ORIGINAL ARTICLE

# Digital dermatoglyphics in the evaluation of the genetic basis of breast cancer in Bosnian-Herzegovinian population - quantitative analysis

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## ABSTRACT

**Aim** To determine differences in quantitative traits of digital dermatoglyphics between breast cancer women and the women in the control group (healthy women).

**Methods** This case-control study included digital dermatoglyphics of 50 patients with confirmed breast cancer diagnosis compared with 50 healthy examinees with the absence of familial history of any type of cancer. Collecting samples was performed among Bosnian-Herzegovinian population by Printake method. The comparison of the mean values between the examined groups was made by the Student's t-test and Mann-Whitney U test.

**Results** The results showed that, with regards to the pattern intensity, no statistically significant difference was detected between the two examined groups ($p>0.05$).The absence of any significant difference in the number of papillary ridges on an individual finger between the breast cancer patients and the control group was found ($p>0.05$), although the total number of papillary ridges on all ten fingers had somewhat lower values in the examined group.

**Conclusion** This research confirms the existence of genetic predisposition for breast cancer development, emphasizing the relevance of hereditary factors in the ethiopathogenesis of this disease. The quantitative traits of digital dermatoglyphics were not a reliable and predictive tool for detecting a potential risk for breast cancer in small populations.

**Key words:** breast neoplasms, fingerprints, genetic markers, risk

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## INTRODUCTION

Breast cancer is a heterogeneous disease, occurring as a result of genes damages actively involved in the cell cycle regulation (1). Breast cancer is the most common malignant tumour among women, and each year around 1.7 million new cases are reported worldwide, accounting for 25% of all types of cancers, and is the second common cancer (2). In Bosnia and Herzegovina (B&H), the number of newly-diagnosed breast cancer cases at the annual level is 1.152 (3).

The most thoroughly-investigated genes involved in hereditary, family breast cancer are BRCA1 and BRCA2 (4). In the families with high breast tumour risk, the female carriers of mutations in BRCA1 gene have 80-90% greater risk of disease development (5), whereas the mutations of BRCA2 genes were detected in 10-30% of the cases (6). Women with BRCA1/2 mutations have poor prognosis and slender chances to live than women without them. Other predisposing factors such as benign proliferative lesions in breasts, first pregnancy being delayed, early menarche, menopause at an older age, and nulliparity increase the risk of breast cancer by 1-2 times (7).

Dermatoglyphics represent a series of parallel ridges separated by grooves created by epidermis on the volar sides of fingers and toes. They are fully formed in the 21st week of intrauterine life (8), meaning that the genetic message contained in the genome gets deciphered during that period which, on the other hand, reflects on the dermatoglyphic patterns. Once formed, the dermatoglyphics remain unchanged throughout life as they are not susceptible to the surrounding influences, except when traumatic disorders occur. Even though there are no two persons with identical dermatoglyphic reports, there is a high correlation in dermatoglyphic properties within a family, as well as within certain population groups (9). There is evidence suggesting that family history of breast cancer may be associated with certain fingerprint patterns (10). Taking into account the major prevalence of breast cancer, it would be of a great help, on the basis of dermatoglyphic patterns evaluation, to determine which women are actually exposed to the risk (11), which would undoubtedly represent a non-invasive, cost-effective screening method (12).

Similar studies were already conducted in B&H, describing differences in qualitative properties of digital dermatoglyphics in breast cancer patients and healthy controls (12).

The aim of the study was to identify possible differences in the quantitative properties of digital dermatoglyphics in breast cancer patients and phenotypically healthy B&H women, in order to determine application of dermatoglyphics as a screening method in the future.

## PATIENTS AND METHODS

### Patients and study design

This case control study included 100 women and they were divided into two groups. The sample size was determined according to the similar studies in the world because B&H does not have statistic evidence about the total number of women with breast cancer. This sample was made up by convenience. All women were provided with appropriate information about aim, methods and purpose of this research. Informed consent form was signed by all participants of the study.

In the case (patients) group there were 50 randomly selected volunteer (following inclusion and exclusion criteria) women 18-85 years of age, with patohistologically confirmed breast cancer. All women had no history of any other genetically based disease or disorders. Patients in the terminal phase of the disease were not included. Selection was performed throughout Breast Cancer Associations, mostly from Federation of Bosnia and Herzegovina.

Inclusion criteria: female respondents, age over 18 years of life, informed consent signed, patohistologically confirmed diagnosis of breast cancer, citizenship of Bosnia and Herzegovina. Exclusion criteria were medically confirmed diagnosis of other type of cancers, the presence of disability linked to the fingers of both hands, the presence of disability linked to the palm of both hands, the presence of genetically based diseases or disorders.

