ABH secretors status in Osogbo, Southwestern Nigeria

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ABSTRACT
There are variations in the distribution of secretors and non-secretors in relation to ABO blood group which influence disease susceptibility from one region to another. In Nigeria, there are no reports on the proportion of secretors and non-secretors among the Yoruba people of Southwestern region. This study was carried out to determine the secretor status of the inhabitants of Osogbo, Southwestern Nigeria. Blood and saliva samples were collected from each of the 740 apparently healthy individuals (362 men and 378 women) who participated in this study. ABO blood grouping was done using standard tile and tube methods and secretor status was determined by haemagglutination inhibition test. Of the 740 participants, 578 (78.1%) were secretors and 162 (21.6%) were non-secretors. The frequencies of secretors were 78.7 and 77.5% in male and female participants (ᵡ²=0.16, p=0.69). ABO blood group distributions among the participants were 52.7% group O, 20.8% group A, 22.0% group B and 4.5% group AB and there were no significant variations between men and women (ᵡ²=0.034, p=0.98). The incidence of secretors was 86.8% in group O, 64.9% in A, 71.8% in B and 66.7% in AB (ᵡ²=36.696, p<0.001). This study shows that secretors are more than non-secretors, secretor status is independent of sex and the ability to secrete ABH substances varies significantly with ABO blood grouping with blood group O secretors being more than non-O secretors.

INTRODUCTION
The ABO blood group and secretor status of individuals are inherited independently. The ABH (FUT 1) gene codes for the ABO blood group. The secretor (FUT 2) gene interacts with FUT 1 gene to determine the ability to secrete blood group antigens into body fluids and secretions. A person can either be a secretor (SeSe/Sese) or a non-secretor (sese) of ABH substances. Secretors are persons who put their blood type antigens into their body fluids and secretions while non-secretors put little or none of their blood type antigens into their body fluids and secretions. Non-secretors are at a potential health disadvantage compared to secretors as an appreciable number of diseases/disorders have been associated with inability to secrete ABH substances. For example, non-secretors had been reported to be more prone to infection caused by Haemophilus influenzae (Blackwell et al., 1986a) meningitis and pneumonia (Blackwell et al., 1986b) recurrent urinary tract infections (May et al., 1989), thrombotic and heart disease (O'Donnell et al., 2002), oral disease and cavities (Campi et al., 2007), chronic Candida sp. infection (Thom et al., 1989) duodenal and peptic ulcers and infection caused by Helicobacter pylori (Azevedo et al., 2008), coeliac disease (Dickey et al., 1994), chronic obstructive pulmonary disease (Kauffman et al., 1996), autoimmune diseases like multiple sclerosis,
ankylosing spondylitis, reactive arthritis, Grave's diaease (Collier et al., 1988; D'Adamo and Kelly, 2001). Nevertheless, non-secretors had been reported to be more resistant to infections caused by influenza virus, rhinovirus, echovirus, respiratory syncytial virus (Raza et al., 1991), norovirus (Thorven et al., 2005) and HIV (Ali et al., 2000).

The frequency distributions of secretor and non-secretor phenotypes had been less studied in Nigeria. Emeribe et al. (1992) investigated secretor status of residents of Calabar city, Southsouth Nigeria. In Kano, Northwestern Nigeria, Onwuka et al. (2012) investigated secretor status among pregnant women. In Southwestern Nigeria, where this study was carried out, we are not aware of any deliberate study set out to determine the incidence of secretor status in the region. There are genetic variations from one region to another in Nigeria. Knowledge of the secretor status of every locality is necessary to be able to explain the occurrence or otherwise of certain diseases that have been associated with secretion or non-secretion of ABH substances since ABO and secretor genetics interact to influence disease susceptibility.

This study was carried out to ascertain the frequency distribution of secretors and non-secretors and its relationship with ABO blood group phenotypes among the Yoruba people of Southwestern Nigeria.

**MATERIALS AND METHODS**

The study was carried out in Osogbo, Osun State, Southwestern Nigeria. A total of 740 individuals (of age ≥16 years) with no clinical sign and symptoms of ill health as of the time of investigation participated in the study. Informed consent was obtained from the participants. Ethical approval for this study was obtained from the Ethical Committee, Ladoke Akintola University of Technology Teaching Hospital, Osogbo, Nigeria. From each participant, 2 ml of venous blood was collected for ABO blood grouping using standard tile and tube techniques. The ABO blood grouping is based on agglutination of red blood cells by antibody (Waters, 1994). It was performed on saline washed red cells using commercially prepared monoclonal anti-A, anti-B (Biotech Laboratories, U.K).

Also, 2 ml of saliva was collected for determination of secretor and non-secretor phenotypes. For saliva collection, participants were first asked to rinse their mouths with portable water, then given some paraffin wax to chew and asked to put 2 ml of saliva into a sterile plain tube. Saliva samples collected were tested within 1 h of collection. The determination of secretor status employs the principle of Agglutination inhibition where saliva is mixed with commercial antiserum and allowed to incubate for a short time. Then red blood cells of the appropriate blood group are added to the test mixture (Waters, 1994). If the person is a secretor, the soluble blood group antigens in the saliva would react with and neutralize the antibodies in the commercial antiserum and so there would be no free antibody to agglutinate the red blood cells. The absence of agglutination is interpreted as positive for secretor status and presence of agglutination is interpreted as non-secretor.

