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Original Research Article

Phenylthiocarbamide(PTC) Taste Perception among Pulmonary Tuberculosis Patients in Southwest Nigeria

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Abstract: Understanding the genetic variation existing among individuals in relation to common diseases is necessary for classifying, comparing and managing them. In Nigeria, tuberculosis is common but we are not aware of any study on the association between phenylthiocarbamide (PTC) taste perception and tuberculosis. This present study was carried out to determine whether or not inability to taste PTC was associated with pulmonary tuberculosis. A total of 220 individuals comprising 113 tuberculosis patients (test group) and 107 apparently healthy subjects (control group) participated in this study. Tasters and non-tasters were determined among the participants using PTC taste strips. Of the 113 tuberculosis patients, 52 (46.0%) were tasters and 61 (54.0%) were non-tasters while 76 (71.0%) and 31 (29.0%) of the 107 control subjects were tasters and non-tasters respectively. Non-tasters of PTC were significantly more associated with tuberculosis patients than control subjects ($\chi^2 = 14.13$, df = 1, $p < 0.001$). This study shows that inability to taste PTC is significantly associated tuberculosis.
Keywords: Phenylthiocarbamide, tasters, non-tasters, tuberculosis patients, healthy controls

INTRODUCTION

Tuberculosis is one of the deadliest diseases of mankind, still posing a major health, social and economic burden at a global level and basically in low and middle income countries [1]. Nigeria is the third highest tuberculosis burden country in the world and number one in Africa with 16% tuberculosis notification rate and tuberculosis treatment gap accounting for 15% of the global gap [2].

Phenylthiocarbamide (PTC) tasting is believed to be generally determined by a single gene, TAS2R38 with two alleles; one for tasting which is dominant (TT or Tt) and the other which is recessive (tt) for non-tasting. However, some studies have shown that there are other genes or environmental factors that influence PTC tasting which suggest that it does not follow the one gene, two allele myth of Mendelian genetics [3].

Several studies have reported association or lack of association between PTC taste perception and different diseases/disorders [3-10]. With regard to tuberculosis, only a few studies are available and they showed conflicting reports on its relationship with phenylthiourea taste perception. For instance, Akesson [11] in Southern Sweden reported lack of association between tuberculosis and phenylthiourea taste perception. In his study, Saldanha [12] had conflicting reports in that he observed a significant association between tasters of phenylthiourea and tuberculosis among the adults' population but a significant association between non-tasters and tuberculosis among the children studied and then suggested a pleiotropic effect of genes determining taste thresholds for phenylthiourea. Understanding the genetic variation existing among individuals in relation to common diseases is necessary for classifying, comparing and managing them. There is no investigation to our knowledge that has related tuberculosis with PTC taste perception among Nigerian population. The aim of this study was to find out whether or not PTC taste status was associated with pulmonary tuberculosis.

MATERIALS AND METHODS

The present study was carried out in Osogbo, Southwest Nigeria. The test participants (113) were

tuberculosis patients attending tuberculosis clinic at the State Teaching Hospital, Osogbo while the control subjects (107) were apparently healthy students and staff from the same institution who had no tuberculosis as of the time of investigation. Questionnaire was administered to each participant to obtain relevant information. Ethical approval for this study was obtained from the Ethical Committee of the College of Health Sciences, Ladoke Akintola University of Technology, Osogbo and the Ethical Committee of Osun State Teaching Hospital, Asubiaro, Osogbo, Nigeria. Phenylthiocarbamide (PTC) taste strips (0.0143 mg of PTC /strip) were obtained from Carolina Biological Supply Company, North Carolina, USA. Each participant was given a PTC taste strip and a filter paper (as control) and was asked to put each on their tongue and allow to be soaked in their saliva before describing their perception to each strip. Taste description of each participant was recorded.

STATISTICAL ANALYSIS

Statistical analysis was done using Statistical Package for Social Science (SPSS version 14). Differences between proportions and percentages were tested by Chi-Square test. A p value of <0.05 was considered significant. The allelic frequencies were determined by Hardy-Weinberg equation.

RESULTS

A total of 220 subjects participated in this study; 113 (51.4%) of which were tuberculosis patients (51 males and 62 females) and 107 (48.6%) were controls (52 males and 55 females) of age ≥16 years. The sex and age distribution of the study population are given in Table 1. The distributions of males and females in the test and control groups were not significantly different (χ^2 = 0.27, df = 1, p = 0.61). Also, the distributions of age between the test and control subjects were statistically comparable (χ^2 = 0.43, df = 4, p = 0.98).

The distributions of PTC taste perception among the test and control subjects are given in Table 2. Of the 113 tuberculosis patients, 46.0% and 54.0% were tasters and non-tasters respectively while 71% and 29% of the controls were tasters and non-tasters respectively. The percentage of non-tasters in the test group (54.0%) was significantly higher than that of the non-tasters in the control group (29.0%) (χ^2 = 14.13, df = 1, p < 0.001). Therefore, non-tasting of PTC or PTC blindness was significantly associated with tuberculosis.

