Impact of bitter taste threshold on caries experience in relation to ABO blood types among dental students at Al Kufa University

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ABSTRACT

Background: Blood group system and the ability to taste phenylthiocarbamide (PTC) are the most studied traits in human genetics which have been extensively used in describing genetic variations among human populations around the world that may had an effect on dental caries.

The aims of present study were to investigate the caries experience among students with different bitter taste threshold in relation to blood type.

Materials and Methods: The sample of present study includes dental students female aged19-21 years. The diagnosis of dental caries was done according to the criteria of Manjia *et al*, 1989 recording decayed lesion by severity (D_{1-4}) MFS. Furthermore, bitter taste sensitivity was measured according to PTC (phenylthiocarbamide) test while concerning blood types, depending on the identity student's. Statistical analysis that used in this study can be classified into two categories: Descriptive Analysis and second Inferential analysis (Levene test, One-way Analysis of Variance).

Results: The data of present study demonstrated that the differences in caries experience among different bitter taste threshold were found statistically not significant although the higher mean value for the higher grades of caries severity (D2-3) were among medium taster students while the non-taster group had the higher mean value of D_1. Concerning difference in caries experiences among students with different bitter taste threshold for blood types were not significant in spite of grade D1 was found higher among non –taster A, AB blood type students while for O blood type students were found within super taster. While grade D_4 severity was found higher with medium taster among students with A, AB blood types while found higher with super taster among students with O type as grades D4 were absent among students with B blood type.

Conclusion: Bitter taste perception which identified according to ptc test has some effect on dental caries experience and were found different for different blood type.

Keywords: Bitter taste, ptc test, caries, blood groups. **(J Bagh Coll Dentistry 2017; 29(3):121-127)**

INTRODUCTION

The most sensitive of the tastes is bitterness, and many perceive it sharp, unpleasant or disagreeable. Bitterness is of interest to those who study evolution in addition to different health researchers. A large number of natural bitter compounds are considered to be toxic. The capability to detect bitter-tasting, toxic compounds at low thresholds is considered to provide an important protective function (1). There are thirty genes that are responsible for bitter taste perception. Because of different variations of this gene, it effect on the ability to detect bitter compounds. These genes coupled with the G protein gustducin and they are responsible for the human capability to taste bitter substances (2). Researchers used two synthetic substances, which are phenylthiocarbamide (PTC) and 6-n-propylthiouracil (PROP) to study the genetics of bitter perception (3). They showed that genetically mediated sensitivity to the bitter taste of PROP has long been associated with enhanced sensitivity to other sweet and bitter compounds. They suggested that tasters and supertasters of PROP may also differ from nontasters in their taste preferences and in their patterns of food rejection and food acceptance.

In addition, they showed that a supertaster person is able to perceive bitter and sweet tastes in low concentrations when compared with medium tasters and non-tasters (4). Other studies found that non-taster person may have a higher concentration and frequency of sugar intake compared to person who are medium tasters or supertasters, and are therefore, more susceptible to dental caries (5,6).

Blood type (also called a blood group) is a classification of blood based on the presence or absence of inherited antigenic substances on the surface of red blood cells (RBCs)also on platelets, epithelium, and cells other than erythrocytes. These antigens may be proteins, carbohydrates, glycoproteins, or glycolipids, depending on the blood group system. The most important blood type system is the ABO blood group system (or blood group system) in human blood transfusion. Found on, the associated anti-A and anti-B antibodies are usually IgM antibodies, which are produced in the first years of life (7)

In past, the relation that link between decay and type of blood belong to 1930. Suk (8) suggested that particular blood type and a tendency towards caries might be constitutional characters, though the O group and good teeth,

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Suk's investigation was followed by a study carried out by Aitchison and Carmichael [9] they studied the distribution of blood type within two groups and found that people with O blood type have higher dental caries experiences, while people with A blood type was the lowest. Also, previous study by O'Rark and Lyschon [10] found a statistical significance regarding the relation blood type and caries history. Later on, few studies found relation between ABO blood types and dental caries [8,11,12]. On the contrary, Barros and Witkop [13] found there was no relation while according to Iraqi study by Kadhim [14],she found a relation between blood types and dental caries.

MATERIALS AND METHODS

This study was carried out at collage of dentistry _Al Kufa University; during the period from the mid of November 2015 till the mid of March 2016. In this study, all female dental students aged 19-21 were selected, (only 170 were participated from 190 as 20 students were not fit the criteria of sample selection). Informed consent was obtained from each participant enrolled in this study before any data collection and examination of the oral health status.

Clinical examination was conducted using plane mouth mirror and dental explorer. The systematic approach of the examination of dental caries was performed starting from the upper right second molar, proceeding in an orderly manner to the lower right second molar. Examination was started with mesial surface followed by occlusal, distal, buccal and lingual surface for all teeth examined.

