

## Taste Sensitivity to Phenylthiocarbamide among three Mongoloid Populations of the Indian Border

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The cis-Himalayan region of the Indian subcontinent, extending from Ladakh in the north-west to Nefa in the north-east, is an extensive region which inhabits a number of tribes and communities with considerable Mongoloid admixture. It is in this region that the Mongoloid racial strain from the Tibetan and Burmese sources has mixed with Mediterranean and or proto-Australoid racial type from the Indian planes, resulting in hybrid populations. Consequently, upon long geographical isolation and inbreeding, these populations have formed "sub-racial" types of their own which differ from each other in degrees and with the rest of the Indian population in broad racial composition.

Of Tibetans, Spitians and Lahaulies, who form the subject data for the present investigation, the latter two have been derived from Spiti and Lahaul, the frontier district of the Panjab State bordering with western Tibet. The former, i.e. the Tibetans, are those who have crossed over to the Indian side, as refugees, after the Chinese occupation of Tibet. Geographically this entire region is comparatively isolated from the rest of the world due to being highly mountainous. Lahaul, Spiti and Tibet are communicable with each other and with the rest of the world only through passes which range from 10000 to 15000 ft. in height from the sea level and are for a greater part of the year covered with snow. Although the people of these regions live in close proximity to each other and the history of their contacts particularly for trade (wool etc.) is ages old, yet the three populations today are endogamous. Cases of inter-marriages among them however are not altogether unknown.

Anthropologically this region occupies a very interesting position. The people of Lahaul and Spiti represent a hybrid of Mongoloid and Mediterranean racial elements derived from the Tibetan and the Hindu sources respectively. They are not only hybrids in the physical sense of the term but also ethnoculturally. This is reflected by the co-existence of the Hinduism and Lamaistic Buddhism, monogamy and polyandry and a well stratified caste structure in the region. The influence of Hindu immigrants is more marked in Lahaul than in Spiti.

It is in this context that the present author has undertaken a detailed survey of various physical anthropological traits in this region with a view to ascertaining the

extent of miscegenation and flow of genes in the region from the Mongoloid and non-Mongoloid sources. The present paper reports the findings, on the distribution of the gene (T) for tasting ability to phenylthiocarbamide in the population of this contiguous area.

### Material and method

The data consist of 242 Tibetans (186 males and 56 females), 125 Spitiens (71 males and 54 females) and 314 Lahaulis (174 males and 140 females). The age of the subjects varies between 12 and 50 years. Close blood relations (parents and children or sibs) were avoided.

The ability to taste and threshold levels were determined by using the serial dilutions of phenylthiocarbamide ranging from 1300 mg to 0.16 mg of PTC per liter of water, in concentration. The solution N. 2, was half as concentrated as solution N. 1, solution N. 3, was half as concentrated as solution N. 2 and so on till solution N. 14. Solution N. 0, indicates those individuals who showed no sign of taste sensitivity to any of the solutions employed. The taste threshold was further confirmed in some of the doubtful cases by using the sorting technique of Harris and Kalmus (1949). The water employed for the serial dilutions was simple boiled local river water, while distilled water to which the local people were not used was avoided.

### Observations

Tab. 1 records the taste thresholds of 242 Tibetans according to sex. The distribution of the threshold is bimodal as shown in the table as well as in Fig. 1. The antimode for the two sex combined has been found at Solution N. 4. The mean threshold for the Tibetan males and females individually is 8.0 and 7.2 respectively whereas for the two together it is 7.8.

Tab. 1. Distribution of taste threshold among 242 Tibetans

	PTC solution number														Total	
	0	1	2	3	4	5	6	6	8	9	10	11	12	13		14
♂	6	3	4	5	1	3	8	12	43	47	35	16	3	—	—	186
♀	1	3	1	2	—	1	7	8	10	12	9	1	1	—	—	56
Total	7	6	5	7	1	4	15	20	63	59	44	17	4	—	—	242
Mean male threshold													8.0			
Mean female threshold													7.0			
Mean total threshold													7.8			

Tab. 2 records the number and percentage of tasters and non-tasters among Tibetans according to sex. The sex differences in the frequency of tasters and non-tasters is not statistically significant.

