Effect of Some Social Habits on PTC Taste Distribution among the Brahmins of Bhimtal (U. P.)

Lakhbir SINGH

*Department of Human Biology, Punjab
University, Patiala 147002 India*

Taste sensitivity to P.T.C. is one of the many genetic traits that are used in the study of human variations. The ability or inability to taste P.T.C. is a genetically determined character, tasting gene (T) being dominant to non-tasting gene (t).

The ability to taste P.T.C. is also met in other primates. Out of 28 chimpanzees in British Zoos, twenty showed by their unambiguous reactions that they were tasters, while seven were non-tasters (one animal was too shy to be tasted). Among three Orangutans two were tasters and one non-taster. Other species were represented by one or two specimens only, some being tasters and some not. Perhaps our ancestors which we have in common with the anthropoids possessed both the T and t genes and have passed them on to us.

Various authors have studied the inheritance mechanism of tasting ability and have sometimes found an exception to the simple rule of Mendelian inheritance i.e. non-taster parents giving birth to taster children. This raises the issue of variable expressivity and penetrance of the gene and it is more interesting to note whether these variable penetrance

and expressivity are also inherited or it is the result of some environmental factors such as age, smoking and drinking habits, eating habits etc., etc. An attempt has been made in this paper to see the effect of age and two of these social habits viz. smoking and alcoholism on taste sensitivity. DAS (1956) has investigated the problem and found 80% penetrance of T gene.

MATERIAL AND METHOD

For the preparation of stock solution and for further dilutions, the technique of HARRIS & KALMUS (1949) has been strictly observed. However, instead of 13 dilutions, only 10 were prepared with an idea that only negligible number of subjects have always been found to taste the thresholds 11, 12 and 13. Further, while classifying the subjects in tasters and nontasters, the frequency of subjects falling in threshold numbers 11, 12 and 13 can not make any significant difference.

For testing a subject, the sorting technique, as given by the same authors, has been used. A total 217 individuals including 156 males and 61 females belonging to the Brahmin caste of Bhimtal area formed the basis of the present

study. The social habits of the subjects, like smoking and alcoholism alongwith their chronological ages were also recorded.

The percentage frequency of tasters is preponderantly higher over that of non-tasters in both sexes (Table-III). There is little difference as regards to the fre-

Table-I. P. T. C. taste threshold distribution in the Brahmins of Bhimtal Area.

Sex	Taste Threshold numbers											Total
	10	9	8	7	6	5	4	3	2	1	<1	
Males	33	39	34	16	5	1	2	3	2	3	18	156
Females	12	17	12	6	4	0	0	3	2	1	4	61
Total	45	56	46	22	9	1	2	6	4	4	22	217

OBSERVATIONS

The distribution of taste thresholds in the two sexes is presented Table-I. The quantitative studies with solutions of P. T. C. by BLAKESLEE and SALMON (1931) and BLAKESLEE (1932) have shown that difference between tasters and non-tasters is of the degree only, even some non-

quency of tasters and non-tasters between two sexes. The gene frequency shows that the taster gene (T) is more frequent both in males as well as females, than that of its allele, the non-taster gene (t). There is very little difference between the gene frequency of T and t, in the two sexes.

Table-II(a-c) show the distribution of

Table-III. P. T. C. taste percentage frequency among Brahmins of Bhimtal Area.

Sex	Absolute Number	Taster	Percentage	Non-Taster	Percentage	Gene Frequency of T	Gene frequency of t
Male	156	128	82.05	28	17.95	0.576	0.424
Female	61	51	82.61	10	16.39	0.595	0.405
Total	217	179	82.49	38	17.51	0.582	0.418

$$\chi^2=0.0729$$

$$d.f.=1$$

$$0.80 > P > 0.70$$

tasters can taste the solution if the concentration is sufficiently high. Therefore, antimodes of the bimodal distribution has been taken as the dividing line between tasters and non-tasters. This antimode falls between solutions 4 and 5.

Out of the total 156 males, 128 were taster and 28 non-tasters, and out of 61 females, 51 were tasters and 10 non-tasters.

various thresholds in different age groups in both the sexes, separately and combined.

The test of significance as applied to study the difference with respect to the frequency of tasters and non-tasters in males and females shows, that the χ^2 value is highly insignificant, at 5% level. Therefore, the phenotype numbers for the

Table-II(a). Taste threshold distributions among male Brahmins of Bhimtal Area.

