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# DERMATOGLYPHIC INDICATORS OF ILLNESS RISK FOR ENDOGAMOUS POPULATIONS

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**Abstract.** The results of a study of digital-palmar Dermatoglyphics from a pathological perspective on a sample of 600 subjects (300 men and 300 women), coming from three endogamous Moldavian villages, with a predominantly catholic population, have been assessed. More than 75% of the persons under investigation were bearers of dermatoglyphic anomalies with serious medical implications. Their frequency in the studied populations draws strikingly close to the values that we have found for some subjects with different congenital and hereditary illnesses in Moldavia. They are present in a high percentage in both men and women and they are often disposed not only on one hand but on both. These digital-palmar anomalies are, in fact, the graphic expression of a rich clinical picture that already exists in the population and that can amplify and diversify within the next generations. In time, this could lead to the degradation of the population's health condition.
**Key words: dermatoglyphics, endogamy, dermatoglyphic anomalies**

**Rezumat**. Lucrarea cuprinde un studiu al dermatoglifelor digito-palmare din perspectivă patologică pe un lot de 600 subiecţi (300 bărbaţi şi 300 femei), provenind din trei sate endogame cu populaţie de confesiune predominant catolică din Moldova. Se constată că, peste 75% dintre persoanele investigate sunt purtătoare de anomalii dermatoglifice cu adânci implicaţii medicale, a căror frecvenţă în populaţiile studiate se apropie frapant de valorile semnalate de noi pentru unele loturi de subiecţi cu diverse afecţiuni congenitale şi ereditare din Moldova. Prezente cu ponderi ridicate atât la bărbaţi cât mai ales la femei şi dispuse în foarte multe cazuri nu numai pe o singură mână a purtătorilor ci pe ambele, anomaliile digito-palmare semnalate, sunt de fapt expresia grafică a unui bogat tablou clinic deja existent în populaţie care se poate amplifica şi diversifica la generaţiile viitoare, ceea ce ar putea conduce la o degradare în timp a stării de sănătate a populaţiilor.
**Cuvinte cheie: dermatoglife, endogamie, anomalii dermatoglifice**

## INTRODUCTION

It is well known that a community's endogamy entails an increase in the consanguinity risk that facilitates the spread, of some pathological genes whose malformative effects also extend to the papillary ridges of the epidermis, as early as the first 3-5 months of intra-uterine life.

Consequently, the dermatoglyphics of some members of demographically closed communities will feature important anomalies or distortions with deep medical implications. They are nothing else but malformative stigmata or signals of possible genetic or teratologic diseases. In the former case, these diseases could become manifest in both bearers and descendants, sometimes with a leap over generations, because the cause factors are genetic in nature. In the

latter case they concern exclusively the bearers of malformative stigmata, given their teratogeneous cause. The dermatoglyphic anomalies in a sample either genetic or teratologic, are expressed by deviations of dermatoglyphic features frequency from the normal values of open communities but, they come close to ones that have been noticed for different severe genetic diseases (2,4,5,9,10,12-16).

The paper presents the digital-palmar dermatoglyphics from a pathological perspective, in three endogamous communities from Moldavia whose population is predominantly Catholic. We should underline from the begining that the low demographic opening level of the three villages under study, illustrated by an endogamy index that has oscillated around 80% over the last 10 years, is not due to their geographical isolation. It originates in their faithfully preserving of the traditional marriage model (between community individuals), as well as in the relatively frequent practice among catholic believers to marry persons that are more or less related.

## MATERIAL AND METHODS

600 subjects (300 men and 300 women) from the endogamous villages Fărăoani (Bacău district), Săbăoani and Gherăesti (Neamţ district) have been investigated. Each collectivity has been represented by 200 persons (100 males and 100 females), from which 1200 digital and palmar prints were gathered between 1998 and 2000. An interview of each subject on family's health condition, including its ancestry, as well as co-lateral and descendent relatives, have been taken.