In the control group there were 50 18-85 years of age healthy women, randomly and voluntary selected by the Department of Biology and Human Genetics, School of Medicine, University of Sarajevo, with no familiar history of any type of cancer nor any other genetically based disorder or disease. Since we had been working with volunteers who wanted to test themselves for possible risk, we did not reject anyone who wanted to participate in the study.

The questionnaire conducted during the process of collecting fingerprints of the examinees included age, marital status, family anamnesis of breast cancer, age of menarche, number of births, abortions or miscarriages, artificial insemination, consumption of contraception, alcohol and cigarettes, age of breast cancer diagnosis, the affected breast, type and grades of cancer, existence of metastases. The existence of hereditary basis for breast cancer (positive family anamnesis), the breast affected, age of menarche and the use of contraceptives were analysed.

### Methods

Fingers and palms painting was performed by using Printake inked polyester foils by methods described by Cummins and Midlo (13).The examinees were taken their fingerprints (of both hands) by means of dyeing method. The collected fingerprints were analysed with a magnifying examination lamp with glass objectives consisting of 3 diopters and field of view of 127 mm diameter.

The following quantitative properties of digital dermatoglyphics have been analysed: PII (pattern intensity index) represents the number of triradii on individual finger, TRC (total ridge count) representing total number of ridges on all ten fingers, whereby for whorl only a higher number of ridges was taken into account, and FRC (finger ridge count representing a number of papillary ridges between triradius and the centre of the drawing at the top of individual finger (Figure 1).

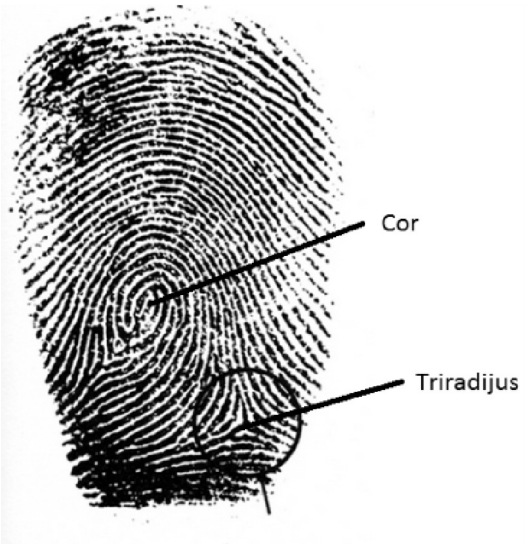


**Figure 1. Characteristic spots on the fingers: triradius – a point where ridges from three directions meet at 120° angle; cor – a point at the centre of the pattern**

### Statistical analysis

The mean values comparison between the examined groups was done by the Student's t-test for variables with normal distribution. The Mann-Whitney U test was utilized for the parameters that did not follow a normal distribution. The accepted statistical significance was at $p<0.05$.

## RESULTS

The hereditary basis of breast cancer was present in 22 (22%) patients, whilst the remaining 78 (78%) did not have cases of breast cancer diagnosis in their families. Breast cancer affected left breast more often, 31 (62%) than the right one, 18 (36%).There was only one (2%) exceptional case of cancer affecting both breasts out of the total number of patients.

Age of menarche (first menstrual cycle) was mostly in the age between 13 and 15, 31 of the patients, and 41 of the controls (62% and 82%, respectively), whereas the number of examinees who had their first period when they were 16+ was quite low, nine (18%) in patients and two (4%) in controls. The occurrence of abortion among the examinees was considerably higher in breast cancer patients, 26 (52%) than in controls, eight (16%).

The use of different contraception methods was prevalent in patients diagnosed with breast cancer, 12 (24%) comparing to the control group, two (4%) women.

The number of triradii, i.e. pattern intensity, was 11 (22%) in the patients group and 12 (24%) in the control group ($p>0.05$).

No significant difference between the patients and controls was observed with respect to the number of ridges on individual fingers (FRC). The total number of papillary ridges turned out to be lower in the examined group on their right hand, and as for the left hand, this number was quite higher in breast cancer patients (Table 1).

On the index finger of right hand (FRD2), the number of papillary ridges had identical values for both the examined and control group, whilst the values slightly differed on the remaining fingers ($p>0.05$).

By comparing the values of the total number of papillary ridges on all ten fingers, no statistically significant difference was observed between the

**Table 1. Number of epidermal ridges on individual fingers in the patient and control groups**

| Right/left individual finger | Number of finger ridges (±SD) in the group | | p |
|---|---|---|---|
| | Examined | Control | |
| FRD1 | 17.100±6.722 | 17.48±6.024 | 0.766 |
| FRD2 | 14 (6.75-19) | 14 (7.25-18) | 0.665 |
| FRD3 | 10.62±6.645 | 12.54±5.849 | 0.128 |
| FRD4 | 14.620±4.776 | 15.720±6.157 | 0.320 |
| FRD5 | 12.440±5.131 | 12.820±4.843 | 0.704 |
| FRL1 | 16.5 (13-20) | 16 (12.75-21) | 0.881 |
| FRL2 | 13.5 (6-18) | 12.5 (5.75-17) | 0.410 |
| FRL3 | 11.82±7.13 | 12.56±6.866 | 0.598 |
| FRL4 | 15 (12-17) | 16.5 (14-19) | 0.093 |
| FRL5 | 14 (11-15.25) | 14.5 (9.75-16) | 0.680 |

FRD, finger ridge on a right finger; FRL, finger ridge on a left finger; 1, 2, etc., the finger number

two examined groups ($p>0.05$) although the total number of papillary ridges had somewhat lower values in the examined group.

