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Predictive Analysis of Palmar Dermatoglyphics in Patients with Breast Cancer for Small Bosnian-Herzegovinian Population

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ABSTRACT

Introduction: Malignant breast cancer is the most common malignancy in women between 40 and 55 years of age. Dermatoglyphs are polygenetically determined properties, whose appearance and number are determined by a specific gene. They represent the skin reefs that are created by epidermis on the fingers or toes, palms and soles. Palmar dermatoglyphs have been used to estimate the hereditary basis of many diseases. **Aim:** The aim of the paper is to determine whether there is a statistically significant difference between the observed qualitative and quantitative parameters of both palms between the experimental and the control group. **Material and Methods:** A survey of the qualitative and quantitative properties of the palmar complex was carried out on a total of 100 female respondents. The first group included 50 women with breast cancer. Comparative data were used for the analysis of palmar dermatoglyphs in the second group of respondents, or 50 phenotypic healthy female subjects. The imprints of the palmar complex were taken using the printake ribbons, analyzed, and the data was then statistically processed and displayed in charts. An analysis of the number of reefs between two digital triradius was performed, followed by the determination of the axially triad position, as well as the ATD angle measurement. **Results:** Quantitative analysis of ATD-angle showed statistically significant difference between the left and right palms of the analyzed groups. However, the analysis of the number of reefs between triradius A-B, B-C, C-D did not show statistically significant results for both the left and right hand between the analyzed groups. **Conclusion:** These results indicate that the quantitative palmar parameter, ATD-angle, can play a role in identifying women with increased risk of breast cancer.

Keywords: breast cancer, dermatoglyphs, ATD-angle, number of reefs.

1. INTRODUCTION

Breast cancer is the most common cancer in women. In developed countries, the likelihood of breast cancer at age between 20 and 80 years is approximately 7.8%, meaning that one of 13 women is affected (1). The tumor of the milky glands are formed through a series of complex molecular changes, resulting in an unregulated cellular process that leads to the spread of transformed cells of breast epithelium with immortal characteristics, uncontrolled growth, and having the ability to spread to distant organs (2). The risk of breast malignancy is higher among women whose family history has one or more of the following factors: a greater number of cases among close relatives, illness in the younger age (younger than fifty years at diagnosis), bilateral illness, addition of ovarian malignancy (3). The main risk factors for breast cancer in women are: age, genetic mutations, family history of breast cancer, personal history, estrogen and progesterone exposure, history of certain benign breast changes, geographical and social factors, use of estrogen and progesterone medications, radiotherapy, overweight, alcohol and smoking (4). Two genes that are implicated in the pathogenesis of breast and ovarian cancer :BRCA1 localized on chromosome 17q21 and BRCA2 localized on chromosome 13q12-13 (5).

According to the data on the health status of the population in Federation of Bosnia and Herzegovina in 2014, breast cancer is by far the most common localization of cancer in women.

Dermatoglyphs, the „inscription“on the skin are reefs or pattern that is created by epidermis on the

fingers or toes, palms and soles (6). Although there is no two people with identical dermatoglyphic findings, there is a high correlation between dermatoglyphic properties within the family, within the population groups as well as within certain human species. Dermatoglyphs are considered as indicators of congenital abnormalities and are a sensible indicator of intrauterine anomalies and are considered to be a very useful diagnostic tool for genetic disorders (7).

2. AIM

The main aim of this study was to determine whether there is a statistically significant difference between the observed qualitative and quantitative parameters of both palms between the control group (the healthy population) and the experimental group (patients with breast cancer).

3. MATERIAL AND METHODS

The study included 50 female subjects in the case group and 50 females in the control group.

In case group were 50 women in the age group of 20-80 with pathohistologically confirmed breast cancer. In the control group were 50 healthy women **with no familiar history** of any type of cancers nor any other genetically based disorder or disease.

