HYDROGEN CYANIDE SMELL SENSITIVITY IN SOME INDIAN POPULATIONS

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The ability to smell HCN has been examined in a sample of 2619 subjects from Hyderabad, Andhra Pradesh, belonging to different Indian ethnic groups. One single antimode, between concentrations of 5% and 10%, has been found. No sex nor ethnic differences were noted. Previous claims of possible sex-linked inheritance could not be confirmed.

The ability to smell hydrogen cyanide (HCN) has been considered to be hereditary by a number of authors, although different mechanisms have been suggested: sex-linkage (Kirk and Stenhouse 1953, Fukumoto et al. 1957, Srivastava 1961), autosomal dominance (Huser 1958), or no simple Mendelian inheritance (Brown and Robinette 1967).

The present report is based on the analysis of cyanide smell sensitivity in a sample of 2619 subjects (1705 boys and 914 girls), aged 10-18 years, belonging to six secondary schools of different parts of Hyderabad, and broadly classified into 14 ethnic groups.

Four different concentrations of NaCN — 1%, 5%, 10%, and 20% — were prepared and kept in air-tight bottles. Each subject was made to smell them serially, starting from the 1% solution and closing each bottle immediately after the subject had smelt it.

The results are shown in Table 1.

It may first of all be noted that one single antimode in the distribution of threshold values is found, between 5% and 10%. Accordingly, individuals with threshold values at 1% and 5% were classified as smellers; those with values at 10%, 20%, and over, as nonsmellers. However, the 20% concentration was also considered as a discriminating threshold, for better comparison with previous studies (e.g., Kirk and Stenhouse 1953) where the classification of smellers and nonsmellers was based on this antimodal value.

Nonsmellers are found to be 58.0% with the 5-10% concentration as the antimode, and 20.5% with the 20% one.

No sex differences are found, except for two groups (Kamma and West Indian Castes) with the 5-10% antimode, and for three groups (Kamma, Velama, and Muslims) with the 20% one.

No large ethnic differences are found, especially with the 5-10% antimode, though a considerable deviation is found for four groups (Velama, Scheduled Castes, Christians, and West Indian Castes) with the 20% antimode.

Finally, cyanide smell sensitivity having been claimed to be X-linked, its possible association with color blindness (see Murty and Vijayalaxmi 1974 for technical details) has been examined. Such an association would however be expected only if the two loci were very close to one another on the X chromosome. Color blindness having been found in 25/705 smellers vs. 30/1000 nonsmellers, and in 45/1356 smellers vs. 10/349 nonsmellers, respectively with the 5-10% and the 20% antimode, no significant association is found ($\chi^2 = 0.39$ and $\chi^2 = 0.25$, respectively).

Whereas in most studies an antimode at 20% concentration has been found, we have found our antimode to lie between 5% and 10% concentration; Brown and Robinette (1967), moreover, found a trimodal distribution with antimodes lying around 0.01% and 0.0001% concentration. These differences might be due to ethnic factors accounting for different acuity for smell sensitivity, age groups being the same. The trimodal distribution found by Brown and Robinette may be the result of testing with low concentrations (similarly to what has been observed by Lugg, in 1968, with PTC).

Acta Genet. Med. Gemellol. (1975), 24: 169-171

Table 1. *HCN Smell Sensitivity in Some Indian Groups: Percent Frequency of Smellers at the Different NaCN Concentrations*

