Dermatoglyphics in diabetes: a prospective diagnostic aid and early preventive tool

Introduction
Dermatoglyphics are ridged patterns on the palmar and plantar surfaces of humans (fingerprints, palm prints and foot prints), which develop approximately between the 13th and 18th weeks of gestation. They manifest complex genetic backgrounds that are currently not fully explained, but polygenic multifactorial inheritance is the most agreed upon inheritance mechanism. Among the numerous quantitative and qualitative dermatoglyphic traits, commonly assessed variables include: fingerprint patterns (whorl, loop, or arch), finger ridge counts (total [TFRC] and absolute [AFRC]), palmar angles (‘atd’, ‘adt’, and ‘dat’), palmar a–b ridge counts, and palmar axial triradius positions (t, t’, t’’). (See Figures 1 and 2.)

This article refers to recent widespread research which has drawn attention to dermatoglyphic differences between individuals or groups affected by diabetes and those without diabetes; such research highlights the possibility of employing dermatoglyphic differences as diagnostic aids and preventive tools to alert those with a genetic predisposition. The strengths and weaknesses of these studies are underlined, thus serving as a guide for future research in this area.

Dermatoglyphics: medical aspects
Clinical research on dermatoglyphics highlights the possibility of employing these as preventive counselling techniques and/or diagnostic aids for several disorders, with such studies generally following two types of analysis techniques.

The first involves an indirect method which underlines the importance of realizing that dermatoglyphic deviations manifested in affected subjects might reflect environmental and/or genetic stresses (developmental noise) during prenatal development; these have been shown to be attributable to the generation of random deviations from the expected bilateral symmetry of organisms quantifiable as the degree to which fluctuating asymmetry is present within phenotypic traits. Stressors during prenatal development have been shown to cause fluctuating asymmetry in varying degrees, with such factors as extreme temperatures, environmental pollution, psychological stress, population density and inbreeding being significantly associated with its manifestation.

Fluctuating asymmetry and diabetes
It has recently been shown that fetuses whose mothers have faced hunger during their prenatal development have a higher risk of developing diabetes. Similarly, a group of researchers measured the glucose tolerances of adolescents whose mothers had been exposed to the
catastrophic 1998 Quebec ice storm; it was found that, among the adolescents, the severity of maternal stress experienced was directly proportional to increased insulin secretions and central obesity, both of which are recognised risk factors for the development of diabetes.\textsuperscript{9} Increases in insulin levels are known to be an early feature of insulin resistance that gradually lead to diabetes.\textsuperscript{10,11} Such findings point to the importance of measuring prenatal developmental homeostasis to assess a possible predisposition to diabetes, with dermatoglyphic variables being able to play a pivotal role in quantifying the degree to which such stressors have affected the fetuses.\textsuperscript{4,9,12,13}

### Dermatoglyphic case control studies

For most of the parameters evaluated by such studies, distinctions among the parameters of significance vary from one report to another; more strikingly, some findings contradict those reported by their counterparts, even those done from the same subcontinent. With this in mind, the most commonly shared findings among studies that at this stage can be cited to have positive predictive values – being indicative of a predisposition to diabetes – include: a decrease in ulnar loops on the digits entailing a simultaneous increase in the whorls,\textsuperscript{14,15} increased mean palmar and digital ridge counts,\textsuperscript{16,17} and distally deviated axial triradii\textsuperscript{20,21} for type 2 diabetes; and an overall increase in whorls with simultaneously decreased loops,\textsuperscript{22} more pronounced on the left thumbs of the diabetic group\textsuperscript{25} for type 1 diabetes.

### Drawbacks of the studies so far

There are several weaknesses in the studies done thus far, possibly explaining the numerous contradictory findings among them. The foremost drawback relates to the noticeably low sample sizes in the majority of studies. Age and sex matched standard case control studies following pre-defined calculated sample sizes are limited. Secondly, some studies have not distinguished between the types of diabetes mellitus, with a few studies having included both types of diabetes in their case group, despite the fact that their aetiologic features and underlying genetic mechanisms are very distinct. Thirdly, due consideration regarding the age of onset of diabetes has not been a focus for most studies; this might have important implications given that variants of type 2 diabetes itself exist and these differ, among other features, in their ages of onset. The fourth drawback observed in the majority of the studies is that, in their case groups, they overlook the possible occurrence of other commonly concurrent disorders such as hypertension and cardiac disorders, each of which have their own effects on dermatoglyphics.\textsuperscript{24,25} Finally, only a limited number of studies\textsuperscript{12} have emphasised the importance of prenatal developmental disturbances (measured by fluctuating asymmetry) in comparisons of cases and controls.

### Recommendations

Future investigators ought to carry out more intensive research eliciting the genetic background of the various dermatoglyphic traits. This is invaluable in generating a framework in order to understand better the underlying mechanism by which dermatoglyphic traits are related to the various disorders with which they have been associated, thereby establishing a link between these genes and ascertained resistance/susceptibility genes for the disorders. Secondly, any study which is to be conducted in the future regarding dermatoglyphic markers in diabetes should adhere to the standard case control study designs with ample and pre-defined sample sizes. Thirdly, due emphasis should also be given to the importance of differentiating between the diabetes types and subtypes, as well as the commonly occurring manifestations of concurrent disorders such as hypertension and cardiac disorders among the cases, which, per se, have an impact on dermatoglyphic manifestations.

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**References**

References are available in *Practical Diabetes* online at www.practicaldiabetes.com.
References