Inclusion criteria

- Sex/Female respondent
- Age: minimum 18 years of life
- Informed consent-signed
- Pathohistologically confirmed breast cancer diagnosis

Exclusion Criteria

- Medically confirmed of any other type of cancer
- Disability linked to the palm of both hand
- The presence of genetically based diseases or disorders.
- The Printake polyester foils with dye were used for taking palmar prints. This method is used in a similar studies related to this type of research. (30)

The following qualitative dermatoglyphic properties were studied on the palms:

- Tenar and 1st interdigital space–below the thumb and between the thumb and the second finger;
- 2nd interdigital space–between the second and third fingers
- 3rd interdigital space–between the third and the fourth finger
- 4th interdigital space between the fourth and fifth fingers
- Hypotenar–in the area of the palm opposite to the thumb.

In the palm, the position of the axial triradius is determined. According to Penrose (1954), the ATD angle at 45° corresponds to the axial triradius t, the angle of 46-55° axial triradius, and 56° is the axial triradius t". If there are more triradius in the palm, in consideration is taken the largest ATD angle (8). The lines A, B, C, and D are also monitored on the palm and determined are the areas of their ends.

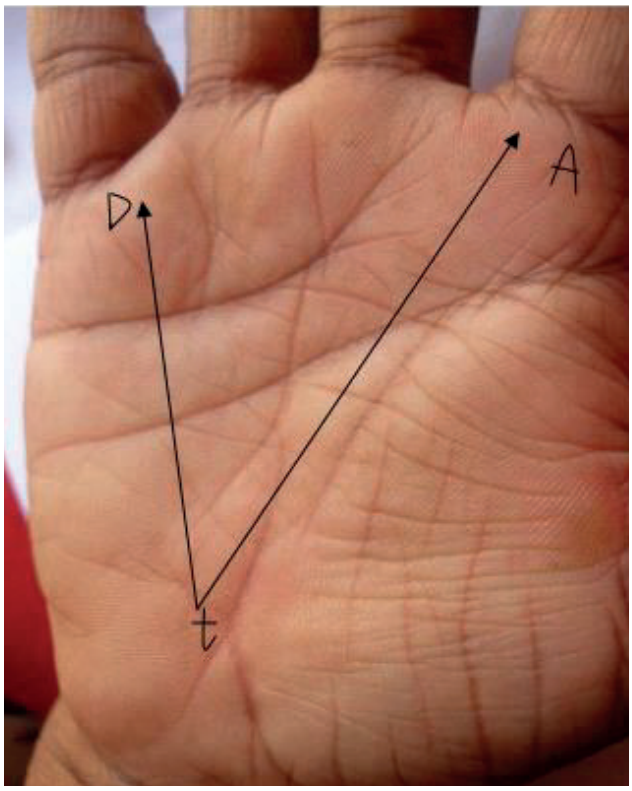

Figure 1. Position of the ATD angle in the palm

Quantitative dermatoglyphic properties on palms:

AB RC D–the number of ridges between triradius a and triradius b of the right palm;

AB RC L–the number of ridges between triradius a and triradius b left palm;

BC RC D–number of ridges between triradius b and triradius c right palm;

BC RC L–number of ridges between triradius b and triradius c left palm;

CDC D D–the number of ridges between triradius c and triradius of the right palm;

CD RC L–the number of ridges between triradius c and triradius d of the left palm;

ATD D–the angle of the triangle a, t and d on the right palm, measured in degrees;

ATD L–the angle of the triangle a, t and d on the left palm, measured in degrees.

Statistical analysis

The SPSS computer software for statistical analyses (Statistical Package for Social Sciences) version 13.0 for Windows was used for data processing. For this research a p- value of ≤ 0.05 was considered as statistically significant.

