

A study of an association between PTC tasting ability and Cataract

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Abstract

The research was carried out from November 2018 to April 2019. The main objective was to study the association of the sensitivity of PTC and the incidence of cataract and glaucoma. The sensitivity of tasting the PTC substance was examined among a sample of (56) of cataract and glaucoma patients and (50) healthy individuals; their aged range (35-65) years old from both gender males and females. The results showed that the percentage of whitewater prevalence was very high (90%) while there were no patients of black water recorded and both of them were (10%). The results of the study showed that the sensitivity of patients' taste of PTC showed high percentage (76.7%) of non-tasters as compared to the tasters (23.3%) among white water patients. Healthy individuals recorded (76.0% and 24.0%) for tasters and non-tasters respectively. These results suggested that there is an association between white water incidence and lack of taste of PTC.

Keywords: PTC, Taste, Cataract, Gender

Introduction

A cataract is defined as an opacity of the lens producing a variation of the refractive index of the lens. This variation derives from modifications in the lens structure resulting in light scattering, frequently a consequence of a significant concentration of high-molecular-weight protein aggregates. Cataracts cause half of all cases of blindness and one third of the visual impairment cases worldwide.

Around 100 genes throughout the genome are in the OMIM database explaining the different syndromes caused by different genes. Nevertheless, it is sometimes genetically difficult to establish this difference because clinically one gene defect can result in either lens affection or systemic disease. Some examples of this variance are found in the affected AGK gene, which results in either an isolated cataract or in Senger syndrome (OMIM 212350) (Aldahmesh et al., 2012); the MAF gene, in which a molecular defect can result in cataracts or in Ayme-Gripp syndrome (OMIM 601088) (Narumi et al., 2014; Sun et al., 2014; Ma AS et al., 2016), or in the NHS gene alteration which can lead to isolated cataracts or Nance-Horan syndrome (OMIM 302350) [Coccia et al., 2009; Li D et al., 2016].

Despite advances in its surgical treatment, age-related cataract remains a leading cause of low vision and blindness worldwide (Pascolini and Mariotti, 2012). With continued aging of global populations, the socioeconomic burden of cataract is projected to increase and this has prompted the search for non-surgical means to reverse, delay or prevent cataract formation (Moreau and King, 2012; Toh et al., 2007).

The inability to taste certain compounds has long been believed to be due to simple recessive Mendelian inheritance (Blackslee Fox 1932). Kim and co-workers identified a region on chromosome 7 with strong linkage to PTC taste sensitivity, this gene was called *tas2r38*. Three common SNPs associated with PTC sensitivity, each of which results in changes to the amino acid sequence of the PTC receptor, present at positions 49, 262, and 296. The SNPs were also shown to be inherited together in certain combinations, e.g., haplotypes; PAV and AVI: PAV/PAV homozygotes and PAV/AVI heterozygotes for taster phenotype and AVI/AVI homozygotes for non-taster phenotype (Kim et al., 2003).

An early study detected an elevation of PTC non taster phenotype among open angle glaucoma patients associated with low level of protein bound Iodine, and this relation still a mystery (Bowman 1980). While another study refers to a link between some type of glaucoma; Traumatic and Uvetivic with high incidence of taster phenotype (Brooks and Gillies 1988). Recent study identified a gene nearby the location of *tas2r38* gene which represent a mitochondrial membrane protein involved in lipid and glycerolipid metabolism which may involve in cataract incidence (Aldahmesh et al., 2012). Also, Recent studies revealed a great variation in proteins content of saliva () and blood () among tasters and non-tasters and these differences may reflect a metabolic variation between these two phenotypes.

A comprehensive study was conducted to explain PTC gene polymorphisms and molecular genetic study of PTC tasting among Basrah population (Ayied, et al. 2014; Ahmed, et al. 2015). The association of PTC taste gene and blood pressure among a sample of Al- Basrah population (Mohaus and Ayied, 2018).

Due to the great clinical and genetic heterogeneity; the genes implicated in the process of cataract genesis is still a controversial issue; this study may assist in identifying the probable gene involved in inherited cataract.

Materials and Methods

The sample

The sensitivity test of PTC was examined among males and females of (56) patients (experimental sample) from the Fayhaa General Hospital and Qurna General Hospital and (50) healthy individuals (control sample their age ranged (35-70) years old. The patients were diagnosed by the doctor as having a cataract or glaucoma or both. Personal information of Patients was recorded in addition to healthy individuals.