Age Groups in years	Solution Numbers												Total Number of Individuals
	10	9	8	7	6	5	4	3	2	1	<1	M. T. S. N.	
8-12	13	6	7	4	1	—	1	1	1	—	4	8.32	38
13-17	11	11	6	6	—	—	—	1	1	—	3	8.45	39
18-22	1	5	3	1	—	—	—	1	—	—	—	8.09	11
23-27	2	8	2	1	1	1	—	—	—	1	—	7.94	16
28-32	1	2	1	2	1	—	1	—	—	1	3	6.78	12
33-37	—	2	2	—	—	—	—	—	—	—	3	8.50	7
38-42	1	3	5	—	1	—	—	—	—	—	1	8.30	11
43-47	—	—	—	—	—	—	—	—	—	—	—	—	—
48-52	2	1	3	1	—	—	—	—	—	—	1	8.57	8
53-57	1	—	2	—	—	—	—	—	—	—	1	8.67	4
58-62	1	—	3	1	1	—	—	—	—	1	—	6.86	7
63-67	—	—	—	—	—	—	—	—	—	—	1	—	1
68-70	—	1	—	—	—	—	—	—	—	—	1	9.0	2
Total	33	39	34	16	5	1	2	3	2	3	18	8.15	156

Table-II(b). Taste threshold distribution among female Brahmins of Bhimtal Area.

Age Groups in years	Solution Numbers												Total Number of Individuals
	10	9	8	7	6	5	4	3	2	1	<1	M. T. S. N.	
8-12	3	6	5	—	—	—	—	—	—	—	—	8.86	14
13-17	4	4	—	1	1	—	—	—	—	—	1	8.90	11
18-22	—	1	1	—	—	—	—	2	1	—	1	5.0	6
23-27	3	1	2	1	—	—	—	—	—	—	1	8.86	8
28-32	—	1	—	1	1	—	—	1	—	—	—	6.25	4
33-37	—	2	—	—	—	—	—	—	1	—	—	6.67	3
38-42	1	—	1	1	—	—	—	—	—	—	1	8.34	4
43-47	—	1	—	—	—	—	—	—	—	1	—	5.02	4
48-52	1	1	1	1	—	—	—	—	—	—	—	8.50	4
53-57	—	—	1	—	1	—	—	—	—	—	—	7.00	2
58-62	—	—	—	1	1	—	—	—	—	—	—	6.5	2
63-67	—	—	1	—	—	—	—	—	—	—	—	8.0	1
68-70	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	12	17	12	6	4	—	—	3	2	1	4	7.82	61

Table-II(c). Taste threshold distribution in total population of Brahmins of Bhimtal Area.

Age groups in year	Solutions Number												Total Number of Individuals
	10	9	8	7	6	5	4	3	2	1	<1	M. T. S. N.	
8-12	16	12	12	4	1	—	1	1	1	—	4	8.48	52
13-17	15	15	6	7	1	—	—	1	1	—	4	8.58	50

18-22	1	6	4	1	—	—	—	3	1	—	1	7.13	17
23-27	5	9	4	2	1	1	—	—	—	1	1	8.22	24
28-32	1	3	1	3	2	—	1	1	—	1	3	6.62	16
33-37	—	4	2	—	—	—	—	—	1	—	3	7.72	10
38-42	2	3	6	1	1	—	—	—	—	—	2	8.31	15
43-47	—	1	—	—	—	—	—	—	—	1	—	5.0	2
48-52	3	2	4	2	—	—	—	—	—	—	1	8.55	12
53-57	1	—	3	—	1	—	—	—	—	—	1	8.0	6
58-62	1	—	3	2	2	—	—	—	—	1	—	6.78	9
63-67	—	—	1	—	—	—	—	—	—	—	1	8.0	2
68-70	—	1	—	—	—	—	—	—	—	—	1	9.0	2
Total	45	56	46	22	9	1	2	6	4	4	22	8.07	217

two sexes have been combined together and the frequencies of tasters and non-tasters, analysed in the whole population come to be 82.49 and 17.51 percent respectively.

To evaluate the effect of age, the whole population was divided into thirteen age groups. The mean threshold solution number (M.T.S.N.) was calculated in each age group. There is no statistically significant correlation between age and

threshold solution number. The mean threshold value is as high as 9.0 in age group of 68-70 years and as low as 5.0 in the age group of 43-47 years.

The effect of smoking and alcoholism on the taste sensitivity to P.T.C. was also estimated. The whole population was divided into smokers, non-smokers, alcoholics and non-alcoholics. Table IVa-IVd show the distribution of various thresholds among them. The value of χ^2

Table-IV(a). Taste threshold distribution among alcoholics.