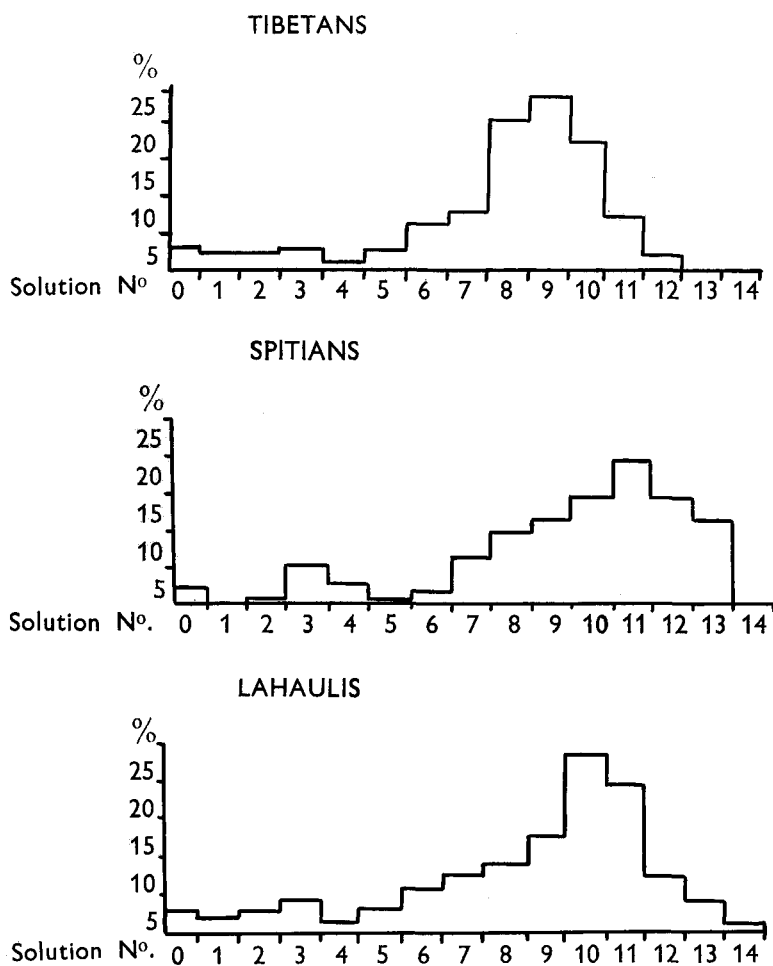


Fig. 1. Distribution of taste threshold to PTC in each of the three populations

Tab. 2. Number and percentage of tasters and non-tasters among Tibetans

	Tasters		Non-tasters	
	N.	%	N.	%
♂	167	89.79	19	10.21
♀	49	87.50	7	12.50
Total	216	89.26	26	10.74

$\chi^2 = 2.00, df = 1, p > .05$   
(antimode at sol. 4)

Tab. 3 records the taste threshold of 125 Spitians. The distribution of thresholds is again clearly bimodal. For the two sex combined the antimode falls at solution 5. The mean thresholds for males, females and the combined groups has been worked out as 9.3, 9.7 and 9.5 respectively.

Tab. 4 shows the number and percentage of tasters and non-tasters among Spitians according to sex. The sex difference is not significant statistically.

Tab. 5 records the taste threshold of 314 Lahaulis arranged according to sex. The distribution of threshold in this population also is bimodal, as recorded in the earlier two populations. Antimode for males and females combined lies at solution 4. The mean threshold for males, females and for the combined group is 7.0, 8.5 and 7.6 respectively.

Tab. 6 shows the number and percentage of tasters and non-tasters among Lahaulis according to sex. The sex difference is not statistically significant.

### Discussion

Most investigators (Kalmus, 1957; Das, 1956) have found that females are more sensitive to the taste of phenylthiocarbamide than males. In the present investigation, however, there are no sex differences either in the incidence of tasters and non-tasters or in the taste threshold distribution. Since the chi-square values have failed to show any statistically sex differences with regard to these, the two sexes have been grouped together and treated as one for purposes of gene frequency determinations and inter-groups comparisons.

Although Tibetans have a low frequency of non-tasters when compared with Spitians and Lahaulis, but when actually chi-square tests are applied between Tibetans and Spitians ( $\chi^2 = 0.192$ ,  $df = 1$ ,  $p > 0.05$ ) and Tibetans and Lahaulis ( $\chi^2 = 0.503$ ,  $df = 1$ ,  $p > 0.05$ ), these differences in the proportion of tasters and non-tasters among them appear to be only superficial. Thus these three populations are homogenous with regard to the distribution of the taster gene ( $\chi^2 = 0.69$ ,  $df = 2$ ,  $p > 0.05$ ). This homogeneity among them, however, may not be true in regard to other anthropological traits.

