurdish races; and relationship among ABO blood group, secretor status, pH of saliva, and dental caries. Saliva and blood samples collected from 81 students and employees randomly affiliated in Department of Biology, College of Science, Al-Mustansiriyiah University, Baghdad, Iraq. The samples were tested for ABO blood grouping by hemagglutination slide method, secretor status by hemagglutination inhibition test, and pH of saliva by pH meter. Caries experience was assessed by calculating the number of decayed, missing, and filled teeth (dmf-t) in all volunteers. Results showed that 62% of the study populations were secretors and 38% were non secretors. The races of participants showed 60% secretors in arabic subjects and 71% in kurdish. The frequency of secretor status in different ABO blood groups were in both B and O types was 72.7% and 64.4%, respectively. While, in case of group A and AB the frequency was 40%, and 33.3%, respectively. This study revealed significantly, reverse correlation between the dmf-t and the pH values of saliva. The salivary pH of secretors was high acidic than those of non-secretors, consequently, the frequency of dmf.t. values was higher in the secretors as compared to non-secretors. Finally, dmf-t values were differ among the different ABO blood groups, in which B blood group revealed the highest dmf.t value, while AB blood group showed the lowest dmf.t. In conclusion, the high frequency of secretors among blood group O individuals compared to A and AB blood groups may at least explain the low incidence of many malignancies in group O, and the present study revealed strong correlation between the dmf.T. and both salivary acidity and secretor status.

Keywords: ABH secretor, ABO blood groups, Dental Caries, dmf.T. value, Salivary pH.


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INTRODUCTION

An Austrian Karl Landsteiner discovered the ABH blood group system in 1901 [1]. In the ABO blood group, individuals are divided into four major blood groups, A, B, AB and O, according to the presence of the antigens and agglutinins [2]. The ABO blood types are not found in equal numbers. In Caucasians in the United States, the distribution is type O, 47%; type A, 41%; type B, 9%; and type AB, 3%. Among African American, the distribution is type O, 46%; type A, 27%; type B, 20%; and type AB, 7%. Among Western Europeans, 42% have group A, 9% group B, 3% group AB and the remaining 46% group O [3]. A and B antigens of ABO blood group system are converted from their precursor, H substance. This conversion starts at 5 to 6 weeks of intra-uterine life. Conversion of H substance into either A or B is partial. In case of group O there is no conversion of H substance [4].

In 1930, it was found that individuals could be classified as ‘secretors’ and ‘non-secretors’ according to their ability to secrete ABO blood group antigens in saliva [5]. ABO blood group antigens (A, B, and H), in addition to their presence on blood cells and platelets, are also present on other tissue cells and are variably expressed through body fluids (except CSF), such as, saliva, tears, semen, urine, gastric juice, and breast milk [6, 7]. ABH secretions are controlled by fucosyltransferase 2 (FUT2) secretor gene located on the short arm of chromosome number 19 in the form of two alleles denoted as dominant “Se” and recessive “se”. In their pattern of inheritance, Se Se and Se se produce a dominant secretor phenotype while se se produces a recessive non-secretor phenotype. Therefore, “O” blood group secretes only H substance, A blood group secretes A and H substances while B blood group secretes B and H substances in the fluids [8, 9]. It is generally known that about 80% of the world’s population are secretors of ABH antigens and only 20% are non-secretors but with some racial and ethnic differences [1, 10].

The expression of the blood group antigens in saliva may change the specific interaction between microorganisms and their salivary glycoprotein receptors, which might interfere in development and prevention of oral infectious diseases. This finding could be used for further researches on the relationship between the blood group antigens and oral diseases as well as in its forensic applications [11]. Dental caries is an infectious disease characterized by localized destruction of tooth tissue. Multiple factors, such as the interaction of bacteria, diet, and host response, all influence dental caries initiation and progression. Saliva plays an important role in optimal oral health and new research suggests that salivary pH is even more critical to the development and progression of dental caries than once thought[12].

The study aims to evaluate the prevalence of ABH blood group secretors and non-secretors among a section of students and employees of Al-Mustansiriyyah University in Iraq along with their gender and ethnic groups. Also this study was designed to investigate if dental caries experience might be associated with secretor status and pH in the saliva of this population.

MATERIALS AND METHODS

In this study, a total number of 81 students and employees were randomly selected from the department of biology, College of Science, Al-Mustansiriyyah University, Baghdad, Iraq. The age of group was ranged from 18 to 64 years old. Both genders with apparently healthy status was included. After taking consent, 55 males and 26 females participated in the study and comply with the research study. The work conducted following approval from ethical and academic committees of department of biology, College of Science, Al-Mustansiriyyah University, Baghdad, Iraq.