4. RESULTS

After analyzing data from descriptive statistics, the largest number of subjects was 61-75 years old (42%), while the mean age of cancer diagnosis was 51.69 (range 30-78 years). The positive family history of the disease was present in 11 patients (22%), and with the largest number, 31 (62%), the cancer affected the left breast. In the analysis of first menstruation age (menarche) survey, the majority of respondents from experimental (41) and of the control group (31) had menarche in the range

from 13 to 15 years, while in the range of 16 to 18 years the percentage was higher for the experimental group (9) in relation to control (2). Metastases were present in 10 patients (20%) and most commonly in adjacent lymph nodes. Of the total number, the highest number of respondents (34) had the first child at the age of 18-25 (68%). Also, majority of respondents was breastfeeding, out of a total of 40 (80%) in the control, and out of the total number 28 women (56%) breastfeeding the baby. It was observed that more respondents in experimental, 12 (24%) used some form of contraception, unlike the control group, where only 2 (4%) women used contraceptives. Of the 50 respondents, 26 (52%) had abortion, while 10 (20%) respondents had spontaneous abortion. Of the 50 respondents in experimental, 17 (34%) smoke cigarettes, while in the control group 8 (14%) women consume cigarettes.

Number of epidermal ridges

The difference between the number of epidermal reefs between a-b, b-c and c-d triradius in the experimental and control groups did not have any statistical significance (Table 1).

	Mean ± SD (Min.-Max.)		p-value
	Experimental	Control	
ABRCD	45 (40.75-49)	43 (37.75-50.25)	0.798
ABRCL	43 (40-47.25).	43 (37.25- 50.25)	0.896
BCRCD	30.3400 ± 6.09654	28.2000 ± 6.80636	0.100
BCRCL	30.2400 ± 6.19269	28.3200 ± 6.31629	0.128
CDRCD	39.4800 ± 7.22874	39.5800 ± 5.83127	0.939
CDRCL	40.7000 ± 8.55057	41.6400 ± 7.64188	0.563

Table 1. Average number of epidermal reefs in the experimental and control group

ATD angle

The mean ATD angle of the right palm in the experimental group, or women with breast cancer was 48.07, while the mean ATD angle of the right palm in the control group, the phenotypic healthy women were 45.12. The mean ATD angle of the left palm were similar, in the subjects with breast cancer was 47.05, while in the control group of phenotypically healthy women, this value was 44.9 (Table 2).

ATD angle	Mean	p-value
	Experimental Control	
	Right hand	
	48.07 45.120.015	
	Left hand	
	47.05 44.9 0.020	

Table 2. Mean values of ATD angle of right and left hand in the experimental and control group

By comparing the frequency of axial triradius between the group of breast cancer patients and the phenotypic healthy population, a statistically significant difference was found. By comparing the statistical values of the right palm ATD angle in defined groups of subjects, it was observed that the ATD angle was higher in the experimental (breast cancer patients) (p=0.015, p <0.05).

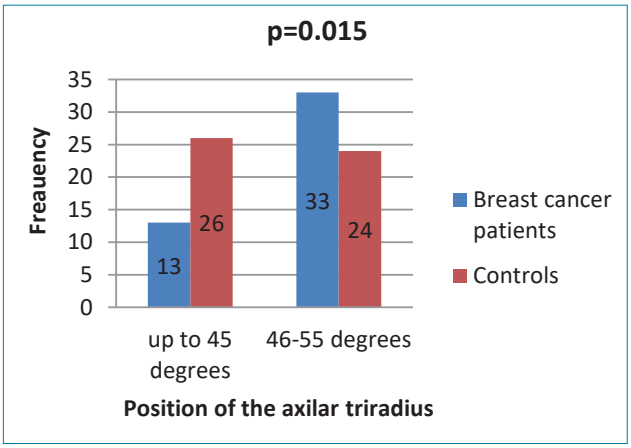

Figure 2a. Frequency of axial triradius position in the experimental and control group-right palm