Monoclonal anti-A, anti-B and anti-H (Biotech Laboratories, U.K.) of titre 128 were diluted and used at a dilution of 1 in 16. The 2 ml of saliva collected from each participant was transferred in a centrifuge tube, placed in a boiling water bath for 10 min, allowed to cool and then centrifuged at 2000 g for 5 min. The supernatant was serially diluted in saline from 1 in 2 to 1 in 32. Three tubes containing saline, saliva from a known secretor and saliva from a known non-secretor respectively were set up alongside as controls. An equal volume of the diluted anti-A (or anti-B or anti H) serum was added to each tube, mixed and incubated for 15 min at room temperature. Then an equal volume of a 2% suspension of A\(_2\) (or B or O) red cells in saline was added to each tube, mixed and incubated at room temperature for 1 h. Then the tubes were viewed for agglutination. The saline control tube should have agglutination for the test to be valid. Agglutination in all of the individual’s test tubes indicated a negative result for secretor status. Absence of agglutination signified that the saliva contained A or B or H substances indicating a positive result for secretor status (Waters, 1994).

The statistical package for social sciences (SPSS 14) was used for statistical analysis. Differences between percentages and proportions were tested by chi-square test. Sample means were compared by student’s t test. A p-value of < 0.05 was considered to be significant.

**RESULTS**

A total of 740 individuals comprising 362 (48.9%) males and 378 (51.1%) females participated in the study. The mean ages of the male (36.7±10.7 years) and female (35.8±11.2 years) participants were not statistically significantly different. The frequency distributions of ABO blood group and secretor status by sex among the study population are given in Table 1. ABO blood group distributions among the participants were 52.7% group O, 20.8% group A, 22.0% group B and group 4.5% AB. Of the 362 male participants, 53.0% had group O, 20.7% group A, 21.8% group B and 4.4% group AB. Similarly, of the 378 female participants, 52.3% had group O, 20.9% group A, 22.2% group B and 4.5% group AB. There was no statistically significant variation in the distributions of ABO blood group phenotypes between men and women (χ\(^2\)=0.034, df=3, p=0.98).

Also, of the 740 participants, 578 (78.1%) were
Table 1. Frequency distributions of ABO blood group and secretor status by sex among the study population in Osogbo, Southwestern Nigeria.

<table>
<thead>
<tr>
<th>Sex</th>
<th>ABO blood group</th>
<th></th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group O</td>
<td>Group A</td>
<td>Group B</td>
<td>Group AB</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>192</td>
<td>75</td>
<td>79</td>
<td>16</td>
<td>362</td>
</tr>
<tr>
<td>Female</td>
<td>198</td>
<td>79</td>
<td>84</td>
<td>17</td>
<td>378</td>
</tr>
<tr>
<td>Total</td>
<td>390</td>
<td>154</td>
<td>163</td>
<td>33</td>
<td>740</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secretor status</th>
<th>Secretor</th>
<th>Non-secretor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>285</td>
<td>77</td>
<td>362</td>
</tr>
<tr>
<td>Female</td>
<td>293</td>
<td>85</td>
<td>378</td>
</tr>
<tr>
<td>Total</td>
<td>578</td>
<td>162</td>
<td>740</td>
</tr>
</tbody>
</table>

Table 2. Distribution of ABO blood group between secretors and non-secretors among the Study Population in Osogbo, Southwestern Nigeria.

<table>
<thead>
<tr>
<th>Blood group</th>
<th>Secretor</th>
<th>Non-secretor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>339</td>
<td>51</td>
<td>390</td>
</tr>
<tr>
<td>A</td>
<td>100</td>
<td>54</td>
<td>154</td>
</tr>
<tr>
<td>B</td>
<td>117</td>
<td>46</td>
<td>163</td>
</tr>
<tr>
<td>AB</td>
<td>22</td>
<td>11</td>
<td>33</td>
</tr>
<tr>
<td>Total</td>
<td>578</td>
<td>162</td>
<td>740</td>
</tr>
</tbody>
</table>

secretors and 162 (21.9%) were non-secretors. Of the 362 men who participated in this study, 285 (78.7%) were secretors and 77 (21.3%) were non-secretors while 293 (77.5%) and 85 (22.5%) of the women who participated in this study were secretors and non-secretors respectively. There was no statistically significant difference between the ability to secrete ABH substances and sex ($\chi^2=0.16$, df=1, $p=0.69$).

