

**DERMATOGLYPHICS IN INSULIN – DEPENDENT DIABETES  
OR DIABETES MELLITUS TYPE 1 (T1DM)**

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**Abstract.** The **aim** of the present paper is the study of the dermatoglyphics pathology on a lot of 133 subjects diagnosed with Diabetes Mellitus type 1 (58 men and 75 women) out of which 58 are children and teen-agers aged 4 and 18 years diagnosed with Diabetes Mellitus type 1 (T1DM) at the age 2 and 17 years. The other 75 are adults and old people aged are 24 and 79 years, diagnosed with T1DM since they were between 22 and 76. T1DM can be primary insulin dependent in 51.12% of the studied cases and the secondary insulin-dependent in 48.88%. **Material and methods.** We gathered a total of 266 digito-palmar prints (166 from the masculine series and 150 from the feminine ones). **Results and discussion.** We are entitled to say that both patients with a juvenile debut in diabetes and those with a late release of the disease present –in their digital dermatoglyphic picture- important distortions or anomalies with serious medical implications, that reach percentages that bring them close to those patients suffering from serious cardio-vascular diseases (CVD) and ophtalmic diseases (OD) at the level of the whole sample, but are different from the witness lot. These distortions, which are present to both the masculine and the feminine series, in both hands of the affected people (especially on the left ones), are the graphic expression of the intervention of the diabetes genetic factor, and partially of the external triggers from the uterus level in an early stage of prenatal life. **Conclusions.** The environment factors from the prenatal life act in the post-natal period, being responsible for the release and clinical manifestation of the proper disease. The results we got, even if they are the first of this type in our country, support the idea of using dermatoglyphics (a less costly and easier to reproduce in any stage of post-natal life) as **marker**, together with metabolic, immunologic and genetic markers, in predicting a potential diabetogen risk at the population level.

**Key words: dermatoglyphics, insulin–dependent Diabetes Mellitus (T1DM), distortions or anomalies**

**Rezumat. Obiectivul** acestei lucrări este studiul patologiei dermatoglifelor pe un lot de 133 de subiecți cu diabet zaharat tipul 1 (58 bărbați și 75 femei) din care 58 sunt copii și adolescenți de vârstă cuprinsă între 4 și 18 ani și cu un debut al bolii între 2 și 17 ani iar 75 sunt adulți și bătrâni între 24 și 79 ani la care boala s-a declanșat între 22 și 76 ani. În 51,12% din cazuri, T1DM este primar insulino-dependent iar la 48,88% secundar insulino-dependent. **Material și metodă.** Au fost recoltate un număr de 266 amprente digito-palmare (116 de la seria masculină și 150 de la seria feminină). **Rezultate și discuții.** Se constată că, atât pacienții cu un debut juvenil al diabetului cât și cei cu o declanșare târzie a bolii prezintă în tabloul dermatoglific digital importante distorsiuni sau anomalii cu profunde implicații medicale care, pe ansamblul întregului eșantion, sunt similare cu cele semnalate la pacienții cu boli cardio-vasculare (BCV) și boli oculare (BO) grave, dar se distanțează sensibil de

eșantionul martor. Prezente atât la seria masculină cât și la seria feminină, pe ambele mâini ale afecțiunilor dar cu deosebire pe cele stângi, aceste distorsiuni sunt expresia grafică a intervenției factorului genetic diabetogen, și parțial, a triggerilor externi de la nivelul uterului într-o etapă timpurie a vieții prenatale. **Concluzii.** Factorii de mediu din viața prenatală acționează în perioada postnatală fiind responsabili de declanșarea și manifestarea clinică a bolii. Rezultatele obținute, chiar dacă sunt primele de acest gen în țara noastră, susțin o posibilă utilizare a dermatoglifei (test mai puțin costisitor și ușor de reprodus în oricare din etapele vieții postnatale), ca **marker** util, alături de markerii metabolici, imunologici și genetici, în predicția unui posibil risc diabetogen la nivel populațional.