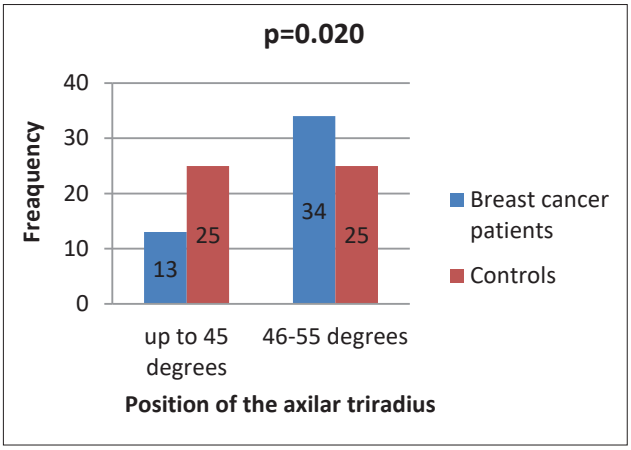

Figure 2b. Frequency of axial triradius position in the experimental and control group -left palm

Similar results were obtained for the left palm. It was observed that ATD angle was also higher in patients with breast cancer and the results were statistically significant (p=0.020, p<0.05) (Figure 2a and 2b).

5. DISCUSSION

Based on the results obtained after processing the data collected through the survey questionnaire, numerous indicators of the experimental and control group were obtained.

Positive family history is considered a very important risk factor, and the role of this factor in screening and prevention goes beyond mammography (9). Similarly, Ewertz (10) reported that increased risk is associated with family history of breast cancer. The mean value of breast cancer diagnosis age in this paper was 51.69, while other results (11) indicate that the median value of breast cancer age was 45.9 (range 24-65), indicating that the limit is shifted and that younger women are more and more affected. In the Federation of Bosnia and Herzegovina, statistical data show that the average age of registered malignant neoplasms is 63 years (12). The age of first menstruation in the experimental group was at the highest percentage between 13-15 years, or 62%, and in the control group 82%, which is correlated with 2002 results (13), where the percentage for the same age in the experimental group was 74.9% and for control 75.1%.

It has been observed that more patients had malignant disease in the left breast (62%), which is consistent with the 2012 survey (14), where it is reported that the left breast was also more affected and that the total number (75 subjects), even 45 of them had malignant left breast (60%), and the most common location of breast cancer is the upper outer quadrant (15).

The highest percentage of breast cancer patients got their first child between 18-25 years of age (68%), correlating with the results obtained in 2002 (12), where the percentage was 79.5 for this age group, as well as the results from 2009 (16), where 77.6% of respondents had their first child before the age of 25.

In this study, the results showed that more respondents in the experimental group used some form of contraception, while in the 2002 study (12) there was no significant difference between the control (3.6%) and the experimental group (2.4%) and similar results are quoted by Laamiri et al. (17).

Our results show that more patients (80%) were breast-feeding compared to control (56%), which did not appear to be a protective factor for the development of breast cancer. The results are consistent with Nguyen et al. research (11). However, the results of previous studies show significantly different results and indicate that breast-feeding is a protective factor in the emergence of breast cancer (18).

In this study, there was a significant difference between the experimental and the control group in the incidence of abortion. The results indicate that three times more women with breast cancer were subjected to abortion than the control group, correlating with Lazović et al. research (19), whose results show that abortion is associated with a small increase in risk for breast cancer, and this is confirmed by the results of Ozmen et al. (15). However, Paoletti and Clavel-Chapelon (20) and Andrie et al. (21) found no correlation between abortion and increased risk for breast cancer.

No statistically significant difference in the incidence of spontaneous abortion between the experimental and the control group was found, which is consistent with the results of Daling et al. (22) and Ozmen et al. (15), where it is also reported that no increased risk of breast cancer associated with spontaneous abortion was noted.

In our study, it was noted that more patients consume cigarettes (34%) than the control group (14%), which is consistent with the 2013 results (23) that indicate that active smoking is associated with increased risk of breast cancer in women who started smoking before their first birth and that smoking can play a role in the emergence of breast cancer.