The control group consisted of 300 subjects (150 males and 150 females)

For all the relevant dermatoglyphic pathology indicators, sexual and bilateral differences have been followed. The results have been compared with normal values (7,17), as well as those found for some groups with ocular diseases (OD), cardio-vascular diseases (CVD), mentally handicapped people (MH), deaf-mutes (DM), malformed children's parents (MCP) or of children suffering from the Down syndrome, all of them coming from Moldavia.

The methods that have been used are the ones practiced in pathological dermoglyphic studies (1-3,5,17).

## RESULTS AND DISCUSSION

The analysis of the dermatoglyphic records has revealed that 74.0% of the persons investigated in Fărăoani, 75.0% in Săbăoani and 78.5 % in Gherăieşti had 2 to 7 dermatoglyphic anomalies of serious clinical implications in their digital-palmar dermatoglyphic picture. At the level of the population, it is suggestively expressed by 14 anomalies (3 of which are digital and 11 palmar) of multiple medical implications highlighted in all three communities. Their frequencies, comparatively to that of the population in Moldavia (7,8) and also to that which we have noticed for some groups with various congenital and hereditary diseases, coming from Moldavia as well (9,10,12,14-16) is indicated in Table 1.

**Table 1. The frequencies of digital and palmar dermatoglyphic anomalies**

| Digital and palmar anomalies (%) | | Sex | Fărăoani | Săbăoani | Gherăești | Control group | MH | DM | CVD | OD | MCP | DCP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** (total arches on | | M | 10.1 | 12.0 | 8.8 | 4.5 | 7.2 | 6.5 | 7.0 | 7.3 | 6.5 | 20.6 |
| the ten fingers) | | F | 12.6 | 13.0 | 14.5 | 7.2 | 7.1 | 9.0 | 12.7 | 12.3 | 13.3 | 7.3 |
| **L** (total loops on | | M | 58.2 | 58.4 | 55.7 | 67.0 | 56.9 | 53.1 | 56.2 | 58.8 | 53.6 | 52.5 |
| the ten fingers | | F | 59.6 | 61.9 | 58.5 | 75.2 | 61.1 | 60.1 | 58.4 | 53.9 | 54.7 | 62.9 |
| Monomorphism | Left | M | 28.0 | 26.0 | 18.0 | 13.0 | 29.2 | 25.8 | 30.0 | 22.0 | 18.0 | 25.0 |
| | | F | 24.0 | 24.0 | 13.0 | 12.1 | 27.5 | 19.7 | 34.5 | 21.0 | 29.0 | 32.4 |
| | Right | M | 28.0 | 11.0 | 16.0 | 12.3 | 23.6 | 24.7 | 22.5 | 24.0 | 14.0 | 18.7 |
| | | F | 16.0 | 18.0 | 18.0 | 11.5 | 27.5 | 21.1 | 23.6 | 23.0 | 24.0 | 27.0 |