Age groups in years	Solutions Numbers											Total number of individuals	
	10	9	8	7	6	5	4	3	2	1	<1		M. T. S. N.
8-12	1	—	1	—	—	—	—	1	—	—	—	7.0	3
13-17	1	4	4	3	—	—	—	—	1	—	—	7.77	13
18-22	1	5	2	1	—	1	—	1	—	—	—	7.82	11
23-27	2	8	2	1	1	—	—	—	—	1	—	8.13	15
28-32	1	2	1	2	1	—	1	—	—	1	3	6.78	12
33-37	—	2	2	—	—	—	—	—	—	—	1	8.5	5
38-42	1	3	5	—	1	—	—	—	—	—	1	8.3	11
43-47	—	—	—	—	—	—	—	—	8	—	—	—	—
48-52	2	1	3	1	—	—	—	—	—	—	1	8.57	8
53-57	1	—	2	—	—	—	—	—	—	—	1	8.67	4
58-62	1	—	3	1	1	—	—	—	—	1	—	6.86	7
63-67	—	—	—	—	—	—	—	—	—	—	—	—	—
68-70	—	1	—	—	—	—	—	—	—	—	1	9.0	2
Total	11	26	25	9	4	1	1	2	1	3	8	7.84	91

Table-IV(b). Taste threshold distribution among non-alcoholics.

Age groups in years												M. T. S. N.	Total number of individuals
	10	9	8	7	6	5	4	3	2	1	<1		
8-12	15	12	11	4	1	—	1	—	1	—	4	8.58	49
13-17	14	11	2	4	1	—	—	1	—	—	4	8.85	37
18-22	—	1	2	—	—	—	—	2	1	—	1	5.5	7
23-27	3	1	2	1	—	—	—	—	—	—	1	8.86	8
28-32	—	1	—	1	1	—	—	1	—	—	—	6.25	4
33-37	—	2	—	—	—	—	—	—	1	—	2	6.67	5
38-42	1	—	1	1	—	—	—	—	—	—	1	8.34	4
43-47	—	1	—	—	—	—	—	—	—	1	—	5.0	2
48-52	1	1	1	1	—	—	—	—	—	—	—	8.5	4
53-57	—	1	—	1	—	—	—	—	—	—	—	7.0	2
58-62	—	—	—	1	1	—	—	—	—	—	—	6.5	2
63-67	—	—	1	—	—	—	—	—	—	—	1	8.0	2
68-70	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	34	30	21	13	5	—	1	4	3	1	14	8.23	126

Table-IV(c). Taste threshold distribution among smokers.

Age groups in years	Solution Numbers											M. T. S. N.	Total number of individuals
	10	9	8	7	6	5	4	3	2	1	<1		
8-12	1	—	1	—	—	—	—	1	—	—	—	7.0	3
13-17	1	4	4	3	—	—	—	—	1	—	—	7.77	13
18-22	—	5	2	1	—	1	—	1	—	—	—	7.60	10
23-27	2	7	2	1	1	—	—	—	—	1	—	8.07	14
28-32	1	2	1	2	1	—	1	—	—	1	3	6.78	12
33-37	—	2	2	—	—	—	—	—	—	—	2	8.56	3
38-42	1	3	5	—	1	—	—	—	—	—	1	8.30	11
43-47	—	—	—	—	—	—	—	—	—	—	—	—	—
48-52	2	1	3	1	—	—	—	—	—	—	1	8.57	8
53-57	1	—	2	—	—	—	—	—	—	—	1	8.67	4
58-62	1	—	3	1	1	1	—	—	—	1	—	6.86	7
63-67	—	—	—	—	—	—	—	—	—	—	—	—	—
68-70	—	1	—	—	—	—	—	—	—	—	1	9.0	2
Total	10	25	25	9	4	1	1	2	1	3	9	7.81	90

Table-IV(d). Taste threshold distribution among non-smokers.