Ethnic group	Boys						Girls						Total					
	N	1%	5%	10%	20%	> 20%	N	1%	5%	10%	20%	> 20%	N	1%	5%	10%	20%	> 20%
HINDUS:																		
Brahmin	393	28.2	12.9	14.3	21.1	23.4	208	24.4	16.3	15.9	14.9	26.4	601	27.6	14.1	14.8	19.0	24.5
Reddy	101	24.8	6.9	10.9	32.7	24.8	34	26.5	14.7	8.8	23.5	26.5	135	25.2	8.9	10.4	30.4	25.2
Kamma	78	37.2	11.5	19.2	17.9	14.1	26	11.5	11.5	26.9	15.4	34.6	104	30.8	11.5	21.2	17.3	19.2
Velama	78	16.7	20.5	35.9	17.9	8.9	37	27.0	13.5	18.9	16.2	24.3	115	20.0	18.3	30.4	17.4	13.9
Vaisya	38	36.8	13.2	13.2	10.5	26.3	14	21.5	7.1	21.4	28.6	21.4	52	32.7	11.5	15.4	15.4	25.0
Backward Castes	163	23.3	18.4	13.5	23.3	21.5	58	27.6	13.8	13.8	17.2	27.6	221	24.4	17.2	13.6	21.7	23.1
Scheduled Castes	112	30.4	19.6	15.2	20.5	14.3	30	43.3	16.7	13.3	13.3	13.3	142	33.1	19.0	14.8	19.0	14.1
Kshatriya	98	28.6	9.2	8.2	28.6	25.5	49	34.7	10.2	8.2	26.5	20.4	147	30.6	9.5	8.2	27.9	23.8
WIC	64	18.8	12.5	7.8	29.7	31.3	45	26.7	28.9	11.1	8.2	24.4	109	22.0	19.3	9.2	21.1	28.4
NIC	45	22.2	4.4	31.1	17.8	24.4	54	24.1	16.7	18.5	18.5	22.2	99	23.2	11.1	24.2	18.2	23.2
Others	42	42.9	11.9	14.3	14.3	16.7	7	28.6	14.3	14.3	—	42.9	49	40.8	12.2	14.3	12.2	20.4
Total (Hindus)	1212	27.4	13.5	15.4	22.3	21.4	562	27.2	15.8	15.1	16.7	25.1	1774	27.3	14.3	15.3	20.5	22.5
MUSLIMS	418	33.0	7.7	19.9	19.7	19.9	308	28.9	14.6	17.2	26.9	12.3	726	31.3	10.6	18.7	22.7	16.7
CHRISTIANS	45	33.3	26.7	17.8	15.6	6.7	18	33.3	22.2	11.1	22.2	11.1	63	33.3	25.4	15.9	17.5	7.9
UNKNOWN	30	23.3	16.7	30.0	16.7	13.3	26	15.4	23.1	15.4	23.1	23.1	56	19.6	19.6	23.2	19.6	17.9
GRAND TOTAL	1705	28.9	12.5	16.8	21.3	20.5	914	27.6	15.7	15.7	20.5	20.5	2619	28.4	13.6	16.5	21.0	20.5

WIC: West Indian Castes NIC: North Indian Castes

Table 2. *Frequency of Cyanide Nonsmellers in Different Populations*

Population	Sex	CN antimodal concentration (%)	N	Nonsmellers (%)	Reference
Australians	M	20	132	18.2	Kirk and Stenhouse 1953
	F	20	112	4.46	
Africans	M	20	71	25.4	Allison 1953
Japanese	M	20	433	18.2	Fukumoto et al. 1957
	F	20		5.5	
Indians (Lucknow)	M	20	99	17.17	Srivastava 1961
	F	20	157	5.73	
Indians (Hyderabad)	M	20	1705	20.5	Present authors
	F	20	914	20.5	
	M	5-10	1705	58.7	
	F	5-10	914	56.7	

Unless the distribution of threshold values for cyanide sensitivity be actually multimodal (which would make inappropriate the definition of smellers and nonsmellers on account of one single antimodal concentration), it may be concluded that there may exist a standard range of concentrations where the distribution exhibits one single antimode.

From the comparison of our results with those obtained by other authors (Table 2), it may be noted that our data fail to support the previous findings of significant sex differences in the inability to smell cyanide and the ensuing conclusion that it be inherited as a sex-linked recessive (Kirk and Stenhouse 1953, Fukumoto et al. 1957, Srivastava 1961). Though to a limited extent, this is also confirmed by our finding of a lack of association between cyanide sensitivity and color blindness. On the other hand, our results cannot verify the hypothesis of autosomal dominance (Huser 1958), nor that of no simple Mendelian inheritance (Brown and Robinette 1967).

Further studies with closely spaced concentrations in an appropriate range, especially among the higher concentrations tested by Brown and Robinette, seem to be necessary.

Acknowdedgement

We are grateful to Prof. O.S. Reddi for encouragement and thank Miss Padma, Dr. K. Naggender and the staff of the schools for cooperation.

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