**Cuvinte cheie: dermatoglife, diabet zaharat insulino-dependent, distorsiuni sau anomalii**

#### INTRODUCTION

Known from the antiquity as a *mysterious disease* given by alimentation, **Diabetes Mellitus (DM)** can be defined today, in the light of new progress in the fields of etiology, pathogenic, diagnosis and therapy as a *heterogeneous etiological syndrome*, characterized by a *profound and complex turbulence of the energetic metabolism* (1-6).

The energetic metabolism is involved through the *glucidic metabolism* (hyperglycemia and, or glucosurie), the *proteinic metabolism* (hiperuemia and hiperuria) and the *lipidic metabolism*. It is *associated to them the resistance* or incapacity of *peripheral tissues of using the insulin necessary to transform glucose into glycogen*, as a reserve of energetic substance. Therefore, we can say that DM is a disease of the whole organism, involving directly or indirectly almost all body cells, tissues and organs and whose gravity depends on the organism genetic luggage, on the degree and duration of the metabolic unbalance (2, 4). Consequently, the disease complications may be multiple. Among them an important place is diabetes cardiopathy, obliterant athero-

sclerosis of inferior members, coronarian athero-sclerosis, arterial hypertension (HTA), diabetic nephropathies and the diabetic retinopathy. Diabetes is, in general, clinically manifest at a likely level of glicemia > 200 mg/dl, in the case of provoked glycem test. The limits of glicemia between 140 and 160 mg/dl are considered as *impaired glucose tolerance* which can either develop or not into insulin-independent diabetes or Diabetes Mellitus type 2 (T2DM).

Starting from the seriousness of the disease and from its complications, literature estimates that today a number of 3.2 million people suffering from diabetes die annually all over the world: one out of 20 deaths are due to diabetes (that is considered to be the second cause of death after cancer); one out of 10 deaths for adult people between 35-64 years of age is due to diabetes and three quarters of the deceased persons because of diabetes belong to the segment of age of under 35 years (5-10). According to World Health Organization (WHO) and International Federation for Diabetes (IFD), diabetes is considered a planetary epidemic. Its frequency is expected to grow in the following 25-

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30 years in the developed countries by 1.5 times, affecting the older groups of age (64 and over), while in developing countries it is expected to double, but it will affect especially the groups of 35-64 years of age (7, 8, 10). Given the complex etiology of diabetes, this can have a multitude of forms, grouped in the latest WHO classifications, from 1985 and 1998 (not yet definitive) in two classes largely spread and well known for a long time respectively: ***the insulin-dependent diabetes or Diabetes Mellitus type 1 (T1DM)*** named by the great french doctor Lancereaux since 1877, the ***pancreatic or weak diabetes*** (at which the pancreatic cells  $\beta$  issuing insulin are destroyed in a percentage of 90% - present in our country in 10-15% of the total number of diabetes people) and the non insulin-dependent diabetes or insulin-independent one - ***Diabetes Mellitus type 2 (T2 DM)*** named by the same Lancereaux and the ***fat diabetes or constitutional*** one, present in 85-90% out of the total number of suffering of diabetes people in Romania (4). There are also other forms of disease as ***gestational diabetes*** that appears to some pregnant women and that can develop or not in a T2DM; ***malnutrition diabetes***, that appears in some tropical countries to persons under 30 years and may vary in form, and some forms of ***special diabetes*** that manifest as various forms of endocrine troubles or serious genetic congenital maladies (1,3, 6, 8, 10).

**The diabetes type 1 (T1DM)**, which makes the object of our study, is significant for the groups of age of up to 30-40, but especially for 1-18 ages,

although in our country, the peak of the annual rate of incidence, moved to the group of 65-69 years of age (4). The T1DM average annual rate of incidence is 3.5/100 000 inhabitants, that situates our country among those with a reduced incidence of the disease. The incidence rate of the disease is 5.0/100 000 inhabitants between 1 and 14 years of age, that situates Romania on the last but one place in Europe, after the North of Greece.

