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Theoretical and observed Frequencies of Fingerprint Pattern Formulae

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Antecedents

Several papers studying the inheritance of the four patterns whorl, arch, ulnar and radial loops, in their incidence in both hands and fingers are found in the literature on dermatoglyphics.

In that respect, recent papers by Becker (1954; 1960) about the incidence in parents-offspring of whorls and arches in each finger of both hand are an interesting example of that line of investigation.

Our Laboratory (Kolski and Scazzocchio, 1961) has published a paper computing the frequency of the four patterns in each finger in the population of Montevideo as the basis for similar studies.

But as a preliminary step we decided to find out if the inheritance of the dermatoglyphic patterns is independent for each finger or if certain patterns appear to be more or less linked. Much information is to be found in the literature about mirror-imaging and symmetry (Kirchmair, 1935; Dankmeijer & Renes, 1938), but we have not been able to find any study concerning the peculiar predominance of some dermatoglyphic formulae and its explanation by factors other than random.

Material and methods

We have studied the frequency of the more common dermatoglyphic formulae in the population of Montevideo on the data registered in the specialized office of the Police Department, in a total of 1,170,000 individuals. We picked up the ten most frequent formulae among the thirty that fill up the larger files.

The dermatoglyphic formulae are indicated according to the Vucetich system (Valdez, 1924), but substituting for the numbers, the first letter of the words whorl, arch, radial and ulnar loop. The formula is expressed by a fraction in which the numerator represents the right hand and the denominator the left one. From left to right the pattern of each finger is set down starting with that of the thumb.

We calculated the theoretical frequency of these formulae according to the incidence for each pattern per finger in our population.

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Results and discussion

The frequency and percentages of the ten most common formulae in our population are given in table 1, together with the probable incidence of the same formulae calculated on the basis of the frequency of the different patterns in each finger.

If the incidence of the dermatoglyphic formulae were completely at random, the frequencies observed in our sample should fit the calculated ones. If there were no agreement between these values, we should be demonstrating that the patterns are inherited in particular forms of association, and this fact would show the need to focus the genetic studies to an association of figures or dermatoglyphic formulae, instead of studying each finger independently.

Table 1

Formulae	Observed frequency	Observed percentage	Calculated frequency	Calculated percentage
UUUUU / UUUUU	63,900	5.462%	2,984	0.254%
VVVVV / VVVVV	36,000	3.077%	6	0.0005%
VVVVU / VVVVU	28,800	2.462%	150	0.012%
URUUU / URUUU	24,100	2.060%	550	0.047%
UUUUU / UAUUU	20,600	1.761%	1,030	0.088%
UUUUU / UUUUU	20,000	1.709%	1,369	0.117%
URUUU / UUUUU	19,400	1.658%	1,109	0.094%
UUUVU / UUUUU	17,200	1.470%	3,160	0.271%
VVUUU / VVUUU	15,000	1.282%	2,150	0.185%
VUUUU / VUUUU	14,400	1.231%	2,050	0.175%

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The simple differences between the observed values and the calculated ones, show the sharp disconnection. The computation by means of the X^2 corroborates largely that fact, since the exaggerated probable values discard in all the cases, beyond any doubts, random differences.

It is not possible then to expect combinations depending upon the frequency of the dermatoglyphic patterns. We feel that we may conclude that certain combinations, we do not know whether complete formulae or partial combinations of one or more patterns in two or more fingers, are influenced by heredity in a certain measure, and by the environment. Then, there seems not to be a genetic mechanism for each finger. We come to the conclusion that in the future the genetic study of frequent associations of pattern or patterns in two or more fingers and perhaps complete formulae, will be interesting. In this sense we can observe in the most frequent formulae a complete predominance of bilateral symmetry, although we find exceptions. This fact previously observed by Dankmeijer and Renes (1938) supports our hypothesis.

Summary

A study was made on the frequency of some dermatoglyphic formulae in a sample of individuals of the population of Montevideo.

The theoretically expected frequency of the ten most common formulae was also calculated on the basis of the incidence of each pattern per finger in the same population.

The comparisons made between observed frequencies and calculated ones show such large differences that they cannot be attributed to chance.

Consequently we conclude that the genetical studies of dermatoglyphic patterns should be made for associations of patterns in two or more fingers or complete formulae rather than for individual fingers.

Bibliography

1. Becker E., 1954: Zur Vererbung der Wirbelmuster der Papillarleisten der menschlichen Fingerbeeren. Z. menschl. Vererb.- u. Konstitutionslehre, 32: 106-115.
2. Becker E., 1960: Zur Vererbung der Bogenmuster der Fingerbeeren. Anthrop. Anz., 23: 294-297.
3. Dankmeijer J. & Renes R. C., 1938: General rules in the symmetrical ocurrence of papillary patterns. Am. J. Phys. Anthropol., 24: 67-79.
4. Kirchmair H., 1935: Ueber relative und absolute Symmetrie der Papillarmuster bei gesunden und kranken Populationen. Ztschr. f. Morphol. u. Anthropol., 33: 464-473.
5. Kolski R. & C. Scazzocchio, 1961: Estudio de frecuencia de caracteres dermopapilares en nuestra población. Revista Facultad Humanidades y Ciencias, 19: 213-224.
6. Valdez P. L.: Nociones sobre el sistema de identificación dactiloscópica de Vucetich. Ed. C. Garcia, Montevideo, 1924.

RIASSUNTO

È stata esaminata la frequenza delle formule dermatoglifiche in un campione di abitanti di Montevideo.

La frequenza teoricamente attesa delle formule più comuni è stata anche calcolata, sulla base dell'incidenza di ogni disegno, per dito, nella stessa popolazione.

I raffronti fra frequenze osservate ed attese mostrano differenze tali da non poter essere attribuite al caso.

Si conclude, quindi, che gli studi genetici dei dermatoglifi dovrebbero essere compiuti per associazioni di disegni in due o più dita, o in formule complete, piuttosto che in singole dita.

RÉSUMÉ

Nous avons étudié la fréquence de quelques formules dermopapillaires dans un échantillon d'individus de la population de Montévideo.

Nous avons aussi calculé la fréquence théorique des dix formules les plus fréquentes, en nous basant sur la fréquence de chaque dessin par doigt dans la même population.

Les comparaisons faites entre valeurs observées et calculées montrent des différences tellement grandes, qu'elles ne peuvent pas être attribuées au hasard.

Nous arrivons à la conclusion que les études génétiques des dessins dermopapillaires, doivent se faire pour des associations de dessins dans deux ou plusieurs doigts, ou dans des formules complètes, plutôt que par doigts individuels.

ZUSAMMENFASSUNG

Bei einer Einwohnerstichprobe der Stadt Montevideo wurde die Häufigkeit der Fingerabdrucksformeln untersucht.

Die theoretisch zu erwartende Häufigkeit der zehn üblichsten Formeln wurde auch auf Grund des Vorkommens jeder Fingerzeichnung pro Finger bei der gleichen Bevölkerung berechnet.

Bei einem Vergleich zwischen erwarteten und beobachteten Häufigkeiten zeigten sich Unterschiede, die zu gross waren, um nur als zufällig zu gelten.

Daraus wäre zu schliessen, dass es angebracht wäre, die genetischen Fingerabdrucksuntersuchungen. eher auf Grund von Fingerzeichnungsassoziierungen in zwei oder mehr Fingern oder gar in vollständigen Formeln, als bei einzelnen Fingern durchzuführen.