The diagnosis of dental caries was done according to the criteria of Manjia *et al* [15] recording decayed lesion by severity (D_{1-4}) MFS. Also, it was recorded by the application of decayed (D), missing (M) and filled (F) surface index.

PTC test was used to identify the bitter taste sensitivity. Test strips impregnated with phenylthiocarbamide (PTC) was used to identify differences based on whether a bitter taste is perceived according to its manufacture instruction. They supplied in stoppered vials containing 100 strips per via that used to test for the genetic ability to experience a bitter taste from PTC. Phenylthiocarbamide (PTC) is present at only 3-5 micrograms per strip. At this level, the compound is negligible and harmless and this is done according to its manufacture instruction [16]

The procedure was done as follow according to manufacture instruction that after the person placed the strip on his tongue and closed the mouth. There are three basic results:

. Super taster will taste extreme bitterness within a micro-second .

. A medium taster will start to detect the bitterness after 10-20 seconds .

. Non-taster will not taste any bitterness .

. ABO blood group typing was obtained in this study by depending on the identity card of the female dental students that has the type of ABO blood group.

Statistical analysis can be classified into two categories: Descriptive Analysis (Frequency, Percentage for nominal variables while mean, SD for numeric variables) and second Inferential analysis (Levene test, One-way Analysis of Variance).

RESULTS

The frequency distribution of the sample according to bitter taste is shown in table **1.** This table shows that medium taster was the most predominant (44.12%) followed by super taster (34.71%) and non-taster (21.18%) while the distribution of the sample according to ABO blood are showed in table **2**. This table shows that for all ages the most predominant types were types A and O while the least predominant was type AB.

The frequency distribution of the sample according to ABO blood type in relation to PTC test are shown in table **3**. This table shows that super taster (37.29%) and medium taster (38.66%) were higher in A blood type followed by O blood type for super (30.51%) and medium (34.67%) taster. In contrast, non-taster was higher in O blood type (47.22%) followed by B blood type (25%), A blood type (16.67%) and AB blood type (11.11%).

The differences in caries experience represented by DMFS components among different bitter taste threshold were statistically not significant as shows in table **4**. Furthermore, the higher mean value of DMFS with its component Ds and FS were among supertaster students while the lower mean value of them was found among medium students, apposite result found among Ms component as the lower mean value among supertaster and higher mean value among medium.

The data of present study showed that the differences among different bitter taste threshold for the caries experience represented by severity (D_1-D_4) were statistically not significant as showed in table **5**. However, the higher mean value for the higher grades of caries severity (D_{2-3}) were among medium taster students as those students had the lower mean value of lower grade of severity. On the other hand, the non-taster group had the higher mean value of D_1 and lower mean value of grade D3 of caries severity. In addition, the lower mean value of D_2 and D_4 were found among super taster group. This table also shows that D_1 grade was higher with non-taster while D_2, D_3, D_4 grades were higher among students with medium taster.

Influence of different bitter taste threshold on dental caries according to DMFS and its components and in relation to ABO blood types are shown in table **6**. Concerning difference in caries experiences represented by DMFS and its components among students with different bitter taste threshold for blood types were not significant**.** However, as the higher mean values was found among students with non-taster for A blood type while for blood type B and AB, the higher mean DMFS was found for the student with medium taster while super taster among students with O blood type. Concerning Ds component, other picture found as the higher mean Ds was found among students with non-taster for blood type A and lower mean Ds was found among students with super taster for O blood type while concerning B and AB blood types, the highest mean Ds value was among students with medium taster. Concerning Ms component, the data showed that the missing surfaces was present only among non-taster for the A and AB blood types. The same finding also present for O blood type as the higher mean value was found for super taster. On the other hand, the Fs component was found in the highest mean among student with medium taster for B, AB blood types while was found higher among non-taster for A blood type and among super taster for O blood type.

Concerning difference in caries experiences represented by caries severity (D_1-D_4) among different bitter taste threshold for different blood types, the data showed no significant difference as in table **7**. However, grade D_1 was found higher among non –taster A, AB blood type students while for O blood type students were found within super taster. However, opposite picture was found for grade D_3 as it had the higher mean among students with O, B and A blood types as grades D_3 were absent among students with AB blood type while grade D_4 severity was found higher with medium taster among students with A, AB blood types while found higher with super taster among students with O type as grades D_4 were absent among students with B blood type.