**T1DM**, that begins noisily from the clinical point of view, by obvious symptoms like: asthenia, tiredness, polyurie, polyphagy, polydipsy, weight loss, may be in its turn ***primary insulin-dependent*** (that necessitates insulin-therapy from the very beginning and represents approximately 7% of the total number of patients) and ***secondary insulin-dependent***.

**Causal factors implied in releasing T1DM**, are ***autoimmune or idiopathic*** nature (unknown causes) (1, 2, 4, 11, 12). The ***autoimmune process***, that supposes ***the destruction of the pancreatic cells  $\beta$  from Langerhans islands***, usually appears to those patients with a genetic diabetes predisposition, but the ***release as such of the process is produced by factors from the outside (triggers)***, hypothesis supported actually by the reduced concord of the disease to monozygotic twins (30-50%) or by the great interval, of approximately 30 years, at which the disease may be released at one of the unaffected twins. The mechanism by which the multiple environment factors may interfere in

the autoimmune process of  $\beta$  cells destruction is not yet well known (4, 8, 10, 12). The first proofs of the  $\beta$  cellular dysfunctions in T1DM appear when these cells mass is reduced at its half and the disease release as such is signaled when 90% of the insular tissue is destroyed.

Studies performed on twins, on families with 2-3 children suffering from diabetes as well as molecular genetics ones have shown that **from the genetic point of view, T1DM is a multifactorial disease** (1, 4, 11-15).

The genes that control the susceptibility, genesis and release of the disease are situated on several chromosomes (the pairs 2, 3, 6, 7, 11, 15, 16). The chromosome 6 is mainly involved on whose short arm (towards its distal part) 3 genes HLA were discovered, one that controls susceptibility for T1DM, one with diabetogenic role and one that assures the organism resistance to the disease. Besides these, it is supposed that a newly discovered gene on the long arm of the same chromosome 6 would have the same importance, with an exclusively diabetogenic role (12).

The big number of genes with diabetogenic predisposition, the population hetero-geneity, the complex structure of the human genome, the interaction between genes and environment factors created great difficulties in their identification, as well as in the explanation of their way of transmission. That is why, the aspect of T1DM heredity remains open. Besides the *immunological markers* or *metabolic markers*, are used also *genetic markers* that imply the

detection of HLA genes, for the disease prediction and for its precocious discovery,

Within the above mentioned context, the present paper was performed in order to study dermatoglyphics pathology in T1DM, starting from the well-known relationship between these morphological characters and the disease, which in general can be found in their complex iconography represented by those well known dermatoglyphic abnormalities or distortions (10, 13, 14, 16-21). Through our study we are trying to underline the possible contribution of the genetic component as well as of the external factors from the uterus level in the genesis and release of the disease, even from the first 3-5 months of intra-uterine life of the ones affected, when the epidermal papilar ridges are finalized until death.

#### MATERIAL AND METHODS

**133** patients with the diagnosis of **T1DM** - at the Mental Health Center Iasi, the "Sf. Maria" Clinical Pediatric Hospital Iasi and the Diabetics Center, of the "Sf. Spiridon" Universitary Hospital - have been investigated. Out of the total number of 133 patients with T1DM, **58** are children and teenagers (**33** boys and **25** girls) of ages between 4 and 18 years. The disease release in these cases occurred between the age of 2 and 17y. The rest of **75** patients are adults and old people (**25** men and **50** women) of ages between 24 and 79y and in which the diabetes started between the age years 22 and 76 years (until the age of 50y in 50% cases and over the age of

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50y in 50%). In 51.12% of patients the disease appeared as primary insulin-dependent diabetes and for the rest of them (48.88%) as a form of secondary insulin-dependent.

