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SHORT COMMUNICATION

The Association Between Phenylthiocarbamide (PTC) Tasting Ability and Psychometric Variables

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Tasters and nontasters of the chemical phenylthiocarbamide differ in personality and in IQ test scores. Using an undergraduate sample, nontasters were significantly more "placid" (rather than "apprehensive") "relaxed" (rather than "tense"), and "practical" (rather than "imaginative") and scored higher on the more visuospatial component of an IQ test than their taster counterparts.

KEY WORDS: personality; IQ; phenylthiocarbamide (PTC).

INTRODUCTION

The taste thresholds for the chemical phenylthiocarbamide (PTC) and closely related compounds containing the H—N—C=S grouping are bimodally distributed. Those individuals more sensitive to PTC are called "tasters," and those less sensitive "nontasters." The ability to taste PTC has been shown to behave as a simple dominant Mendelian character by most studies (Blakeslee and Salmon, 1931; Blakeslee, 1932; Lugg, 1970). Surveys indicate that the PTC polymorphism is widespread in human populations. In Europe and Asia the taster frequency is about 70% (gene frequency $\simeq$ 0.5), although higher frequencies are found in Africans and American Indians (Mourant *et al.*, 1976). The relationship between PTC tasting and thyroid disease has received considerable attention since PTC and related substances show antithyroid activity. There is a significant

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nontasters with nontoxic goiter and a significant excess of tasters with toxic goiter (Harris and Kalmus, 1949b). Other conditions also show a significant association with taster status, for example, tuberculosis, leprosy, glaucoma, and carcinomas of the breast, cervix, and ovary (Mourant *et al.*, 1978), while a significant association between diabetes mellitus and nontasting (Terry and Segall, 1947) has been reported. The present study reports on the association between PTC taste thresholds and psychometric variables.

METHOD

The sample comprised 141 first- and second-year Cambridge undergraduates drawn at random from two single-sexed colleges. Males and females were represented in population proportions. PTC taste thresholds were determined using standard serial dilutions of PTC, starting from the highest dilution (i.e., highest solution number = 16) and working down together with sorting and eight tumbler tests (Weiner and Laurie, 1969). The sample was divided into taster ($N = 109$) and nontaster ($N = 32$) phenotypes using a conventional criterion (Harris and Kalmus, 1949a). The distribution of tasters and nontasters was within the range of other United Kingdom samples (Mourant *et al.*, 1976) [$\chi^2_{(1)} = 3.04$, $P > 0.05$].

Personality was assessed using Cattell's Sixteen Personality Factor Questionnaire (Form C) (Cattell and Eber, 1972). It was designed to give the most complete coverage of personality possible in a brief time. The 16 dimensions or scales are essentially independent, and any test item contributes to the score on only one factor. The IQ test was the AH5 (Heim, 1968), which is a group "pencil-and-paper" test of general intelligence, designed for adults or late teenagers of high intelligence. The test consists of two parts, each containing 36 questions. Part I comprises verbal and numerical problems; Part II is composed of diagrammatic items involving geometric shapes and clock dials. The two scores tend to be correlated significantly. Both tests were hand scored without prior knowledge of the subjects' taste threshold or taster status.

RESULTS

The Cambridge personality mean scores were compared with the scores obtained from a British undergraduate sample (Saville and Blinkhorn, 1976) ($N = 1293$). No significant differences between the samples' means were found, indicating that Cambridge University students were not dissimilar in personality to students at other British universities. However the total IQ mean score of this sample was significantly higher than the published norms for university students (Heim, 1968) [$t_{(1085)} = 7.02$, $P < 0.001$]. This result, which is in agreement with those of two previous Oxbridge studies (Heim, 1968; Clough, 1978), probably reflects the selective entrance bias by these universities.

In addition to the genetic marker, PTC, our subjects had been assessed on four other genetic or possible genetic factors [ABO blood group, handedness (McManus, 1980), hand-clasping (McManus and Mascie-Taylor, 1979), and armfolding (McManus and Mascie-Taylor, 1979)] as well as the 18 separate psychometric measures (16 personality factors and the 2 components of the AH5 intelligence test). With this number of variables there is a danger of obtaining a type I statistical error on any single analysis. As a global test for a relationship between the variables, we carried out a canonical correlation of the 7 independent variables, i.e., the 6 "genetic" factors [ABO has 2 df (there being no AB's)], plus sex, and the 18 dependent psychometric variables. The first canonical correlation had a Wilks' λ of 0.136, which is highly significant statistically ($P = 0.003$). No other canonical correlates were significant. Scrutiny of the coefficients of the canonical correlate suggested that PTC status was the major determining factor and a discriminant analysis was therefore carried out to determine whether the 18 variables related to PTC status; overall there was a highly significant discrimination between tasters and nontasters (Wilks' $\lambda = 0.717$, $\chi^2 = 43.06$, 19 df, $P = 0.0013$). A hierarchical discriminant analysis, with a criterion of minimizing the residual variance, showed that personality factor PF-O was most strongly related to PTC status [$F(1,139) = 15.83$, $P = 0.003$]. After removal of the effects of this factor, none of the remaining variables showed a significant relationship to PTC status. In our sample, PF-Q4, PF-M, and the more visuospatial component of the AH5 test (Part II) had also shown significant relationships with PTC status [$F(1,139) = 13.92$, 5.034, and 5.742, and $P = 0.0003$, 0.0264, and 0.0179, respectively]. Since these characters also showed significant correlations with PF-O (Pearsonian correlations = 0.465, 0.203, and −0.146, respectively), it is possible that one of these factors rather than PFO per se is the main associate of PTC status.