Age groups in years												M. T. S. N.	Total number of individuals
	10	9	8	7	6	5	4	3	2	1	<1		
8-12	15	12	11	4	1	—	1	—	1	—	4	8.58	49
13-17	14	11	2	4	1	—	—	1	—	—	4	8.85	37

18-22	1	1	2	—	—	—	—	2	1	—	1	6.14	8
23-27	3	2	2	1	—	—	—	—	—	—	1	8.87	9
28-32	—	1	—	1	1	—	—	1	—	—	—	6.25	4
33-37	—	2	—	—	—	—	—	—	1	—	1	6.67	4
38-42	1	—	1	1	—	—	—	—	—	—	1	8.34	4
43-47	—	1	—	—	—	—	—	—	—	1	—	5.02	4
48-52	1	1	1	1	—	—	—	—	—	—	—	8.54	5
53-57	—	—	1	—	1	—	—	—	—	—	—	7.0	2
58-62	—	—	—	1	1	—	—	—	—	—	—	6.5	2
63-67	—	—	1	—	—	—	—	—	—	—	1	8.0	2
68-70	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	35	31	21	13	5	—	1	4	3	1	13	7.26	127

Table-V(a). The percentage frequency of tasters and non-tasters among the smokers and non-smokers; alcoholics and non-alcoholics.

Habit	Absolute Number	Tasters	%age	Non-Tasters	%age
Smokers	90	74	82.12	16	17.88
Non-smokers	127	105	82.68	22	17.32
Alcoholics	91	76	83.51	15	16.49
Non-alcoholics	126	103	81.75	23	18.25

Chi-square Test Table

Table-V(b). Distribution of taste senistivity among smokers and non-smokers.

Habits	Tasters		Non-tasters		Total
	Obs.	Exp.	Obs.	Exp.	
Smokers	74	74.24	16	15.76	90
Non-smokers	105	104.76	22	22.24	127
Total	179		38		217
Value of $\chi^2=0.0075$					
Degree of Freedom=1		0.95>P>0.90 Non-significant			

Table-V(c). Distribution of taste sensitivity among alcoholics and non-alcoholics.

Habits	Tasters		Non-tasters		Total
	Obs.	Exp.	Obs.	Exp.	
Alcoholics	76	75.06	15	15.94	91
Non-alcoholics	103	103.94	23	22.06	126
Total	179		38		217
Value of $\chi^2=0.1146$		Degree of freedom=1			
0.80>P>0.70		Non-significant			

in the four groups is highly insignificant (Table Vb and Vc). It can, therefore, be said, as inference from this data that the smoking and drinking habits have no effect on the tasting ability.

DISCUSSION

In the Brahmins of Bhimtal area the frequency of tasters is much higher (82.49%) in comparison to non-tasters (17.51%). In the frequency of non-tasters they resemble with the Kumaonese (Rajputs 12.12% and Brahmins 12.63%; SETH, 1962) and the Danguria Tharu (SHRIVASTVA, 1961) of U. P., in which the percentage of non-tasters is 15.06%. Outside India, Brahmins of Bhimtal area seem to correspond to some Europeans, such as Brazilian Whites; Turkese and Cook Islanders in which the percentage of non-tasters is 18.1% (KALMUS, 1951); 18.3% (SIMMONS *et al.*, 1953) and 16.3% (SIMMONS *et al.*, 1955) respectively, rather than to the Chinese with percentage of non-tasters as 10.6% (BARNICOT, 1950).

Numerous studies have failed to show a significant difference in the distribution of taste sensitivity in the two sexes. This indicates the absence of any relationship between taste sensitivity and sex and thus shows that the gene determining the

taste sensitivity is not located on the sex chromosomes. However, some investigations have also found that the females are more sensitive to the taste of P. T. C. than males. They have shown that the mean threshold solution number is higher in females than males, but in the present investigation the mean threshold solution number is higher in males. The percentage frequency of tasters is higher in females than males in the present study.

By comparing the present data with that of FALCONER, 1947; PONS, 1955; Freire-MAIA, 1960, it can be safely concluded that the smoking and drinking habits have no significant effect on the ability to taste P. T. C. (Table-VI). Analysing the average thresholds for smokers and non-smokers several authors (AKESSON, 1959; SALMON and BLAKESLEE, 1935; FALCONER, 1947; PONS, 1955; SHARMA, 1959; CUNHA and ABREU, 1956 and the present study) did not find any detectable smoking effect on the sensitivity to taste P. T. C.

The results of the present study indicate that within the limits of this experiment there is no statistically significant correlation between age and threshold solution numbers to P. T. C. solution. All the same the data is too meagre and noth-

Table-VI. A comparison of the percentage of non-tasters among smokers and non-smokers.