Almost in 43% of cases in children and teen-agers (16 boys and 8 girls) it the disease had a family history. Out of the **75** adults and old people, in **29** cases (about 40%) the diabetes type 1 was inherited. Consequently, out of the total number of affected people, T1DM was hereditary in 39.85% that has confirmed the degree of T1DM inheritance percentage of about 30-50% affected children and teen-agers. T1DM was accompanied by complications like: chronicle hepatitis and other hepatic affections, renal, ocular and cardiac affections in about 31%. The rest of children didn't have any other affection. The adults and old people, as we expected, the specter of the clinical picture that accompanies diabetes is much larger, most of the affections (in many cases in an advanced stage) were existing even before the application of the insulin therapy. Thus, in almost 60% from adults and old people affected, the T1DM was associated with pancreatitis, hepatic affections, urinary affections, circulation problems at the inferior members (obliterant arteriopathy, arthritis etc.), diabetic neuropathy, diabetic cardiomyopathy, HTA, diabetic retinopathy, etc. The rest of **30** patients did not present any other manifest affection apart from T1DM. For all digital dermatoglyphic indicators that we have evidenced, we followed the sexual dimorphism,

bimanual differences, as well as their disposition depending on the finger, important elements in measuring the patient degree of affection from dermatoglyphic perspective at the lot level. The processing and interpretation of results was not undertaken differently at children and adults or considering other already mentioned associated factors (heredity, affections accompanying the disease), but on the whole sample of affected people.

The results were reported on one hand to those obtained by us on a witness lot from Moldova area and on the other hand to those obtained for the patients with cardio-vascular diseases (CVD) and severe ocular diseases (OD), affections that are more often met in the specter of the affected people clinical picture (18, 19, 22).

The methods of work we undertook were those currently applied in the studies of pathological dermatoglyphy (13, 16, 17, 22, 23, 24).

## RESULTS AND DISCUSSIONS

The individual analysis of **digital prints** for patients with T1DM, showed important anomalies or distortions with deep clinical implications, both in the case of those for which the release of the disease occurred in childhood or adolescence and with a late release of the disease (17, 18, 20, 21, 22, 24).

The distortions, that were evidenced in the entire lot that actually represent both deviations of some dermatoglyphic characteristics from the existing values of the apparently normal population where the affected people come from, and deviations from the classical line

of sexual dimorphism, of bimanual differences, disposition depending on fingers, are represented by the followings:

➤ ***A sensible reduction of the frequency for the majority model-loops (L)*** - up to 60.22%, the witness lot were the frequency was 71.0% his characteristic was reported before to other European groups of diabetics (14,16). Like in the other two maladies that served us as basis for comparison, as well as in the reference lot, L are especially met to the feminine series in approximate equal proportions for the two hands (58.95% on the left hand and 60.60% on the right one) a different situation from the normal people, where they prevail on the left one. The L distribution on the five fingers showed an increased frequency on the fingers V and III, similar to those existing in CDV and OD and to the reference series. Some important differences are signaled only for the three last positions from the classical scheme: IV>II>I instead of I>IV>II (table 1). The diminishing of L frequency led to ***another important distortion***, respectively its ***grows for W and A***, the first being more frequent to the masculine series and on the right hands and the second to the feminine series, on the left hands as it was evidenced in the witness lot as well as in patients with CVD and OD. As far as the W and A disposal on the fingers in decreasing order of their frequency, similar to L, it differs from the normal people only for the last three positions

from the classical scheme, by which the diabetics approach the patients with CVD and severe OD (table 1).