The distribution of ABO blood group between secretors and non-secretors among the study population is given in Table 2. Of the 740 participants, 390 (52.7%) were group O, 154 (20.8%) were group A, 163 (22.0%) were group B and 33 (4.5%) were group AB. Of the 390 group O individuals, 86.9% and 13.1% were secretors and non-secretors respectively, 64.9% and 35.1% of the group A individuals were secretors and non-secretors respectively, 71.8% and 28.2% of the group B individuals were secretors and non-secretors respectively while 66.7% and 33.3% of the group AB individuals were secretors and non-secretors. The frequency of secretors varied significantly with ABO blood group phenotypes ($\chi^2=36.696$, df=3, $p<0.001$). The proportion of secretors who were group O individuals was significantly more than the proportion of secretors who were: (i) group A individuals ($\chi^2=34.269$, df=1, $p<0.001$), (ii) group B individuals ($\chi^2=18.227$, df=1, $p<0.001$), (iii) group AB individuals ($\chi^2=8.427$, df=1, $p=0.004$), (iv) non-O individuals ($\chi^2=37.471$, df=1, $p<0.001$).

**DISCUSSION**

In this study, secretor status was not dependent on sex. This is in line with the findings of Emeribe et al. (1992), Jaff (2010) and Saboor et al. (2014) who all reported no significant difference between the incidence of secretors in men and women. Similarly, the distribution of ABO blood group phenotypes was not dependent on sex in this study. Previous studies carried out reported no association between blood groups and sex (Falusi et al., 2000).

The incidence of secretors in this study population was 78.4%. In Calabar, Southsouth Nigeria, Emeribe et al. (1992) reported an incidence of 86.9% secretors. Jaff (2010) in Iraq reported a frequency of 76% secretors, Akhter et al. (2011) reported 60% frequency of secretors in Dhaka, Bangladesh while Saboor et al. (2014) reported a frequency of 64% secretors in Karachi, Pakistan. All these findings support that secretors are more than non-secretors. This study showed that to every non-secretor, there were about four secretors. This is in line with the reports of secretors among the whites or world wide of about 80% (Denborough and Downing, 1968; Waters, 1994). The differences observed in the frequencies of
secretors in the studies carried out in Pakistan and Bangladesh might be partly due to their small sample sizes. 

Blood groups O and AB were the most common (52.7%) and least common (4.5%) groups respectively of the ABO blood group phenotypes in this study. This is line with other studies in Nigeria. Falusi et al. (2000) reported the following in Nigeria: groups O and AB prevalence of 49.9% and 4.2% respectively among the Yoruba peoples, groups O and AB prevalence of 46.7% and 3.8% respectively among the Hausa/Fulani peoples, groups O and AB prevalence of 41.5% and 4.9% respectively among the Birom/Tiv peoples, groups O and AB prevalence of 56.9% and 2.5% respectively among the Igbo peoples, groups O and AB prevalence of 55.6% and 3.4% respectively among the Kanuri peoples. Bakare et al. (2006) reported groups O and AB prevalence of 50.0% and 5.9% respectively, Adeyemo and Sobyoejo (2006) reported groups O and AB prevalence of 55.0% and 2.7 respectively, Oluwadare and Shonekan (2008) reported groups O and AB prevalence of 53.0% and 3.9% respectively. Jaff (2010) in Iraq reported groups O and AB prevalence of 37.0% and 7.0% respectively, Akhter et al. (2011) in Bangladesh reported groups O and AB prevalence of 36% and 7% respectively while Saboor et al. (2014) reported groups B and AB prevalence of 35.6% and 10.9% respectively. In Africa the frequency of occurrence of group O and AB was put at 49% and 4% respectively, in Asia, it was 40% and 5% respectively, among the whites it was 45% and 4% respectively while among the Nepalese group A was the most common with 33% while AB was the least with 12% (Cheesbrough, 2000). These values showed that marked differences occurred due to geographical and racial differences.

Secretors varied significantly with ABO blood group in this study. Emeribe et al. (1992) and Jaff (2010) reported similar findings in their studies. The higher proportion of group O secretors than any other group reported in this study is in line with the report of Jaff (2010) which implies that among group O individuals, the incidence of secretor is high. According to Jaff (2010), several studies had shown that group O individuals were less associated with many malignancies and that group O had been implicated in suppression of growth and spread of tumours. This protective effect of group O could be linked to secretion of ABH substances. Group O secretors had been reported to possess the highest level of natural anti-TF antibodies which had been implicated in prevention of cancer of the stomach together with gastric or duodenal ulcer and reduction in their severity (Kurtenkov et al., 1995; Hansson et al., 1996). Similarly, group O secretors had been reported to have the lowest concentration of von Willebrand factor (vWF) which had been implicated in cancer of the ovary, bladder and colon (O'Donnell et al., 2002). There appears to be a positive interaction between ABO blood group gene and ABH secretion gene which produces a synergy that offers group O secretors more resistant to these chronic diseases and disorders than any other group. The tendency for a large number of O individuals to secrete ABH antigens compared to the other blood groups might be responsible for the low incidence of these diseases especially malignancies and their less severity in the locality.

**Conclusion**

We conclude that Secretors are more than non-secretors. The ability to secrete ABH substances varies significantly with ABO blood grouping. Blood group O individuals are more likely to be secretors than non-O. In Southwestern Nigeria, the results of the study could be used to explain the occurrence and distribution pattern of diseases that have been associated with secretor status.

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