| | Indivi - | M | 15.0 | 4.0 | 5.0 | 3.1 | 9.7 | 10.1 | 10.0 | 14.0 | 4.0 | 6.2 |
| | dual | F | 6.0 | 8.0 | 6.0 | 3.2 | 16.0 | 11.8 | 12.7 | 9.0 | 12.0 | 13.5 |
| $A^R$ in Hypothenar | | M | 5.0 | 3.0 | 2.0 | 1.5 | 4.2 | 4.6 | 16.2 | 3.5 | 11.0 | 12.5 |
| | | F | 8.5 | 7.5 | 5.0 | 2.2 | 3.5 | 7.6 | 8.2 | 3.0 | 11.0 | 5.4 |
| $L^U$ in Hypothenar | | M | 9.5 | 12.5 | 11.5 | 5.9 | 9.3 | 9.5 | 17.5 | 14.6 | 11.0 | 12.5 |
| | | F | 6.5 | 9.5 | 12.0 | 3.5 | 2.5 | 8.0 | 10.1 | 11.5 | 11.0 | 10.8 |
| **t** axial | | M | 58.0 | 66.0 | 61.0 | 75.7 | 52.9 | 56.7 | 48.7 | 58.0 | 59.5 | 62.5 |
| | | F | 46.5 | 55.0 | 57.0 | 66.8 | 51.9 | 48.7 | 41.8 | 53.0 | 51.0 | 44.5 |
| Combinations of 2, 3 | | M | 30.0 | 21.5 | 25.5 | 15.2 | 28.3 | 27.5 | 38.7 | 30.5 | 27.0 | 22.0 |
| and 4 **t (tt'; t't''$t^u$; tt't''$t^u$)** | | F | 35.0 | 23.0 | 23.5 | 18.8 | 21.3 | 29.6 | 31.8 | 30.0 | 26.0 | 29.7 |
| **T** line finalisation in | | M | 24.5 | 10.5 | 14.5 | 5.2 | 18.6 | 13.6 | 35.0 | 14.0 | 21.9 | 9.4 |
| the fields 11 and 12 instead of 13 | | F | 27.0 | 13.5 | 19.5 | 7.0 | 19.2 | 23.0 | 35.5 | 19.0 | 32.1 | 14.8 |
| Dense and very dense | | M | 18.5 | 23.0 | 27.0 | 2.1 | 20.7 | 18.2 | 31.2 | 23.5 | 25.5 | 9.4 |
| net in the Thenar/**I** | | F | 21.0 | 37.5 | 45.5 | 5.5 | 45.8 | 32.7 | 42.7 | 58.5 | 43.5 | 19.0 |
| The **a-b** distance much | | M | 69.0 | 43.0 | 40.0 | 5.7 | 82.9 | 60.2 | 56.2 | 53.5 | 27.3 | 37.5 |
| under 21 mm in females and 24 mm in males | | F | 42.0 | 25.0 | 23.5 | 6.1 | 49.2 | 30.0 | 32.7 | 25.0 | 15.0 | 16.2 |
| The **a-b** distance much | | M | 20.0 | 29.5 | 26.0 | 3.5 | 3.6 | 9.6 | 7.5 | 7.5 | 52.0 | 15.6 |
| more 21 mm in females and 24 mm in males | | F | 19.0 | 37.5 | 30.6 | 4.2 | 14.2 | 20.8 | 32.0 | 16.0 | 67.0 | 35.1 |
| Partial supression | | M | 32.0 | 36.0 | 32.5 | 15.9 | 21.5 | 20.0 | 38.7 | 33.5 | 28.0 | 34.4 |
| of **C** line (**Cx**) | | F | 29.0 | 21.0 | 27.0 | 11.6 | 21.0 | 19.1 | 27.7 | 21.0 | 25.5 | 31.1 |
| Total supression | | M | 8.5 | 5.5 | 6.0 | 2.2 | 9.1 | 8.0 | 8.8 | 10.5 | 7.0 | 3.1 |
| of **C** line (**Co**) | | F | 7.0 | 7.0 | 5.5 | 2.5 | 7.2 | 9.2 | 8.2 | 12.5 | 10.5 | 10.8 |
| Transversal palmar | | M | 1.0 | 9.0 | 7.5 | 2.1 | 8.0 | 7.9 | 2.5 | 4.5 | 12.0 | 6.6 |
| Sulcus | | F | 2.0 | 4.5 | 4.0 | 1.5 | 9.2 | 3.0 | 8.2 | 4.1 | 17.1 | 9.5 |

