DIGIT RATIO IN GROUPS OF SPORTING AND NON-SPORTING WOMEN AND MEN AND ITS RELATIONS WITH SOMATIC FEATURES AND MOTOR FITNESS

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Abstract The aim of the paper was to evaluate the digit ratio between groups of sporting and non-sporting women and men, and attempt to determine a value typical for athletes of each gender. Additionally, the aim was to evaluate relations of the digit ratio with both the somatic structure and motor fitness, which could then be used to improve on sports selection criteria.
The research material comprised 22 anthropometric measurements together with results of four motor fitness tests of students active in various sports disciplines. The control group comprised students who had never practiced sport. The sporting students showed significantly lower digit ratios compared to the control group of non-sporting students. Correlations between the digit ratio and features of the body structure were low. Both sexes recorded significant negative correlations between the digit ratio and handgrip strength, as well as with the long jump length.
Those with a lower value of the digit ratio had better predispositions to practicing sports.

Key words 2D:4D index, body build, motor fitness, sport

Introduction

The level of sports activity and the success at a sports are conditioned by many factors. One such factor is the somatic structure, which develops under the effect of endo- and exogenic factors as pre-natal development progresses. The digit ratio is one of the morphological features that can be prognostic for high sports achievements, developing at the early stage of ontogenesis between the 13th and 14th pregnancy week and under the effect of the sex hormones; androgens (Garn, Burdi, Babler, Stinson, 1975; Lutchmaya, Baron Cohen, Raggatt, Knickmeyer, Manning, 2004; Manning, Scutt, Wilson, Lewis-Jones, 1998). A low exposure of the foetus to uterine testosterone accompanied by a high concentration of estrogens, increases the value of the digit ratio making the digit structure more feminine (ratio ≥1), and conversely, a high concentration of testosterone accompanied by a low concentration of estrogens lowers the digit ratio, which is characteristic for males (ratio <1) (Hönekopp, Bartholdt, Beier, Liebert, 2007; Lutchmaya et al., 2004; Manning, Kilduff, Cook, Crewther, Fink, 2014). The digit ratio formula, once developed in the prenatal period, stays unchanged throughout the internal uterine development stage and in further periods of life (Brown, Finn, Cooke, Breedlove, 2002a; Garn et al., 1975; Manning, 2002a).

Research has shown that a high concentration of testosterone, manifesting a lower digit ratio, produces greater strength, power and dexterity (Fink, Thanzami, Seydel, Manning, 2006; Hönekopp, Schuster, 2010; Longman, Stock, Wells, 2011). Additionally, it increases the tendency of aggressive behaviour, risk taking, and the willingness to fight (Austin, Manning, McInroy, Mathews, 2002; Bailey, Hurd, 2005; Kociuba, Kozieł, Chakraborty, Ignasiak, 2017). Some authors have indicated that not practising any sport correlates with a higher digit ratio compared sporting individual (Bennett, Manning, Cook, Kilduff, 2010; Giffin, Kennedy, Jones, Barber, 2012; Hsu et al., 2015; Manning, 2002b). Furthermore, the competitors with a more masculine digit ratio are better at sports than those with a more feminine digit ratio value (Bennett et al., 2010; Frick, Hull, Manning 2016; Manning, Hill, 2009; Tamiya, Lee, Ohtake, 2012). Recent years have seen increased interest in the importance and possibility of using the digit ratio in determining aspects of human health, physical and behavioural features. Relationships between the digit ratio and the waist-hip ratio (WHR), and the waist-chest ratio (WCR) have been found. (Fink, Neave, Manning, 2003). Also, a negative correlation between the digit ratio and both sports results and motor fitness was found, with a lower digit ratio being mostly predominant in better results and getting higher on the podium than those with a higher digit ratio (Fink et al., 2006; Hone, McCullough, 2012; Hönekopp, Schuster, 2010; Ingham, Whyte, Jones, Nevill, 2002; Longman et al., 2011).

The process of sports selection may consider many aspects: somatic structure, motor fitness and mental predisposition. An early selection in terms of somatic structure shows low effectiveness due to developmental variations in morphological and functional features, as well as genetic conditions of the development rate. At early development stages, it is thus difficult to predict the growth processes. Hence identifying the features that do not change after development and which, at the same time, are related to particular properties of the human organism, seems to be significant for coaches and the sportspeople themselves. Such criteria can be met by the digit ratio, which does not change over ontogeny.