DISCUSSION

The frequency distribution of the sample according to bitter taste are that medium taster was the most predominant followed by super taster and non-taster and this was in line with the distribution of bitter taste sensitivity (PTC) test where the majority of the population are taster while other are not taster because of genetics picture of bitter perception. Different variations of this gene affect ability to detect bitter compounds [(17)]. This observation established the homogeneity and unbiased nature of the study, as well as points to the natural distribution that is likely to exist in the population where the study was carried out.

Differences in caries experience among different bitter taste threshold were statistically not significant, in spite of presence of the higher mean value of higher grade of caries (D_{2-3}) were found among medium students. This may be due to that that a supertaster person is able to perceive bitter and sweet tastes in low concentrations when compared with medium tasters and non-tasters [(4)]. Also, many studies stated that inherited behavior and taste thresholds may play an important role in the frequency of carbohydrate intake. Genetic sensitivity to taste may be associated with a preference for or rejection of some foods. Sensitivity to taste is an inherited trait and so this effect on the type of food that eaten and as a result on dental caries protection or risk [(6)]

ABO blood group system is the most studied trait in human genetics followed by the ability to taste phenylthiocarbamide (PTC). These two traits have been extensively used in describing genetic variations among human populations around the world [(18)] and this could give some explanation to the finding of the present study as the difference in caries experiences among different bitter taste sensitivity for different blood types were not significant. In previous century, Hoskins [(19)] found that the blood groups antigens in saliva are known to interact chemically with the taste buds, and they are found in different concentrations among the various different taste buds.

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Table 1: Frequency distribution of bitter taste among students

PTC test	No	%
Super taster	59	34.71
Medium taster	75	44.12
Non-taster	36	21.18

Table 2: Frequency distribution of ABO blood types among students

Blood type	No	%
A	57	33.52
B	40	23.52
AB	12	7.05
O	61	35.88

Table 3: Frequency distribution of the ABO blood type in relation to bitter taste among students

Variables	Groups	ABO							
		A		B		AB		O	
		No.	%	No.	%	No.	%	No.	%
PTC	Super	22	37.29	16	27.12	3	5.08	18	30.51
	Medium	29	38.66	15	20.00	5	6.67	26	34.67
	Non-taster	6	16.67	9	25.00	4	11.11	17	47.22

Table (4): Dental caries experience represented by DMF index and its components among students with different bitter taste threshold

Variables	Bitter taste threshold (PTC test)	No	Mean	±SD	F	Sig.
Ds	**Super**	59	4.68	0.38	1.065	.347
	Medium	75	5.48	0.37		
	Non-taster	36	5.22	0.60		
Ms	**Super**	59	1.02	0.31	2.671	.072
	Medium	75	0.33	0.14		
	Non-taster	36	0.42	0.23		
Fs	**Super**	59	2.25	0.46	.199	.820
	Medium	75	2.69	0.54		
	Non-taster	36	2.42	0.56		
DMFs	**Super**	59	7.73	0.67	.505	.605
	Medium	75	8.55	0.60		
	Non-taster	36	7.83	0.75		
DMFT	**Super**	59	6.07	0.41	.550	.578
	Medium	75	6.64	0.37		
	Non-taster	36	6.42	0.51		

Table 5: Dental caries experience represented by grades of D_1-D_4 among students with bitter taste sensation

Variables	PTC	No	Mean	SE	F	Sig.
D_1	**Super**	59	3.07	0.28	**.136**	**.873**
	Medium	75	3.05	0.25		
	Non-taster	36	3.28	0.40		
D_2	**Super**	59	1.31	0.16	**1.395**	**.251**
	Medium	75	1.83	0.25		
	Non-taster	36	1.72	0.32		
D_3	**Super**	59	0.24	0.10	**1.520**	**.222**
	Medium	75	0.47	0.15		
	Non-taster	36	0.14	0.09		
D_4	**Super**	59	0.08	0.05	**.150**	**.861**
	Medium	75	0.15	0.10		
	Non-taster	36	0.11	0.08		

Table 6: Caries experience represented by DMFs and its components in relation to bitter taste sensation by blood type

Blood type		Super		Medium		Non-taster		F
		Mean	SE	Mean	SE	Mean	SE	
A	DS	4.68	0.52	5.86	0.65	7.33	0.92	2.114
	MS	0.45	0.45	0.17	0.17	0.83	0.83	.492
	FS	1.27	0.46	2.52	0.88	3.00	1.44	.856
	DMFS	6.27	1.02	8.55	0.91	11.17	1.49	2.975
B	DS	4.50	0.61	5.40	0.72	4.11	1.47	.575
	MS	1.56	0.75	0.67	0.45	0.00	0.00	1.559
	FS	2.19	0.88	4.00	1.62	2.89	0.96	.592
	DMFS	8.25	1.42	10.07	1.60	6.11	1.58	1.372
AB	DS	2.00	0.00	5.40	1.40	5.25	2.93	.794
	MS	0.00	0.00	0.00	0.00	1.25	1.25	1.000
	FS	3.00	3.00	3.40	2.52	2.00	1.08	.103
	DMFS	5.00	3.00	9.40	1.86	8.50	2.66	.817
O	DS	5.28	0.89	5.12	0.63	5.06	0.68	.022
	MS	1.39	0.54	0.38	0.27	0.29	0.29	2.504
	FS	3.39	1.08	2.00	0.65	2.06	0.95	.783
	DMFS	9.50	1.14	7.50	1.00	7.41	1.01	1.159