**Table 2. Statistical significance of difference between each community and control group**

| Digital and palmar anomalies (%) | | Sex | Fărăoani | | Săbăoani | | Gherăeşti | |
|---|---|---|---|---|---|---|---|---|
| | | | t | p | t | p | t | p |
| A (total arches on the ten fingers) | | M | 1.730 | NS | 2.206 | < 0.05 | 1.379 | NS |
| | | F | 1.436 | NS | 1.531 | NS | 1.875 | NS |
| L (total loops on the ten fingers) | | M | 1.416 | NS | 1.384 | NS | 1.808 | NS |
| | | F | 2.612 | 0.01 | 2.246 | < 0.05 | 2.785 | < 0.01 |
| Monomorphism | Left | M | 2.962 | < 0.01 | 2.610 | 0.01 | 1.085 | NS |
| | | F | 2.462 | < 0.05 | 2.462 | < 0.05 | 0.211 | NS |
| | Right | M | 3.127 | < 0.01 | 0.312 | NS | 0.831 | NS |
| | | F | 1.026 | NS | 1.447 | NS | 1.447 | NS |
| | Individual | M | 3.425 | < 0.003 | 0.381 | NS | 0.764 | NS |
| | | F | 1.067 | NS | 1.687 | NS | 1.067 | NS |
| $A^R$ in Hypothenar | | M | 1.616 | NS | 0.810 | NS | 0.300 | NS |
| | | F | 2.301 | < 0.05 | 2.019 | < 0.05 | 1.211 | NS |
| $L^U$ in Hypothenar | | M | 2.235 | < 0.05 | 2.966 | < 0.01 | 2.734 | < 0.01 |
| | | F | 1.098 | NS | 1.972 | 0.05 | 2.598 | < 0.05 |
| t axial | | M | 2.955 | < 0.01 | 1.670 | 0.1 | 2.481 | < 0.05 |
| | | F | 3.193 | < 0.003 | 1.884 | NS | 1.571 | NS |
| Combinations of 2,3 and 4 t (tt', tt't'', tt't''$t^u$, etc) | | M | 2.809 | < 0.01 | 1.278 | NS | 2.021 | < 0.05 |
| | | F | 2.887 | < 0.01 | 0.806 | NS | 0.899 | NS |
| $T_{11}$ and $T_{12}$ | | M | 4.457 | < 0.001 | 1.576 | NS | 2.527 | < 0.05 |
| | | F | 4.339 | < 0.001 | 1.709 | NS | 2.980 | < 0.01 |
| Dense and very dense net in the Thenar/I | | M | 4.517 | < 0.001 | 5.290 | < 0.001 | 5.923 | < 0.001 |
| | | F | 3.735 | < 0.001 | 6.410 | < 0.001 | 7.542 | < 0.001 |
| The a-b distance much under 21 mm in females and 24 mm in males | | M | 10.600 | < 0.001 | 7.141 | < 0.001 | 6.716 | < 0.001 |
| | | F | 6.893 | < 0.001 | 4.263 | < 0.001 | 4.000 | < 0.001 |
| The a-b distance much more 21 mm in females and 24 mm in males | | M | 4.241 | < 0.001 | 5.822 | < 0.001 | 5.270 | < 0.001 |
| | | F | 3.801 | < 0.001 | 6.785 | < 0.001 | 5.765 | < 0.001 |
| $C_x$ | | M | 2.994 | < 0.01 | 3.649 | 0.003 | 3.077 | < 0.003 |
| | | F | 3.467 | < 0.001 | 2.019 | < 0.05 | 3.121 | < 0.003 |
| $C_0$ | | M | 2.301 | < 0.05 | 1.387 | NS | 1.555 | NS |
| | | F | 1.718 | NS | 1.718 | NS | 1.231 | NS |
| Transversal palmar sulcus | | M | 0.667 | NS | 2.486 | < 0.05 | 2.071 | < 0.05 |
| | | F | 0.300 | NS | 1.434 | NS | 1.240 | NS |

For many digital and palmar anomalies that have been signaled, the population of both sexes in Fărăoani, Săbăoani and Gherăieşti presents percentage values higher than those from control groups (Table 2).