➤ ***A digital dermatoglyphic anomaly with severe medical implications*** is represented by ***the presence on fingers of some structurally complicated models of the twin loops type (TL), of lateral pockets (LP), of central pockets (CP) or of 2 models combinations on the same finger (A+L; L+W etc)***. (14, 16, 17, 18, 19, 20, 21, 22, 24). They were evidenced in about 3.23% of cases (3.45% in men and 3.0% in women), being more frequent on the left hand of the affected people (4.66% compared to only 1.80% on the right hand) and on the fingers I, III and II or I, II and III, followed by IV and V. We mention that the same situation is present in normal people as were as in severe CVD and OD.

The ***racket types of loops*** are equally important from the pathological significance point of view (14, 16, 17, 18, 21, 24). They are extremely rare models that are absent from the witness lot. The patients with T1DM reach an average frequency of 8.04% (8.26% in men and 7.76% in women), that are above those in the case of severe CVD and OD. As in the latter cases they appear more frequently on the left hand of the affected people (8.27% compared to 7.82% on the right one), prevailing on the fingers V and IV, followed by II>III>I (table 1).

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**Table 1. The frequency of digital distortions (anomalies)**

Digital distortions	Lots of affected people and the witness	%	Sexual differences	Bilateral differences	Disposition on fingers
A on total fingers	T1DM ↘	7.67	F > M	L ≥ R	II>III>I>V>IV
	CVD ( <i>Ana Țarcă, 2000</i> )	10.31	F > M	R ≥ L	II>III>I>V>IV
	OD ( <i>Ana Țarcă, 2001</i> )	9.80	F > M	L ≥ R	II>III>IV>I>V
	Witness lot ( <i>Ana Țarcă, 1995</i> )	3.70	F > M	L > R	II>III>V>IV>I
L on total fingers	T1DM ↘	60.22	F > M	R ≈ L	V>III>IV>II≥I
	CVD	57.47	F > M	L > R	V>III>I>II>IV
	OD	56.40	M > F	L ≥ R	V>III>I>IV>II
	Witness lot	71.00	F > M	L > R	V>III>I>IV>II
W on total fingers	T1DM ↘	32.10	M > F	R ≥ L	I=IV>II>III>V
	CVD	32.21	M > F	R > L	IV>I>II>III>V
	OD	33.80	M ≥ F	R ≥ L	IV>I>II>III>V
	Witness lot	27.50	M > F	R > L	I>IV>V>III>II
Structurally complicated models TL, LP etc.	T1DM	3.23	M ≥ F	L > R	I>III≥II>IV>V
	CVD	2.31	F ≥ M	L > R	I>II>III>IV≥V
	OD	2.25	F ≥ M	L > R	I>II>IV>III>V
	Witness lot	0.20	M > F	L > R	I>II>III>IV>V
Raketoid loops	T1DM	8.04	F > M	L > R	V>IV>II>III>I
	CVD	7.05	M > F	L > R	IV>V>III>II>I
	OD	5.05	F > M	L > R	IV>V>III>II>I
	Witness lot	-	-	-	-
Radiality	T1DM	9.77	F ≥ M	L ≥ R	II>III>I>IV>V
	CVD	11.05	M > F	L > R	II>IV>I=III>V
	OD	9.40	M ≥ F	L ≥ R	II>IV≥I>III>V
	Witness lot	2.85	M > F	R > L	II>III>V>I>IV

T1DM = Diabetes Mellitus type 1 (N = 133; M = 58, F = 75)

CVD = Cardio-vascular diseases (N = 95; M = 40, F = 55)

OD = Ocular diseases (N = 200; M = 100, F = 100)

Witness lot (N = 200; M = 100, F = 100)

➤ A digital distortion whose medical significance could be compared to those produced by the reverse in the normal position of internal organs is the **unexpected growth (compared to the normal) of frequency in radial orientation of digital models taken in**

**their totality (A, L and W)**, given the fact in the case of normal people these present in general an ulnar or cubital direction (13, 14, 16, 17, 24). In patients with T1DM the radial orientation reaches an average frequency of 9.77% (compared to only 2.85% in the

witness lot), being more often met to the feminine series and on the left hands of the affected people, namely reversed if compared to the reference series. From the point of view of the distribution succession on fingers, our series is comparable to normal only by the first two positions from the classical scheme (fingers II and III), the following two places being occupied by fingers I and IV, for which the radial orientation suggests an amplification of their clinical significances for the bearers (table 1).