Low frequency of non-tasters is a characteristic feature of almost all Monogoloid populations (Barnicot, 1950; Saldanha, 1958), Chinese of Malaya (2.00%), Chinese of England (10.60%), Japanese of Brazil (7.11%) and Japanese of Japan (8.23%) have all a low frequency of non-tasters. Data on the Chinese of the main land, however, are not available for any comparisons. Tibetans of present series are strikingly similar to Chinese (Barnicot, 1950) of England in the gene frequency as well as percentage of non-tasters. Like other Mongoloid populations, Spitians and Lahaulis also have maintained a low frequency of non-tasters. However, this is so, despite a considerable Hindu admixture with high frequency of non-taster gene (Das, 1958, Sharma, 1962). This is not only true of the western zone (present study) but also clearly persists through central (Kumaonis) and eastern zones (Riangs) of the

**Tab. 3. Distribution of taste threshold among 125 Spitians**

PTC solution number

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
♂	2	—	1	4	1	—	2	5	6	8	10	14	10	8	—	71
♀	1	—	—	2	3	1	1	3	5	6	8	10	8	6	—	54
Total	3	—	1	6	4	1	3	8	11	14	18	24	18	14	—	125
Mean male threshold													9.3			
Mean female threshold													9.7			
Mean total threshold													9.5			

**Tab. 4. Number and percentage of tasters and non-tasters among Spitians**

	Tasters		Non-tasters	
	N.	%	N.	%
♂	63	88.74	8	11.26
♀	47	87.04	7	12.96
Total	110	88.00	15	12.00

$\chi^2 = 0.27, df = 1, p > 0.05$   
(antimode at sol. 5)

**Tab. 5. Distribution of taste threshold among 314 Lahaulis**

PTC solution number

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
♂	5	6	3	9	1	3	8	11	12	20	40	32	14	9	1	174
♀	3	1	5	5	2	5	7	12	14	17	31	29	5	3	—	140
Total	8	7	8	14	3	8	15	23	26	37	72	61	19	12	1	314
Mean female threshold													8.5			
Mean total threshold													7.6			

**Tab. 6. Number and percentage of tasters and non-tasters among Lahaulis**

	Tasters		Non-tasters	
	N.	%	N.	%
♂	150	86.20	24	13.80
♀	124	88.58	16	11.40
Total	274	87.27	40	12.73

$\chi^2 = 0.486, df = 1, p > 0.05$   
(antimode at sol. 4)

**Tab. 7. Number, percentage and gene frequency of tasters and non-tasters among Tibetans, Spitians and Lahaulis (both sex combined)**

Population	Tasters		Non-tasters		Gene frequency	
	N.	%	N.	%	T	t
Tibetans	216	89.26	26	10.74	.673	.327
Spitians	110	88.00	15	12.00	.655	.345
Lahaulis	274	87.27	40	12.72	.644	.356

$$(\chi^2 = 0.59, df = 2, p > 0.05)$$

**Tab. 8. Frequency of non-tasters for phenylthiocarbamide among different populations tested by means of the sorting or equivalent technique**

Population	Number tested	Non-tasters	Gene frequency	Author
Chinese (Malaya)	50	2.00	.141	Lugg & Whyte, 1955
Japanese (Brazil)	295	7.11	.267	Saldanha, 1958
Japanese (Japan)	656	8.23	.287	Tsuji, 1957
Chinese (England)	66	10.60	.325	Barnicot, 1950
Tibetans (India)	242	10.74	.327	Present study, 1965
Spitians (India)	125	12.00	.345	Present study, 1965
Paniyan (Aloriginals of India)	247	12.15	.347	Das & Ghosh, 1954
Kumaonis (India)	194	12.37	.351	Seth, 1962
Lahaulis (India)	314	12.73	.356	Present study, 1965
Riang (India)	401	16.21	.403	Kumar & Sastry, 1961
Hindus (India)	256	29.30	.540	Das, 1958
Panjabi Hindus (India)	322	31.98	.565	Sharma, 1962

cis-Himalayan region, where similar admixture of Mongoloid and non-Mongoloid elements has taken place. It may be argued here that this low frequency of non-tasters in the cis-Himalayan region may not be entirely due to Mongoloid influence, which no doubt remains a predominant racial element in the region, but may also be partly due to the proto-Australoid influence. Proto-Australoid racial strain lies at the substratum of all the Indian populations and forms a major racial element in the tribal population of the country and the people of cis-Himalayan region. Low frequency (12.15%) of non-tasters among Paniyans (Das and Ghosh, 1954) who form predominantly a proto-Australoid group, also supports this argument.