## DISCUSSION

Women whose mothers suffered from bilateral breast cancer before menopause carry the highest risk of developing breast cancer, i.e. they have 50% chances of being diagnosed with one (14). Plenty of authors successfully apply quantitative analysis of digital dermatoglyphics in order to predict inherited predisposition for a particular disease (15). Since dermatoglyphics are generally considered as indicators of changes in the early embryonic development, their analysis may be used in etiology studies of some other diseases suspected of having genetic predisposition (15). A difference between the group of patients suffering from various diseases and control groups found in many studies: Ramani et al. in 2011 have studied obsessive-compulsive disorder (15), Shakibaei et al. in 2011 the patients with bipolar disorder and schizophrenia (16), Miličić et al. in 2003 (17) autism in children, etc.

Previous researches of quantitative properties of dermatoglyphics in breast cancer patients showed a lower mean ridge count (18). In patients with this malignancy, statistically significant differences in the quantitative properties of digital dermatoglyphics were found in previous studies, suggesting the application of this method as reasonable in the future as "screening" in determining the risk of developing breast cancer (18).

Based on the questionnaire conducted during the process of collecting fingerprints of the examinees involved in this research, we received data that could potentially play a dominant role in the predisposition of breast cancer occurrence. The positive family anamnesis of breast cancer is one of the key risk factors for the disease onset. Women whose first-degree relatives (mother, sister or daughter) suffer from cancer have twice as much chance of being affected by breast cancer (14). A substantial number of authors claim that late age of menarche plays a protective role in breast cancer development (19). Our data is in accordance with official information and records, suggesting that women affected by breast cancer had early menarche, which is linked to faster physical development in childhood. Hassey et al point out that the risk for breast cancer gets reduced by 20% for each year the menarche has been delayed (19).

The results of research of quantitative properties of digital dermatoglyphics, i.e. pattern intensity had no statistically significant difference between the patients and controls in our study; even though, those values were slightly higher in the control group. Sukre et al. have got similar results where the triradii number was somewhat higher in the control group (but without statistical significance between pattern intensity between patients and controls (20). Contrary to the results of these studies, studies conducted by Lavanya and et al. have shown that breast cancer patients have substantially higher pattern intensity than controls (21). Chintamani et al. also established statistically significant higher values of triradii in breast cancer patients compared to healthy ones (18).

No significant differences between patients and controls were detected in this research regarding to the number of ridges on the individual fingers (FRC), and the total ridges count on all ten fingers; the number of papillary ridges was lower on the right hand in the examined group when compared to the control group, whilst the breast cancer patients had these values higher on the left hand. The results of study carried out by Lavanya and et al. showed fairly lower number of papillary ridges on both hands in patients in comparison to the controls (21). In the Chintamani et al. research, a significant difference in the number of papillary ridges on individual fingers has been noticed, where lower values were detected in the examined group comparing to the control group (18). However, Sridevi et al. reached opposite results and they have found the number of papillary

ridges on individual fingers was considerably higher in breast cancer patients in the comparison to the controls (22).

The results of our research are compatible with the results of Sukre et al. demonstrating that the total number of ridges was slightly higher in the control group (20). The results obtained by Lavanya et al. (21) and Chintamani et al. (18) indicate lower total number of ridges in the examined groups when compared to the controls. The research conducted by Raizada et al. revealed that the lower (below 50) total number of ridges on fingertips was linked to breast cancer, whereas the higher number (above 100) was prevalent in healthy examinees (23). The aforesaid indicates that the lower total number of ridges may be associated with the risk of developing breast cancer. Contrary to these conclusions, the research conducted by Sridevi and et al. showed that the total number of ridges was higher in breast cancer patients than in controls (22).

The final results of this research principally confirm the hereditary predisposition of breast cancer and the relevance of hereditary factors in the etiopathogenesis of this disease. Because no statistically significant difference in the quantitative properties of digital dermatoglyphics between breast cancer patients and controls was observed, it is still too early to propose the use of dermatoglyphic analysis as a potential indicator upon calculating the risk of breast cancer. An abundance of questions is yet to be answered.

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## TRANSPARENCY DECLARATION

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