Number of ridges

The mean relative values of the number of reefs between triradius A and triradius B in the palm in this study showed no statistically significant difference, both for the left and for the right hand. However, numerous A-B reef counts in breast cancer patients and phenotypic healthy individuals indicate that there is a difference when comparing the mean values obtained for this parameter. So, Lavanya et al. (24)in their 2012 survey state that the A-B number of right palm reef showed a statistically significant difference with the relative mean value of 30.83 in the experimental group and 36.53 in the control group. A-B number of left palm reef showed statistically significant difference with the relative mean value of 32.7 in the experimental group and 39.16 in the control group. They concluded that the A-B number of reefs was lower in the number of patients with breast cancer compared to the control group.

Sridevi et al. (25) showed that the mean A-B number of right-hand reefs in the experimental group was 36.79±7.51, while in the control group it was 31.40±4.91. In the left hand, the mean value for the experimental group was 35.18±5.94 and in the control 29.74±5.53, which showed a statistically significant difference between the control and the experimental group ($p < 0.001$). In the research conducted by Natekar et al. (26) there was no statistically significant difference in the number of A-B reefs between the control and the experimental group. Madhavi et al. (27) indicate that the number of reef A-B showed a statistically significant difference in their study and was higher in those with breast cancer, with mean value for the right hand of 39.87 and left 39.66 ($p<0.001$).

ATD angle

The results of our research indicate that axial triradius is higher in the experimental group of breast cancer patients compared to the control group, which is consistent with the results of the Natekar et al. ($p<0.05$), and similar results are also reported by Rawat & Ganesh (28) in their research, whereby they noticed that axillar triradius (t + t) of axial triradius was significantly higher it is also noticed that ATD is higher in breast cancer patients compared to the control group.

Oladipo et al. (29) also found significant results for the ATD angle, and similar results are also reported by Mušanović et al (30). It was observed that the mean ATD value of the right hand of the experimental group was 38.78±2.08, which was significantly less ($p<0.05$) than the mean ATD value of the right hand of the control group, which was 42.44±2.18. However, they state different results for the left hand. Therefore, the mean ATD value of the left arm of the experimental group was 39.90±1.87, while at the control value was 40.36±2.27, which was not statistically significant ($p>0.05$).

Lavanya et al. (2012) reported that a significant difference was observed for the ATD angle between the experimental and the control group ($p<0.05$), pointing out that the ATD angle was smaller in the experimental group, with the mean value of 41.5 and the control 44.43. Similar results were obtained from Madhavi and Sarah. (2015), which also state that the ATD angle of both arms is smaller in the control group compared to the control.

Sridevi et al. in their study from 2010, in their results show that there was no statistically significant difference between the ATD angle for the experimental and the control group for the right ($p=0.781$; $p>0.05$) and for the left hand ($p=0.446$; $p>0.05$). Sukre et al. (31) state that a statistically significant difference ATD angle in the left hand between the experimental and control groups, as

well as when they analyzed both hands together ($p<0.05$), however, analysis of ATD angle of the right hand did not show statistically significant results ($p>0.05$).

6. CONCLUSION

The number of women with breast cancer is increasing and is becoming more common in young women, and this is contributed by the fact that there are more and more changes in lifestyle. The results of the ATD-angle analysis showed a statistically significant difference between the experimental and the control group. The ATD-angle results obtained in this study, even on a small number of samples, show that the ATD-angle could be a useful non-invasive marker in breast cancer diagnosis. However, further research is required on a larger in order to sample to confirm the results.

- **Authors' contributions:** Each author gave substantial contributions to the conception or design of the work in acquisition, analysis, or interpretation of data for the work. Each author had a part in article preparing for drafting or revising it critically for important intellectual content, and all authors gave final approval of the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.
- **Conflicts of interest:** There are no conflicts of interest.
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