# DATA ABOUT DIGIT RATIO VALUES IN TWO FEMININE POPULATIONS OF BIHOR AND SĂLAJ COUNTIES (ORADEA AND ŞIMLEU LOCALITIES – NW ROMANIA)

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**Abstract.** This paper is about the differences of digit ratio in two human populations from two localities. These localities are: Oradea and Şimleu, from Bihor and Sălaj counties. Oradea is a locality with over two hundred thousands of inhabitants, which means the variability of some phenotipical features must be a large one. Şimleu is a smaller locality (has under fifty thousands inhabitants), which means the variability of some phenotipical features is lower than in Oradea. This fact is showed in our study. We investigated 100 females in each locality. It were measured the lenghts of the digits 2, 3 and 4, and then we made the digit ratio. The results are important: the digit lenghts are very different in the two localities; the 2D:4D digit ratio, too.

**Keywords:** digit ratio, feminine populations, Oradea, Şimleu, Romania

## INTRODUCTION

In a genetically heterogenous population, many genotypes will be formed by the processes of segregation and recombination. The study of inheritance in humans made necessary the appearance of a particular methods for genetic analysis [15]. Making some special measurements is very important to detect some morphological traits [6]. Some traits have a special inheritance which is not like a mendelian inheritance. We can mention some examples: colour of skin, eyes and hair, dermatoglyphics, intelligence, height, weight etc. There are some factors which interact with the frequency of genes in a population. So, they can increase or decrease the alleles frequencies from a generation to an other. These factors are: non-randomised marriages, alteration of mutation rate, selection, small populations, genetic isolated population and migration [1, 4, 5]. Human population can have some changes in sizes and traits (hair form, colour of eyes, hair, skin, lip firmness, etc.). These traits are determined by the interaction of genotype, environment, geographic area, climate conditions etc. [7-9].

The scientific study of papillary ridges of the hands and feet is credited as beginning with the work of Joannes Evangelista Purkinje, a czech psychologist and biologist in 1823. Then, in 1892 Sir Francis Galton published his classic treaties on fingerprints. He also studied the hereditary aspects of fingerprints, investigating comparisons of siblings, twins and genetically unrelated individuals and was the first to report concordance of papillary ridge patterns among relatives. Specifically, it is the ratio of the length of the index finger (digit 2, or „2D") and the ring finger (digit 4, or „4D") that is sexually dimorphic. Generally, males have a ring finger that is longer than their index finger. Females typically have index and ring fingers of about the same length. The ratio of index finger length to ring finger length is called the "2D:4D digit ratio", or more simply, the "digit ratio". Manning reports that, for males, the index finger is generally about 96 percent of the length of the ring finger, which gives an average digit ratio for males of 0.96. The digit ratio would be 1.00 if the ring and index fingers were the same length, and greater than 1.00 if the index finger was longer than the ring finger. Males generally have a digit ratio below 1.00 - they have what is termed a "low digit ratio". Women generally have a digit ratio of about 1.00 (the index and ring fingers are of about equal length), or a „high digit ratio". Height, like digit ratio, is still sexually dimorphic. But the causes of between population variation in sexually dimorphic traits, such as digit ratio, is certainly puzzling, and it is a fertile area for future research.

## MATERIAL AND METHODS

We investigated 200 individuals. We measured the length of the 2nd, 3rd and 4th fingers of 100 from each locality (Oradea and Şimleu). The individuals were randomised choosed. We measured the length of the fingers, from the finger basis to the superior bound of the phalanx. Then we calculated the digit ratio: 2D:4D, 2D:3D and 3D:4D. Also, we calculated F distribution and z score.

Dictionary:

2D = index finger (second finger);

3D = median finger (third finger);

4D = ring finger (fourth finger);

2D:4D = ratio between index and ring finger length;

2D:3D = ratio between index and median finger length;

3D:4D = ratio between median and ring finger length.

## RESULTS

The results of our research are presented in the following tables. In Table 1 are presented data about the feminine population of Oradea locality. The results obtained were analyzed in Tables 3, 4 and 5.

