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Potential Relation between Genetic Polymorphism of Bitter Taste Receptor TAS2R38 and Blood Groups in Iraqi Population

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Annotation: The ability to taste phenylthiocarbamide (PTC) is the most studied feature in human genetics, beside the ABO blood group system. These two characteristics have been widely utilized to characterize genetic differences amongst human populations around the world. The current study aims to determine the potential relationship between these two genetic traits in Iraqi population. The study included 400 university students, all of Arab origins and without any genetic or health problems. The number of tasters was generally greater than the number of non-tasters with a significant difference ($p = 0.04$). The results showed that most of the tasters were from the AB blood group and most of the non-tasters were from O blood group with a non-significant difference ($p= 0.16, 0.128$, respectively). To support these results, we need to conduct a study on a larger sample size.

Keywords: Genetic Polymorphism, Blood Groups, Iraqi Population.

1. Introduction

Blood groups are fundamental genetic traits that play a crucial role in human biology and health. It's controlled by a single gene located on chromosome 9 and has three possible alleles - A, B, and O. A and B are dominant, while O is recessive (1). Using the presence or lack of particular antigens on the surface of red blood cells, the ABO blood group classification divided people into four major groups: A,B,AB and O (1).

In therapeutic contexts, blood types are essential, especially for organ transplantation, pregnancy management, and transfusion compatibility. In addition to these health consequences, blood types have been connected to a number of illnesses, such as immunological reactions, infections, and cardiovascular problems (2).

Although the ABO blood group antigens are regarded as RBC antigens, the are found on the majority of epithelial and endothelial cells and are expressed on a wide range of human tissues. Approximately 2 million ABO blood group antigens are expressed by each human red blood cell. All body fluids, with the exception of cerebrospinal fluid, contain a soluble form of the ABO blood group antigens in "secretors" such as saliva (3).

The ability to taste the bitterness of phenylthiocarbamide (PTC) is one of the significant threshold characters in humans that has drawn the attention of researchers both past and present. It is one of the genetic markers used in anthropological studies of human evolution, adaptation to its environment, immunity against certain diseases, and nutritional behavior (4).

The trait of tasting bitter substances is a Mendelian trait controlled by a single gene (TAS2R38 gene location on chromosome 7 (7q36) consisting of two alleles: the dominant allele (T) and the recessive allele (t). People who carry the genotype (TTor Tt) are tasters, while people who carry the genotype (tt) are non-tasters. (5). Tasters showed a clear difference in their perception of bitter taste. Some of them felt a strong bitter taste and were believed to have the genotype (TT) while others felt a medium bitter taste and were believed to have the genotype (Tt) (6), while others have suggested that trait is controlled by multiple genes or it is with incomplete dominance (7, 8).

However, recent studies have indicated possible relationship between blood groups and behavioral characteristics, such as taste sensitivity and food preferences (9). Few studies have been conducted to clarify this relationship, especially in Arab populations. Therefore, the purpose of the current study is to determine the existence of this relationship in a sample of students from Wasit University, Iraq.

2. Materials and methods

This study was conducted in the laboratories of the Department of Pathological Analysis at Wasit University during the period from 20/1/2025 to 13/4/2025. 400 students participated in this study, 100 people for each blood type. All of them were non-smoking males, aged between 19-20 years, students from Wasit University in Iraq. They were all in good health and did not have genetic diseases or health problems, especially in the oral area. All participants underwent two tests at the same time: a blood type test and a bitter taste test for PTC.

Commercial antisera (BHAT Bio-Scan), which are available in the Department of pathological analysis, were used to test each subject's blood group. The slide agglutination test, which was conducted according to established protocol, was used to detect blood groups (ABO), and the results were interpreted by looking for visible agglutination.

The participants' ability to taste the bitter taste of PTC was tested using PTC strips (45 mm length by 3 mm broad), PL Precision Laboratories in the USA. Participants were asked to rinse their mouths twice with water, then place the strip on the middle of their tongue and leave it for 30

seconds until it was immersed in saliva (10). They were then asked to describe the taste as strongly bitter, moderately bitter, or tasteless. The SPSS tool version 11.0 was used to conduct statistical analysis in order to compare the result of tasting test with the ABO blood group. The potential differences between blood groups with respect to the PTC tasting were examined using t-test ($P \leq 0.05$).

3. Results

This study was conducted to investigate the relationship between two human genetic traits, namely blood type and the genetic trait of taste of PTC substance. The study included 400 participants, the number of tasters (strong tasters and weak tasters) was greater than the number of non-tasters (260 and 140, respectively) with a significant difference, p value ≤ 0.05 as shown in table 1.

Table 1. Distribution of tasters and non-tasters of the bitter taste of PTC.

Sample(n)	**Tester %**	**Non-tester %**	**P value**
400	260(65%)	140 (35%)	**0.04**
Tester (%)	**Strong tester (%)**	**Weak taster (%)**	
260 (65%)	176 (44%)	**84 (21%)**	

The study showed that the largest number of tasters were from the AB group, with 79 participants, followed by the A group with 68 participants in terms of the number of tasters. The largest number of non-tasters were from the B group and O group with 44 and 43 participants respectively, these differences were not significant (see table 2).

Table 2. Distribution of taster and non- taster according to blood groups.

Categories (n)	**Blood Groups**				
total(400)	A	B	AB	O	***P* value**
Tester (260)	68	56	79	57	**0.16**
Non- tester (140)	32	44	21	43	**0.128**

Discussion

The current study included 400 participants, all of whom were male, to exclude the effect of gender on the test results. Also, all participants were non-smokers, as smoking negatively affects the sense of taste (11, 12). The current study showed that the percentage of tasters was greater than the percentage of non-tasters (65% and 35% respectively) with significant difference. These results are consistent with Mendel's law for traits controlled by a single gene, as the taster allele (T) is completely dominant over the non-taster allele (t) (10).

The results showed that most of the tasters are from the AB blood type, followed by the A blood type (79 and 68, respectively) with no significant difference. These results were consistent with previous studies (13,14) . When assessing taste specificity, the phenotypes governed by the genes determining blood groups had no discernible selective value. Nonetheless, there was an inverse relationship between Rh-negative blood type and PTC taster status. The TAS2R38 locus on chromosome 12, is genetically connected to the Rh blood group locus, which could account for this connection (15).

The variations in taste specificity between blood groups can be attributed to dietary requirements that fluctuate between species and from person to person (16). In a previous study, Zhang GH et al., found that people with strong tastes have a high number of fungiform papillae on their tongues, and this requires more extensive studies (17). For the TAS2R38 bitter taste receptor protein, which causes variable in gustatory sensitivity to phenylthiocarbamide, Bufe B et al. and Galindo-Cuspinera V et al. found that receptor polymorphism also contributes to variation in taste specificity (18, 19).

Conclusion

The study concluded that the relationship was not significant between blood types and the taste of the PTC substance, although individuals of the AB blood type were better tasters. The researchers believe that increasing the sample size may make the results more clear, with the possibility of obtaining significant differences.

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