Also, 34 (66.7%) of the 51 males and 27(43.5%) of the 62 females who had tuberculosis were non-tasters while 17 (32.7%) of the 52 males and 14 (25.5%) of the 55 females in the control group were non-tasters. Non-taster males in the test group were significantly higher than non-taster males in the control group (χ^2 = 11.89, df = 1, p < 0.001). Similarly, non-taster females in the test group were significantly higher than non-taster females in the control group (χ^2 = 4.19, df = 1, p = 0.04). So, tuberculosis was associated with inability to taste PTC in males and females.

Furthermore, non-taster males were significantly higher than non-taster females in the test group (χ^2 = 6.02, df = 1, p = 0.01) but there was no significant difference between non-taster males and non-taster females in the control group (χ^2 = 0.68, df = 1, p = 0.41). Therefore among the tuberculosis patients, inability to taste PTC was significantly higher in male patients than female patients. The allelic frequencies of tasters (T) and non-tasters (t) in the control group were 0.46 and 0.54 respectively while those of tasters and non-tasters in the test group were 0.27 and 0.73 respectively.

Table-1: Distribution of the Test and Control groups by Sex and Age and Taste perception

[a]Sex	Test group	Control group	Total	p
Male	51 (46.0)	52 (48.6)	103 (47.3)	0.61
Female	62 (54.0)	55 (51.4)	117 (52.7)	
Total	113 (51.4)	107 (48.6)	220 (100.0)	
[b]Age (years)				
16 – 25	25 (22.1)	23 (21.5)	48 (21.8)	0.98
26 – 35	27 (23.9)	26 (24.3)	53 (24.1)	
36 – 45	30 (26.6)	28 (26.2)	58 (26.4)	
46 - 55	14 (12.4)	16 (14.9)	30 (13.6)	
≥56	17(15.0)	14 (13.1)	31 (14.1)	
Total	113 (51.4)	107 (48.6)	220 (100.0)	
[c]PTC taste perception				
Taster	52 (46.0)	76(71.0)	128 (58.2)	<0.001
Non-taster	61 (54.0)	31(29.0)	92 (41.8)	
Total	113 (51.4)	107(48.6)	220 (100.0)	

[a]χ^2 = 0.27, df = 1, p = 0.61 [b]χ^2 = 0.43, df = 4, p = 0.98 [c]χ^2 = 14.13, df = 1, p < 0.001

Table-2: Distribution of Phenylthiocarbamide (PTC) Taste Perception among the Test and Control Participants

Sex	Taster	Non-taster	Total	p
[d]Test Subjects (%)				
Male	17(15.0)	34(30.1)	51(45.1)	0.01
Female	35(31.0)	27(23.9)	62(54.9)	
Total	52(46.0)	61(54.0)	113(100.0)	
[e]Control subjects (%)				
Male	35(32.7)	17(15.9)	52(48.6)	0.41
Female	41(38.3)	14(13.1)	55(51.4)	
Total	76(71.0)	31(29.0)	107(100.0)	

[d]$\chi^2 = 6.02$, df = 1, p = 0.01 [e]$\chi^2 = 0.68$, df = 4, p = 0.41

DISCUSSION

In the present study, non-tasters of PTC and the non-tasting allelic frequency of the control group were 29.0% and 0.54 respectively. This is in line with previous reports of non-tasters of PTC among the general population in Southwest Nigeria. Igbeneghu *et al*. [10] reported 30.0% non-tasters and non-tasting allelic frequency of 0.55. Alimba *et al*. [13] reported 29.4% and 0.54 respectively and Bakare *et al*. [14] reported 22.6% and 0.48 respectively. There was a significant higher incidence of PTC tasters than non-tasters in the control group which is in line with many previous studies involving general population [9]. Worldwide, many studies had reported about 30% non-tasters [9, 15]. Also, the result of the control group showed that there was no significant difference between female non-tasters and male non-tasters though the latter were more than the former which is in line with an earlier study carried out in the same locality [10].

In this study, PTC taste perception was examined among tuberculosis patients in Southwest Nigeria to ascertain any possible link between them. There was a significant higher incidence of non-tasters of PTC among the tuberculosis patients than in the control subjects which implied that inability to taste PTC was associated with tuberculosis. In addition, although tuberculosis resulted in significant increase in non-tasting of PTC in both sexes in the test group, male non-tasters were significantly more than female non-tasters. According to Guo and Reed [9] many studies had shown women to be more sensitive tasters than men; the female sex hormones had been linked with influencing PTC sensitivity and it is thought that the modifier loci that increase PTC taste sensitivity might be on the X chromosome or might be autosomal genes regulated by sex hormones.

To the best of our knowledge, this is first study carried out in Nigeria on the relationship between PTC taste perception and tuberculosis. The present study eliminated differences that could be due to age and sex by ensuring that these variables in the test and control subjects were comparable. Therefore, the inability to taste PTC which is significantly associated with tuberculosis suggests that TAS2R38 gene may directly or indirectly participate in conferring susceptibility or otherwise. The exact mechanism is not known but linkage disequilibrium of the taster locus with other loci that predispose to the disease or the pleiotropic effect of the PTC locus has been suggested [9].

CONCLUSION

The findings from this study suggest a positive interaction between inability to taste PTC and tuberculosis. Therefore, non-tasters of PTC are more susceptible to tuberculosis.

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