**Table 1.** Presentation data about digit ratio of a female population in Oradea locality.

| *Parameters* | *Right hands (RH)* | | | *Left hands (LH)* | | |
|---|---|---|---|---|---|---|
| | **2D:4D** | **2D:3D** | **3D:4D** | **2D:4D** | **2D:3D** | **3D:4D** |
| **Average** | 1.005442 | 0.916181 | 1.096054 | 1.005416 | 0.916155 | 1.095514 |
| **Standard deviation** | 0.038179 | 0.027684 | 0.034413 | 0.038106 | 0.028676 | 0.036938 |
| **Variance** | 0.001457 | 0.000766 | 0.001184 | 0.001452 | 0.000822 | 0.001364 |
| **Variation coefficient** | 3.797248 | 3.02172 | 3.13974 | 3.790104 | 3.130081 | 3.371791 |

**Table 2.** Presentation of the right hands-left hands comparison in a females population of Oradea. F distribution and z-test.

| *Digit ratio* | **Right hands-Left hands** | |
|---|---|---|
| | ***F*** | ***z-test*** |
| ***2D:4D*** | 1,003443 | 0,00482 |
| ***2D:3D*** | 1,073107 | 0,006526 |
| ***3D:4D*** | 1,152027 | 0,107142 |

**Table 3.** Presentation data about digit ratio of a female population in Şimleu locality.

| *Parameters* | *Right hands (RH)* | | | *Left hands (LH)* | | |
|---|---|---|---|---|---|---|
| | **2D:4D** | **2D:3D** | **3D:4D** | **2D:4D** | **2D:3D** | **3D:4D** |
| **Average** | 0.995853 | 0.900252 | 1.096191 | 0.986399 | 0.903407 | 1.101221 |
| **Standard deviation** | 0.097525 | 0.034297 | 0.044432 | 0.034753 | 0.033367 | 0.093825 |
| **Variance** | 0.009511 | 0.001176 | 0.001974 | 0.001207 | 0.001113 | 0.008803 |
| **Variation coefficient** | 9.793126 | 3.80966 | 4.053339 | 3.523212 | 3.693518 | 8.520114 |

**Table 4.** Presentation of the right hands-left hands comparison in a female population of Şimleu. F distribution and z-test.

| *Digit ratio* | **Right hands-Left hands** | |
|---|---|---|
| | ***F*** | ***z-test*** |
| ***2D:4D*** | 7,879867 | 0,913253 |
| ***2D:3D*** | 1,056603 | 0,659489 |
| ***3D:4D*** | 4,459473 | 0,484539 |

**Table 5.** Presentation of the right hands and left hands comparison in the two female populations of Oradea and Şimleu. F distribution and z-test.

| *Digit ratio* | *Right hands (RH) Oradea - Şimleu* | | *Left hands (LH) Oradea - Şimleu* | |
|---|---|---|---|---|
| | ***F*** | ***z-test*** | ***F*** | ***z-test*** |
| ***2D:4D*** | 6.527796 | 1,0685 | 1.202982 | 3,68 |
| ***2D:3D*** | 1.535248 | 3,615297 | 1.354014 | 2,8985 |
| ***3D:4D*** | 1.667229 | 0,026570 | 6.453812 | 0,5660 |

## DISCUSSIONS

From Table 1 we can observe in general the decreased variability of all digit ratio in Oradea locality. The observation is justified for all digit ratio, for both hands. So, there are no great variability of this feature. Making F distribution and z test (presented in Table 2), we may strongly affirm that is no significant difference between two hands in population of Oradea. We analyzed 100 individuals. The critical value in table for F distribution in the case of 100 subjects is between 1.43 and 1.53. For z test, the critical interval is between 1.96 and 2.58. In the both cases, our obtained values are lower, so, the differences are not significant (Table 2).

In Table 3, we can notice the small variability of the digit ratio in right and, separately, in left hand. 2D:4D digit ratio of right hand is near a value of moderate variability. But, in general we may say that the variability of all type of digit ratio is low.

Analyzing the F distribution, we may say the two variances (of 2D:4D and 3D:4D digit ratio) of Şimleu are not identical, or we may say the values proceed from two very different groups. After making the z-test, this showed that the averages are not significant different (Table 4). In the other words, comparing the two hands, we didn't noticed significant differences.

Analysing the F distribution for right hands of the two studied localities (Table 5), we may say the three variances are not similar or very different, or we may say the values proceed from two very different groups. After making the z-test, this showed that the averages are not significantly different (Table 5) in the cases of 2D:4D and 3D:4D digit ratio. In the other words, comparing the two hands, we didn't noticed significant differences in the cases of these two ratio in right hand.

The difference was observed in the case of 2D:3D digit ratio. In the cases of left hands, the results are different. The F distribution shows that the data proceed from a very different populations in the cases of 3D:4D digit ratio. But, the z test in the case of this digit ratio didn't show a significant difference between the the populations averages. The differences are significant in the cases of the 2D:4D and 3D:4D digit ratio.

There is a lack of information about digit ratio. Recently, some researchers start to investigate this feature of human race: digit length and digit ratio.