The possibility of a dosage effect was also considered. Within groups there was no evidence for a relationship between the psychometric variables and the PTC threshold, the multiple regression of threshold upon the variables not being significant, within either the nontaster [$F(18,13 = 1.077$] or the taster [$F(18,90 = 0.877$] groups. None of the 36 simple correlations between psychometric variables and PTC threshold, within taster or nontaster groups was significant at the 1% level. There was no evidence of polynomial regression, either quadratic or higher order, between psychometric variables and PTC threshold within each group. Fig-

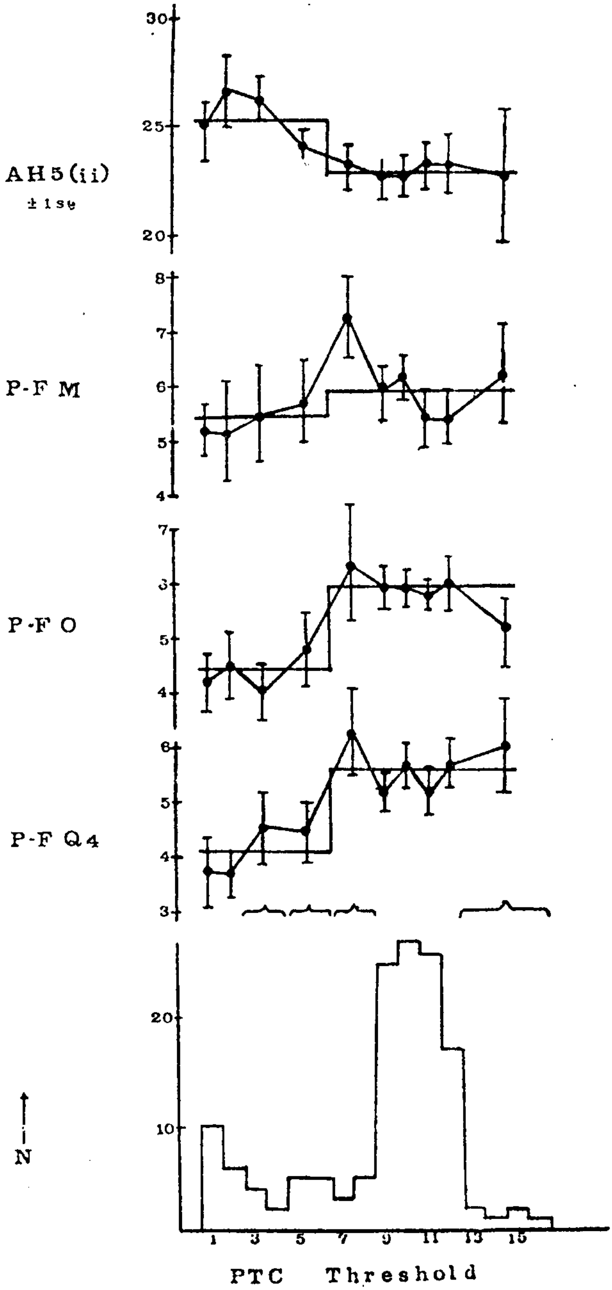

Fig. 1. AH5 (Part II), PF-M, PF-O, and PF-Q4 as a function of PTC taste threshold.

ure 1 shows the scores on four of the personality and intelligence tests as a function of the PTC threshold; since there are no significant within-group correlations, step functions have been fitted.

DISCUSSION

From these analyses, it is clear that nontasters tend to be more "placid" (Cattell's 16PF terminology) rather than "apprehensive" (PFO), "relaxed" rather than "tense" (PFQ4), and "practical" rather than "imaginative" (PFM) and to score higher on AH5 Part II than their taster counterparts. The finding of IQ and personality differences between tasters and nontasters has been suggested by earlier workers (Fischer *et al.*, 1963). Using a small sample of college students ($N = 27$), they found a significant association between digit symbol performance (WAIS; Wechsler, 1958) and taste threshold. In addition, the most extreme nontasters showed a pattern of scores on the WAIS known as "compensated" (i.e., subjects who easily maintain contact with others); more extreme tasters' pattern was "internalized." There is clearly some degree of relationship between WAIS personality profiles and Cattell's PF scores, although it is not possible to determine the precise degree.

The study of the relationship between segregating genetic markers and psychometric variables has been strongly advocated by Thoday (1967) as a means to the analysis of continuous variables in human populations. This approach has already led to the report of an association between IQ score and ABO blood groups in a group of Oxfordshire villages (Gibson *et al.*, 1973). The present study confirms the method as worthwhile; similar findings in other population studies will depend upon whether the phenomenon is due to pleiotropy or linkage disequilibrium.

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