Samples Collection & preparation

With all proper aseptic precautions 2 ml of venous blood was collected from antecubital vein by disposable syringe in a dry sterile test tube containing EDTA anticoagulant. Few drops of blood sample were used directly to determine ABO blood groups according to hemagglutination slide method. The remainder blood sample was washed 3 times with isotonic normal saline, and 5% cell suspension was prepared as RBC suspension indicator to be used for the determination of secretor status [13]. However, the volunteers were asked to rinse their mouths thoroughly with distilled water and discarding first few drops. Approximately 2-3 ml of saliva was collected in a sterile tube. The pH value of saliva was directly determined by using pH meter, and then the saliva was transferred to a test tube and placed in a boiling water bath for 10 min to denature the salivary enzymes. It was then cooled and centrifuged for 5 min at 1000 rpm. and supernatant was collected and diluted with an equal volume of normal saline to detect the ABH secretor status by hemagglutination inhibition method [14].

Hemagglutination inhibition test for Secretor Status

One drop of saliva was added to 1 drop of appropriately diluted anti-A, anti-B or anti-H (Sera clone, Bio test, Driesch, Germany) in micro titration plate with 96 round bottom wells and left at room temperature for 10 min, then 2 drops of 5% RBC suspension indicator were added to each well. The plate was incubated at room temperature for 30 min, and then cell agglutination at well bottom was inspected. The principle of hemagglutination inhibition test based on neutralizing action of soluble ABH substances present in saliva to their corresponding antibodies that are no longer be able to agglutinate red cells possessing the same antigens. Therefore, agglutination of indicator cells by antibody in wells containing saliva indicates that the saliva does not
contain the corresponding antigen (non-secretor status, Se). While failure of known antibody to agglutinate indicator cells after incubation with saliva indicates that the saliva contains the corresponding antigen (secretor status, Se).

Determination of dental caries status

Caries experience was assessed by calculating the number of decayed, missing, and filled teeth (dmf-t) in all volunteers. A tooth with more than one carious lesion was scored as one decayed tooth; a tooth with a filling and a separate carious lesion was scored as one filled tooth.

Statistical analysis

Results are expressed as mean ± standard error (M±SE). Data were analyzed by one way analysis of variance (ANOVA) followed by Fisher’s test for multiple comparisons, using Stat view version 5.0. Differences were considered significant when p<0.05. Regression analysis was performed by analysis of covariance (ANCOVA) also using Stat view version 5.0.

Results

Total number of participants was 81 subjects; 26 women that constitute about 32% of the studied sample and 55 men that constitute 68%. Their age, gender, nationality, ABO blood groups, secretor status were illustrated in table 1. According to the nationality of participants; 67 of them are arabic (82.7%), and 14 (17.3%) are kurdish. In respect to ABO blood groups; the majority of them having O phenotype (72.8%), while the rest ABO phenotypes constitute the minority which include 6.2% group A, 13.6% group B, and 7.4% group AB. However, inhibition of hemagglutination test revealed that that 61.7% of all participants were secretors and 38.3% were non-secretors.

Table 1. Distribution of individuals according to gender, nationality, blood groups, and secretion status

<table>
<thead>
<tr>
<th>Sample size (n)</th>
<th>81</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>Range 18 → 64</td>
</tr>
<tr>
<td>Gender (n) – (%)</td>
<td>Female 26 (32%)</td>
</tr>
<tr>
<td>Nationality(n) – (%)</td>
<td>Arabic 67 (82.7%)</td>
</tr>
<tr>
<td>Blood group ABO</td>
<td>A 5 (6.2%)</td>
</tr>
<tr>
<td>Secretion status (n) – (%)</td>
<td>Nonsecretors 31 (38.3%)</td>
</tr>
</tbody>
</table>

According to the gender, fig 1 showed no significant difference in the frequency of secretor status between male (64% secretors and 36% non-secretors) and females (58% were secretors and 42% were non-secretors).

However, the nationality of participants showed significant differences (P<0.05) in secretor status between arabic subjects (60% secretor and 40% non-secretors) and kurdish (71%, 29%, respectively) (Fig 2).

The frequency of secretor status in different ABO blood groups was shown in fig 3. Frequency of secretors in.

Fig 1. Secretory status according to gender

Fig 2. Secretory status according to nationality

Fig 3. Frequency of secretors among ABO blood groups.
both B and O types was 72.7%, 64.4%, respectively and those significantly (P<0.05) higher than those in A and AB types, which reported 40% and 33.3%, respectively.

In respect with dental caries status of all subjects, the present study revealed significant (P<0.05) reverse correlation between the dmf.t and pH values of saliva (R= -0.29) (Fig 4).