PTC taste sensitivity test

Preparation of PTC substance solution

0.13 g of PTC substance was weighed with a sensitive digital balance, and then it was dissolved in 100 ml of distilled Boiling water to prepare Solution No. 1, which is the highest concentration, then half of the solution (1) quantity is taken and an equal volume of water is added to obtain Solution No. (2), the dilution process continues in the same way to reach solution No. (4), which represents the lowest concentration. .()Use the distilled water as the control solution .

prepare papers of PTC taste sensitivity test

To prepare the test papers for PTC substance taste sensitivity test of the filter papers with a diameter of 125 mm with each solution of the pre-prepared and numbered (1-4) of PTC substance were dipped and then left to be fully saturated. Then it dried and cut into small pieces dimensions of 3 x 1.3 cm and kept in Petri dishes sterilized and clean inside cans.

PTC taste threshold

Before conducting the examination of PTC taste threshold; individual must first make sure that there is no prior feeling of bitterness in his/ her mouth by placing a control paper on the back of the tongue. Then, a filter paper saturated with Solution No. 4, which represents the lowest concentration up to the solutions No. 3 that have the higher concentration and so on until the individual feels the bitterness of the substance and then the number of this solution is recorded to represent the threshold limit for the taste of the PTC for this individual. The individual who did not feel any bitterness until solutions No.1 considered as a non-taster.

Chi squares test was applied to test the significant differences among different percentages of different studied groups. Statistical tests were applied within the statistical SPSS (2016, version 16).

Results

Table (1) shows the incidence of cataract and glaucoma and the two combined among the tasters and non-tasters of both sexes. The high proportion of people with cataracts and mixed (cataracts and glaucoma) were detected among non-tasters of PTC substance as compared to tasters. The results also show a higher incidence of cataracts compared to glaucoma, which did not record any single infection in the sample studied. (Table 2).

Table (1): The number and percentage (%) of infection with Cataract and Glaucoma between the tasters and non-tasters in the patients.

Phenotypes	No	Cataract no.	Glaucoma & Cataract
Tasters	13 (23.3)	12 (23.6)	1 (20.0)
Non-tasters	43 (76.7)	39 (76.4)	4 (80.0)
Total	56 (100)	51 (91.0)	5 (9.0)
X ²		0.032	
p-value		0.858 (Not Significant)	

The results showed a significantly higher rate ($P \leq 0.001$) of non-tasters among those infected with cataracts than in the control sample Table (2). When compared with sex, the percentage of infection among females (64.3%) was higher than that (35.7%) of males (Table, 3). The incidence is also high among individuals of older ages compared to young (4).

Table (2): Comparison of the proportion of tasters and non-tasters between the experimental and control sample.

Phenotype	Cataract patients No. (%)	Control No. (%)
Tasters	13 (23.3)	38 (76.0)
Non-tasters	43 (76.7)	12 (23.01)
Total	56	50
X ²	55.54	
p-value	0.001	

Table (3): Comparison of the proportion of tasters and non-tasters between the experimental sample of males and females

Groups	Gender		Total
	Female	Male	
Non-tasters	24 (66.67)	19 (95.0)	43 (76.78)
Tasters	12 (33.33)	1 (5.00)	13 (23.12)
Total	36 (100)	20 (100)	56 (100)
X ²	5.79		
P-value	0.016		

Table (4): Comparison of tasters and non-tasters with cataract according to their ages.

Phenotypes	No.	More than 40 years	40 or less years
Tasters	13	11 (22.9)	2 (25)
Non-tasters	43	37 (77.1)	6 (75)
Total	56	48 (85.7)	8 (14.3)
X ²	0.017		
P-value	0.897		

Discussion

AVI/AVI homozygotes for non-taster phenotype thought to have a selective advantage (Wooding et al., 2006). However, there are some diseases had been found to be linked to non-taster of both phenotype or genotype (Lee et al., 2012). The usage of PTC tasting as a reliable indicator of weight gain susceptibility (Veluswami et al., 2015).

Kim et al (2003) identified a region on chromosome 7 with strong linkage to PTC taste sensitivity. Interestingly, this region contains nine bitter taste receptor genes and seven odorant receptor-like genes, another study recognizes an AGK gene which may have an association with cataract (Aldahmesh et al., 2012). This pointed to a sort of linkage between these two genes (trait). This study refers to a strong association of PTC tasting ability and cataract in a sample of Basrah population.

It could be hypothesized that any, mutations or situations that severely disrupt homeostatic functions, for example in ion channels, or glycemic control, or simply, stress system (emotional stress such as sadness) might result or might cause in age related cataract (Hejtmancik 2017).

Conclusion

It can be concluded that a high proportion of people with cataracts and mixed (cataracts and glaucoma) were detected among non-tasters of PTC substance as compared to tasters. The results also showed a significantly higher rate of non-tasters among those infected with cataracts than in the control sample.

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