Table 7: Caries experience represented by grades of D_1-D_4 relation to bitter taste sensation by blood type

Blood type		Super		Medium		Non-taster		F	Sig.
		Mean	SE	Mean	SE	Mean	SE		
A	D_1	3.18	0.44	3.07	0.34	4.83	0.70	2.177	.123
	D_2	1.23	0.26	2.24	0.50	2.33	0.56	1.587	.214
	D_3	0.32	0.17	0.31	0.14	0.17	0.17	.106	.900
	D_4	0.00	0.00	0.24	0.24	0.00	0.00	.474	.625
B	D_1	2.75	0.39	2.60	0.59	3.33	1.17	.282	.756
	D_2	1.44	0.32	1.60	0.45	1.44	0.63	.047	.954
	D_3	0.06	0.06	1.27	0.67	0.00	0.00	2.785	.075
	D_4	0.25	0.17	0.00	0.00	0.22	0.22	.954	.394
AB	D_1	1.00	0.58	4.00	1.58	2.25	1.11	1.208	.343
	D_2	1.00	0.58	1.00	0.55	2.75	2.14	.586	.577
	D_3	0.00	0.00	0.00	0.00	0.00	0.00	.	.
	D_4	0.00	0.00	0.40	0.40	0.00	0.00	.656	.542
O	D_1	3.56	0.65	3.12	0.44	2.94	0.46	.335	.717
	D_2	1.33	0.33	1.65	0.35	1.41	0.33	.250	.779
	D_3	0.33	0.24	0.27	0.13	0.24	0.18	.067	.935
	D_4	0.06	0.06	0.08	0.08	0.12	0.12	.118	.889

الخلاصه

خلفيه للموضوع: زمره (فصيلة) الدم (ABO) والقابلية على تذوق الممروره من اغلب الجينات البشريه التي يتم دراستها والتي تستخدم بشده لوصف الاختلافات الجينيه في البشر حول العالم والتي من الممكن لها تاثير على تسوس الاسنان

الاهداف من الدراسة: كانت اهداف هذه الدراسه تقيم مدى اختلاف انتشار تسوس الاسنان بين فصائل الدم المختلفه وعلاقتها بمستوى المروره.

المواد والطرائق قد استمدت المعطيات من طالبات كليه طب الاسنان / جامعه الكوفة بعمر(19-21) سنه ثم تم فحص الاسنان حسب مؤشر (Manjia *et al*, 1989) الذي يتيح تسجيل شدته بينما مستوى الممروره تم قياسها حسب ptc (phenylthiocarbamide) test بينما لفصيله الدم فتم الاعتماد على هويه الطالب

النتائج: اتضح من من تحليل المعطيات التالي ان تسوس الاسنان واختلاف مستوى المروره مختلفه ولكن هذه الفروق لم تكن ذات دلاله إحصائية بالرغم من مستوى شده التسوس المقاسه ب (D_{2-3}) كانت اعلى لدى الطلاب دو متوسطي مستوى المروره بينما كانت اعلى مستوى شده التسوس المقاسه ب(D_1) لدى الطلاب عديمو التذوق للممروره. فيما يتعلق بتسوس الاسنان واختلاف مستوى المروره ضمن فصائل الدم المختلفه فوجدت مختلفه لكن لم تكن هذه الفروق ذات دلائل إحصائية ايضا بالرغم من مستوى شده التسوس المقاسه ب (D_1) كانت اعلى لدى الطلاب عديمي التذوق من زمره فصيله الدم A, B بينما شديدي التذوق فكانوا اعلى في زمره فصيله الدم من نوع O. بنسبه لشده التسوس المقاسه ب D_4 فوجدت اعلى ضمن طلاب متوسطي التدوق من زمره فصيله الدم نوع A, AB بينما وجدت اعلى للطلاب شديدي التذوق من نوع فصيله الدم O بينما شده التسوس المقاسه ب D_4 لم تكن موجوده ضمن الطلاب من فصيله الدم نوع B

الاستنتاج: ان مستوى تذوق الممروره المقاس ب ptc test من الممكن له بعض التاثير على تسوس الاسنان ضمن فصائل الدم المختلفه.