### Summary

Taste threshold for phenylthiocarbamide were studied among 242 Tibetans, 125 Spitians and 314 Lahaulis, the three Mongoloid populations of the Indo-Tibetan border. No statistically significant sex differences have been observed in the frequency of tasters and non-tasters in the present study. The frequency of non-tasters among Spitians (12.00%) and Lahaulis (12.73%) is strikingly similar and slightly higher than among Tibetans (10.74%). Statistically the difference in the three populations is non-significant ( $\chi^2 = 0.95$ ,  $df = 2$ ,  $p > 0.05$ ). In spite of the considerable Hindu admixture with a high frequency of non-taster gene, Spitians and Lahaulis have maintained a rather low frequency of non-tasters. This is true of populations all along the cis-Himalayan region, where similar Mongoloid and Hindu admixture has taken place. Besides the main Mongoloid element the proto-Australoid racial strain in the region may also be considered responsible for lowering the frequency of non-tasters.

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## RIASSUNTO

Sono state studiate le soglie del gusto per la PTC in 242 Tibetani, 125 Spiti e 314 Lahaulis — le tre popolazioni mongoliche della frontiera Indo-Tibetana. Non sono state osservate differenze statisticamente significative nei due sessi. Le frequenze di non gustatori negli Spiti e nei Lahaulis sono molto simili (12.00% e 12.73%) e leggermente più alte di quelle dei Tibetani (10.74%). Tali differenze non sono statisticamente significative ( $\chi^2 = 0.95$ ,  $gl = 2$ ,  $p < 0.05$ ). Nonostante le numerose mistioni con gli Indù — che hanno una frequenza elevata del gene non-gustatore — Spiti e Lahaulis hanno conservato una frequenza di non-gustatori piuttosto bassa. Ciò vale per tutte le popolazioni lungo la regione cis-himalayana, dove si sono verificate mistioni analoghe. A parte l'elemento mongoloide, principale, un gruppo proto-australiano della stessa regione può anche essere considerato responsabile dell'abbassamento della frequenza dei non gustatori.

## RÉSUMÉ

Le goût pour la PTC a été étudié chez 242 Tibétains, 125 Spites et 314 Lahaulis — les trois populations Mongoïdes de la frontière Indo-Tibétaine. Aucune différence statistiquement significative ne fut observée entre les deux sexes. Les fréquences de non-goûteurs chez Spites et Lahaulis paraissent très proches (12.00% et 12.73%) et légèrement plus élevées que chez les Tibétains (10.74%). Ces différences ne sont pas statistiquement significatives ( $\chi^2 = 0.95$ ,  $dl = 2$ ,  $p < 0.05$ ). Nonobstant les considérables croisements avec les Hindous — qui ont une fréquence élevée de non-goûteurs — Spites et Lahaulis ont maintenu une fréquence assez basse de non-goûteurs. Il en est de même pour toutes populations de la région cis-himalayenne, où des croisements pareils ont eu lieu. A part l'élément principal mongoloïde, un groupe racial proto-australien de la région peut aussi être considéré responsable de la diminution de la fréquence de non-goûteurs.

## ZUSAMMENFASSUNG

Bei 242 Tibetern, 125 Spiten und 314 Lahaulis — den drei mongolischen Populationen des Indisch-Tibetischen Grenzgebiets — wurden die Geschmacksschwellen für PTC festgestellt. Es zeigten sich keine statistisch wesentlichen Unterschiede zwischen den beiden Geschlechtern. Das Vorkommen von Nicht-Schmeckern ist fast gleich bei den Spiten und den Lahaulis (12.00% und 12.73%), etwas niedriger hingegen bei den Tibetern (10.74%). Diese Unterschiede sind statistisch nicht bedeutend ( $\chi^2 = 0.95$ ;  $Fg. = 2$ ;  $p = 0.05$ ). Trotz häufiger Vermischung mit den Hindus, bei denen die Nicht-Schmecker ziemlich zahlreich sind, ist die Zahl der Nicht-Schmecker bei den Spiten und den Lahaulis eher niedriggeblieben. Das gilt für alle Bevölkerungen längs der Gegend jenseits des Himalayas, wo ähnliche Völkermischungen vorgekommen sind. Es ist möglich, dass ausser dem hauptsächlichsten, mongolischen Element auch eine proto-australische Gruppe, die in der gleichen Gegend ansässig ist, für das seltene Vorkommen der Nicht-Schmecker verantwortlich gemacht werden kann.