Sr. Investigator No.	Smokers Non-tasters	%age	Total smokers	Non-smokers Non-tasters	%age	Total Non-smokers	Chi-square value (at d. f. = 1)
1. Falconer (1947)	60	27.7	217	41	23.7	173	0.78
2. Pons (1955)	19	25.3	75	24	24.7	97	0.007
3. Freire-Maia (1960)	5	16.7	30	4	9.1	44	0.96
4. Present study	16	17.77	90	22	17.32	127	0.0075

ing can be said very definitely. But KALMUS (1962) have shown that individual P.T. C. sensitivity of adult people declines on the average by 0.0468 ± 0.0118 threshold units (log to the base 2 of concentration) annually; this corresponds to a mean annual increase in threshold of about 3%. According to him, the deterioration is probably more rapid in women than in men, but the age, thyroid condition and taster status do not effect its rate.

SUMMARY

Out of 217 Brahmins of Bhimtal area studied, 179 were tasters and 38 non-tasters, the percentages being 82.49% and 17.51% respectively. The percentage of tasters in males is 82.05 and in females 83.61. The difference in two sexes is statistically insignificant. The taster gene (T) is more frequent both in males and females (.576 in males and .595 in females), than that of its allele (t) (.424 in males and .405 in females). The smoking and drinking habits have insignificant effect on the taste sensitivity of an individual. There is no statistically significant correlation between age and threshold solution number.

BIBLIOGRAPHY

- BARNICOT, N.A. (1950) Taste deficiency for phenylthiourea in Africa-Negroes and Chinese. *Ann. Eugn., Lond.*, 15: 248-254.
- BHATTACHARJEE, P.N. (1956) A genetic survey in the Rarhi Brahmins and the Muslims of West Bengal, A₁-A₂-B-O, M-N, Rh Blood Groups. ABH secretion, Sickel cell, P.T.C. Taste, Middle Phalangeal hair and colour Blindness. B. Dept. Anth. Govt. India, I. M. C. Vol.-V, No.1.
- BLAKESLEE, A. F. (1932) Genetics of sensory thresholds, taste for phenylthiocarbamide. *Proc. Nat. Acad. Sci., Wash.* 18, 120-30.
- BOYD, W.C. (1950) Genetics and the races of man. Little Brown & Co., Boston.
- DAS, S.R. (1956) A contribution to heredity of P.T.C. Taste character based on study of 845 Sib-Pairs. *Ann. Hum. Genet.* 20(4), 334-342.
- DAS, S.R., KUMAR, N., BHATTACHARJEE, P.N. and SASTRY, D. B. (1961) Blood groups (ABO, M-N and Rh), ABH secretion, Sickel cell, P.T.C. Taste and Colour Blindness in the Mahar of Nagpur. *J. Roy. Anth. Inst.* Vol. 91, Part-2.
- HARRIS, H., KALMUS, H. and TROTTER, W.R. (1949) Taste sensitivity to P.T.C. in goitre and diabetes. *Lancet*, 2, 1038-9.
- HARRIS, H., and KALMUS, H. (1950) The measurement of taste sensitivity to phenylthiocarbamide (P.T.C.). *Ann. Eugn., Lond.*, 15, 24-31.
- KALMUS, H., and TROTTER, W. R. (1962) Direct assessment of the effect of age on P.T.C. sensitivity. *Ann. Hum. Genet.*, 26, 2.
- MONTAGU, ASHLEY, F.M. (1962) An introduction to Physical Anthropology.
- NAPIER & NAPIER (1967) A Hand book of Living Primates, Acad. Press., New York.
- SANGHVI, L.D. (1954) Genetic diversity in the people of Western India. *Eug. Quar.* Vol. I, No. 4.
- SETH, P. K. (1962) P.T.C. Taste Threshold distribution among the betel chewers, non-vegetarians and smokers.
- SHARMA, J.C. (1959) Blood and P.T. C. taste studies in Punjabis and the effect of age and certain eating habits on taste threshold. *Anthropologist.* Vol. VI, Nos. 1 & 2.
- SRIVASTAVA, R.P. (1961) Frequency of non-tasters among the Danguria tharu of Uttar Pradesh. *East. Anth.* Vol. XIV, No. 3.
- STERN, C. (1955) Principles of Human Genetics. W.H. Freeman and Co., San Francisco, California.

(received, June 24, 1975)

PTC 味盲におよぼす社会的習慣の影響

——インド，Bhimtal 地区ブラーモンの事例——

Lakhbir SINGH

パンジャビ大学人類生物学教室，インド

Bhimtal 地区在住の 217 名のブラーマンを対象として，PTC 味盲検査を行った。性，加齢，喫煙，飲酒のいずれも，有味（T）・味盲（t）の遺伝子頻度と有意の相関が見られなかった。これは被検者の数が少なかったのが原因と考えられる。