Many of them linked the results of some environmental factors (geographic area, relatives etc) or other normal and abnormal human traits (dermatoglyphics, intelligence, height, weight, malformations, sexual behaviour, autism, schizophrenia etc) [2, 3, 13, 14, 17].

Manning links the proximate causes of digit ratio sexual dimorphism to the effects of sex hormones during early fetal development [13, 14]. He believes the evidence is persuasive, but not yet definitive, that higher levels of testosterone during this critical developmental stage facilitates the growth of the ring finger, while higher levels of estrogen facilitates the growth of the index finger. He also suggests that hypermasculinization increases the likelyhood of homosexuality or bisexuality, in both males and females.

Somewhat surprisingly, the effect size for digit ratio between the sexes varies substantially as a function of geography and race. Surprisingly, the females in some cultures may have a lower digit ratio than males of other cultures, although men have a lower digit ratio than women within populations in all cultures for which there is data. It is unclear why the effect size of the digit ratio of the sexes varies between different populations. This is a curious fact, one for which Manning provides little in the way of definitive conclusions -- and the reader may be left to wonder whether some of Manning's interpretations are threatened by this between population variability in effect sizes. However, the fact that the average height of men of some populations is lower than women of other populations doesn't negate the sex difference in height, nor does the fact that the gender effect size of height varies in different populations. It has been suggested that autism may arise as the result of exposure to high concentrations of prenatal testosterone. There is evidence that the ratio of the lengths of the 2nd and 4th digit (2D:4D) may be negatively correlated with prenatal testosterone [12]. Others [16] related that neuro-hormonal theories of sexual orientation emphasize the organizational effects of testosterone on the developing brain.

A recent suggestion, that the ratio of the length of the 2nd and 4th digits (2D:4D) is negatively correlated with prenatal testosterone, has led to a number of studies of 2D:4D in homosexual and heterosexual men and women. The results have been mixed. In comparison to heterosexual men, mean 2D:4D in gay men has been reported to be hypermasculinized (lower 2D:4D), hypomasculinized (higher 2D:4D), or to show no significant difference. They report a mean 2D:4D in Austrian homosexual and heterosexual men and found no significant difference between means for homosexual and heterosexual 2D:4D, with values for both falling between 0.96 to 0.97.

There are now 6 reports of 2D:4D in heterosexual and homosexual men. Considering Caucasian men, the studies from the United States show low heterosexual mean 2D:4D, and homosexual mean 2D:4D is higher or similar to that of heterosexuals. The European studies show high heterosexual mean 2D:4D, and comparisons with homosexuals reveal the latter to have lower or similar mean 2D:4D to that of heterosexuals. They discuss these results in relation to the suggestion that mean 2D:4D in heterosexual men differs across populations but mean 2D:4D in homosexuals shows less geographical variation (the „uniform mean hypothesis"). It is concluded that more data are required to clarify whether or not there is a 2D:4D effect for sexual orientation in men [10].

The differentiation of the human brain is triggered by sexual steroid hormones in the fetus. The development of both the urogenital system and the appendicular skeleton are under common control by the HOX genes. Schizophrenic men and women showed a more „feminine" phenotype of the index and ring fingers in both hands than same-sex controls. This finding implies that low fetal androgen/estrogen ratio may have a predisposing role in the development of schizophrenia and points toward involvement of endocrine factors in the disturbed hemispheric lateralization attributed to the illness [18].

However, these data also draw attention to difficulties in the interpretation of results when somatic features are employed as biological markers of prenatal hormonal influences.

In our research we observed, in general, the decreased variability of all digit ratio in Oradea locality. The observation is justified for all digit ratio, for both hands. Z-test shows in the both cases the differences are not significant. In Şimleu, comparing the two hands, we didn't noticed significant differences. Analyzing the F distribution for right hands of the two studied localities, we may say that the values proceed from two very different groups. Comparing the two hands, we didn't noticed significant differences in the cases of these two ratio in right hand. The difference was observed in the case of 2D:3D digit ratio. In the cases of left hands, the results are different. The F distribution shows that the data proceed from a very different populations in the cases of 3D:4D digit ratio. But, the z test in the case of this digit ratio didn't show a significant difference between the the populations averages. The differences are significant in the cases of the 2D:4D and 3D:4D digit ratio.

The lack of consistency in the literature may be due to the differences in sample characteristics, methodology, or analytical techniques. This study is important for populational genetics data base. Also, we need to compare more data from different area of our country and of individuals with different diseases, to may detect the appearance of diverse illnesses and heal them.

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