![Fig 4](image)

**Fig 4.** Correlation between salivary pH and dmf.t in all subjects.

On the other hand, the salivary pH of secretors were significantly (P<0.05) lower acidic than non-secretors (Fig 5A), consequently, the frequency of dmf.t values was significantly (P<0.05) higher in the secretors as compared to non-secretors (Fig 5B).

![Fig 5](image)

**Fig 5.** Comparison between secretor and non-secretor saliva in case of pH value and level of dmf.t. A, pH; B, dmf.t.

Finally, dmf.t values were significantly (P < 0.05) differ among the different ABO blood groups (Fig 6), in which B blood group revealed the highest dmf.t value, while AB blood group showed the lowest dmf.t.

The highest frequency of secretors in blood group O individuals compared to A and AB blood groups may explain the low incidence of many malignancies in group O [19-22]. The evidence available indicates that there are some diseases correlated with secretor status as well as with non secretors [23]. The results of this study showed that the dental caries status was more in the secretors than non-secretors. Llena-Puy (2006) suggested that the expression of the blood group antigens in saliva may change the specific interaction between microorganisms and their salivary glycoprotein receptors, which might interfere in development and prevention of oral infectious diseases [11]. However, other researchers showed that the secretor status unrelated to the caries scores [24]. Wacklin et al. (2014) shows that secretor status and FUT2 polymorphism are associated with the composition of human microbiota such as *bifidobacteria* and lactobacilli, and appears thus to be one of the key drivers affecting the individual variation of human intestinal microbiota [25]. There were strong associations between high counts of *S. mutans* or lactobacilli and caries [26]. On other hand, this study showed that the acidity of saliva increase in secretor people which may explain the increase of dental caries among them [26, 27]. Normally, this acidity is due to the metabolism of food in the teeth and that will provide a good condition for bacterial growth [28].

![Fig 6](image)

**Fig 6.** The dmf.t value in different ABO blood groups.

Our results showed that the highest dental caries was in the blood group-B and the lowest was in blood group AB. There are many evidences indicate that blood groups play an important role in the susceptibility or resistance to various infectious and non-infectious diseases [29]. The higher expression of the ABO carbohydrates in secretions and tissues that have contact with the environment such as the skin and

DISCUSSION

This study found that the frequencies of ABO blood grouping were 72.8%, 6.2%, 13.6%, and 7.4% in O, A, B and AB groups, respectively. The frequency of ABH secretor status (61.7%) was higher than non-secretor status (38.3%) in the studied population (Table 1). Several other studies revealed that group ‘O’ and ABH secretors were the most frequent in different ethnic and geographic populations [3, 15-18]. Since secretor status was encoded by a gene carried on somatic chromosome [17]. There was no different between the incidence of secretor statute in men and women (Fig 1), while its frequency revealed difference between kurdish and arabic people in this study (Fig 2), which were similar to many other previous studies [15, 16].

![Table 1](image)

**Table 1.** The frequencies of ABO blood groups and ABH secretor status in the studied population.

<table>
<thead>
<tr>
<th>Blood Groups</th>
<th>Frequency</th>
<th>ABH Secretor Status</th>
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<tbody>
<tr>
<td>O</td>
<td>72.8%</td>
<td>61.7%</td>
</tr>
<tr>
<td>A</td>
<td>6.2%</td>
<td>38.3%</td>
</tr>
<tr>
<td>B</td>
<td>13.6%</td>
<td></td>
</tr>
<tr>
<td>AB</td>
<td>7.4%</td>
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</tr>
</tbody>
</table>

mucous membranes of gastrointestinal and respiratory tracts was one of the arguments used to reinforce the role of these molecules [30]. Since infectious processes are related to the attachment of microbes to molecules expressed in host cells, probably the ABO carbohydrate antigens evolved to create a polymorphic profile in the mucous membrane. This is important to alter potential receptors of bacteria, viruses, etc. Therefore, diversity of these antigens can be related to the susceptibility or resistance to infectious diseases and this feature also represents a functional relationship between blood groups and the immune function [31]. It is suggested that particular blood group and a tendency toward caries might be constitutional characters that were not particularly related to race, although the blood group O and good teeth were less common in civilized people than in primitive races [32]. A high percentage of blood group O and low percentage of blood group A in caries immune group were found in Iceland [33]. Koregol et al. (2010) suggest that the genetic factors may alter oral ecology and the process of periodontal diseases [34]. In conclusion, the present study revealed strong correlation between the dental caries status and both salivary acidity and secretor status.

Conflict of interest
The authors declare that they have no conflict of interests.

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