On the other hand, they draw near or even go beyond those that exist in various groups with genetic diseases in the same region. This accounts for the presence in all three collectivities of cardio-vascular, ocular, neuro-psychic diseases, of malformed children, including those suffering from the Down syndrome. We should also add pulmonary, digestive, renal diseases, hypo-acoustic sensitivity and alcoholism, diseases that stigmatised subjects declared themselves.

As most bearers with malformative dermatoglyphic stigmata are children and youth, there is the risk of the recurrence of many of the above mentioned diseases in the next generations.

Also, there is a risk of diversifying the clinical picture of these populations in time, due to the multiple medical implications of these anomalies (3-6).

With respect to the sexual dimorphism and the bilateral differences in the highlighted dermatoglyphic anomalies' distribution, we can notice that, although it generally preserves the classical line in the Romanian population and implicitly in that of Moldavia) (8,17), there are some tendencies to diminish these differences. Sometimes they can even be erased or inverted, which is a specific characteristic of endogamous collectivities (3) but also of many of the severe genetic or teratologic diseases (1,2,9,10,14). Thus, out of the 14 (fourteen) severe digital and palmar dermatoglyphics anomalies that exist in the studied series (Table 1), *the increased proportion of arches, the spectacular reduction of loops on the fingers, the increased occurrence of* $A^R$ *in Hipothenar, the decrease of the frequency for the bottom position of the axial triradius t, the increased occurrence of the cases with more than a triradius (**tt', tt't"**, etc) in the palm, the high frequency of the cases featuring a dense and very dense net of papillary ridges in Thenar/I and of those featuring an increased distance between the **a-b** triradii*, registered in all series, higher values in women. The total **C (Co)** line suppression had increased values for women only in Gherăeşti and Săbăoani. *However, in the case of monomorphism, be it left, right or individual (*the last one only in Fărăoani), $L^U$ *from the palm's Hipothenar, the much smaller, in comparison with the normal values, **a-b** distance, the **C(Cx)** line partial suppression and the transverse palmar sulcus*, men on the contrary, score percentage values higher than women. From this point of view we notice that the behaviour of the studied populations is quite close to that found for some groups with various genetic illnesses that we have used as terms of comparison and that are included in the same Table 1 (8-11,13,15).

The distribution of the dermatoglyphic anomalies that have been identified depending on the hand has allowed us to point out that five of the anomalies featured by the three populations: *right hand monomorphism,* $A^R$ *occurrence in **Hp**; the papillary ridges*

*disposition in a dense and very dense net in Th/I and the **a-b** distance, much increase, as compared to the normal average (21 mm for women and 24 mm for men)* are more frequent on the right hand of subjects of both sexes. The other nine, on the contrary, are more frequent on the bearers' left hand.

About the disposition of these severe anomalies in bearers we have noticed that, apart from the preferential position of some of them on the right or on the left hand, there are many of cases where these distortions coexist on both hands of the bearers. This suggests a possible amplification of the their malformative effect either on bearers or on their descendents. From this point of view, in the reference sample from Moldavia, in addition to a much reduced occurrence of some of the malformative stigmata that have been analysed, the later appear at the most by one, or by two in bearers and never disposed on both hands.

These reasons immediately require an attempt to open demographically the studied villages, by marriages with partners from distant areas that should lend new vigour to the biological and genetic potential of these population and finally improve their health condition.

## CONCLUSIONS

1. The study of the digital-palmar dermatoglyphics in three endogamous Catholic populations in Moldavia has revealed an ample pathological charge of their picture, suggestively illustrated by an increased frequency of the malformative stigmata with deep clinical significations.
2. Out of the 14 anomalies that exist in more than 75% of all subjects of both sexes, each bearer has between 2 and 7 distortions that are disposed either on only one hand, or bilaterally.
3. These distortion are the graphical expression not only of a diversified clinical picture that already exists among population, but also the possible recurrence of various disorders in the next generations, given the strong hereditary character of dermatoglyphics.

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