➤ A last evidenced digital anomaly whose severe pathological significances consist also in its presence in numerous genetic maladies, is represented by the **increase (over the normality levels) of hand or bilateral monomorphism frequency** (the same type of model - A, L or W - on all five fingers of a hand or the other), **but especially of the individual one** (the same type of model on all the 10 fingers of the individual) (16, 17, 18, 19, 20, 21, 22, 24).

As table 2 shows, the percentage values of monomorphism to diabetics compared to those of the witness lot and of the patients with CVD and OD have superior average values in the feminine series compared to the masculine series, for the left hand monomorphism and for the one of the right hand, as well as for the individual one. This particularity is also found in patients with CVD, OD and in the reference series, which could suggest that the responsible gene for this characteristic might be situated on the chromosome X. Besides, the increased frequency of individual monomorphism both sexes as well as the studied lot, partially confirms the high level of affection concerning the patients, given the fact that the clinical implications of this type of monomorphism are much more severe and multiple (14, 16, 17, 20, 21, 22, 24).

**Table 2. The frequency of hand and individual monomorphism by sex**

Affections	Sex	Monomorphism		
		left hand %	right hand %	Individual %
T1DM	Males	24.13	15.51	10.34
	Females	28.00	26.66	17.33
	M + F	26.31	21.80	14.28
CVD	Males	30.00	22.50	10.00
	Females	34.54	23.64	12.73
	M + F	32.63	23.16	11.58
OD	Males	18.00	14.00	3.00
	Females	29.00	24.00	12.00
	M + F	23.50	19.00	7.50
Witness lot	Males	15.00	9.00	4.00
	Females	13.00	8.00	2.50
	M + F	14.00	8.50	3.25



CONCLUSIONS

This research of digital dermatoglyphics in patients with T1DM, from Moldova (North East of Romania), region helped us to underline the close association between these morphological characteristics with a well contoured heredity and the insulin-dependent diabetes, suggestively illustrated by the presence (in the digital picture of the affected persons) of some important distortions or anomalies with remarkable clinical implications. Their presence in diabetic patients is similar to patients with severe CVD or OD.

These anomalies are represented by the followings:

- **a substantial reduction of the frequency - for loops (L), - with a sensible increase of the frequency for whorls (W) and arches (A).**
- **an attenuation of bimanual differences for all the three digital models**, going up to their total wiping.
- **a reverse order of repartition of the three models on fingers**, but only for the last three positions from the classical scheme of distribution in decreasing order of their frequency.
- **the presence on fingers**-especially on I, II and III - **of some structurally complicated models** (with more than two triradiuses) of the type TL,LP,CP etc, or the combination of two models on the same finger (A + L, A+W, L+ W).
- **an important increase of frequency for the radial orientation of digital models (A,L,W)**. This frequency is mostly met on fingers II and III, but also often met on fingers I and

IV, positions that suggest an amplification of pathological significances.

- **the unexpected growth of frequency for left and right hand monomorphism, but especially for the individual one**, with definitely superior values for the feminine series, as an expression of a more intense affection of this series compared to the masculine one.

The most of the evidenced digital distortions which are present both in the masculine series and in the feminine ones reach higher percentages on the **left hands** of the affected people (as they also appear in other severe genetic maladies), considered to be bearers of most of the dermatoglyphic indicators with a pathological significance.

These findings of digital dermatoglyphic distortions could help in markers design for the detection of the diabetogen risk in population (screening method), at a very cheap cost. The appearance of these markers, before the clinical manifestation of the disease, makes possible their use in prevention programs of diabetes mellitus insulin-dependent.

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