The aim of the paper was to evaluate the digit ratio between groups of women and men, both sporting and non-sporting, and attempt to determine a value typical for sportspeople of both genders; additionally, to evaluate the relations of the digit ratio with both the somatic structure and motor fitness, which could then be used to improve sports selection criteria.

Material and methods

Participants

Ethical approval for the project was obtained from the Ethical Committee at the University School of Physical Education in Wrocław. Their ethical guidelines were followed throughout the study. Participants provided informed oral and written consent prior to testing.

The research material comprised anthropometric measurements together with the results of motor fitness tests of young women (n = 179) and men (n = 404) practising various sports disciplines. The criterion assumed for selecting the persons for that group was at least a 5-year training experience or having a sports class. The control group (women n = 111, men n = 82) were chosen from the students of the Academy of Physical Education, who had declared in the questionnaire survey that they had not undertaken any of the qualified sports nor participated in any regular activities, apart from compulsory activities. The age range of the sample group was 19–25 years.

Measurements and exercise

The height measurements were taken using a GPM Anthropological Instrument measuring body height (B-a), sitting height (B-v), lower limb length (B-tro), and arm span (da3-da3). A spreading calliper from the same manufacturer was also used to measure width measurements of biacromial diameter (a-a), biiliocristal diameter (ic-ic), knee breath (cl-cm), and elbow breath (epl-epm). Measurements were taken using a tape measure of the circumference of the chest, waist, hip, arm at rest and flexed and tensed arm girth. The body mass was measured with electronic scales (accuracy – 0.1 kg). A skinfold calliper (Holtain, UK) with a constant spring pressure of 10 g/mm^2 was used to measure skinfold thickness (subscapular, triceps, suprailiac and abdominal).

The length of the second (2D) and fourth (4D) digit of both the right and left hands were measured using a Vernier dial caliper (to an accuracy of 0.01 mm) from the pseudo-phalangion (pph) point to the dactylion (da) point. Each measurement was performed 3 times and the average calculated. The results were used to calculate the digit ratio as follows:

Digit ratio = second finger length [mm] / fourth finger length [mm].

To estimate the motor fitness of the subjects, four motor fitness tests were used: sit-and-reach, standing long jump, sit-ups, and grip strength of each hand. The tests complied with the Eurofit procedure (1993).

Data analysis

Statistical calculations were performed using Statistica 10.0 (Stat Soft). The distribution of the variables were verified with a Kolmogorov-Smirnov test. In the groups studied, no significant deviations from a normal distribution were found. On this basis, ongoing methods based on a normal distribution were used. The analysis of variance was used to evaluate the intergroup variation and then a Tukey test (RIR) to assess the significance of differences between the pairs of means at a significance level of $p < 0.05$. The level of the connections between the digit ratio and the morphological features and the level of physical fitness were investigated with a Pearson's simple correlation coefficient.

Results

Digit ratio

Analysis of the digit ratio for the right and left hand identified significant differences between the sporting and non-sporting groups of each gender (Table 1). Both sporting women and men showed significantly lower values of the digit ratio as compared with non-sporting control.

Referring the value of that ratio in sporting men to the sporting women, no significant differences in that feature were found. However, a comparison of those men to not-active women demonstrated a considerably higher values of the ratio in women. In turn, non-sporting men showed significantly higher values of the digit ratio than sporting women, and no significant differences with women who are not active physically (Table 1).

Table 1. Statistical characteristics of the digit ratio in the group of sporting and non-sporting men and women

Feature	Training men	Training women	No training men	No training women
2D:4D P	0.973[1.3] ±0.03	0.974[2.4] ±0.028	0.993[1.4] ±0.025	1.003[2.3] ±0.033
2D:4D L	0.974[1.3] ±0.029	0.972[2.4] ±0.026	0.988[1.4] ±0.027	0.995[2.3] ±0.025

Significant differences are marked as follows:

1 – differences between SM and NSM; 3 – differences between SM and NSW; 2 – differences between SW and NSW; 4 – differences between SW and NSM.

Anthropological features

Analysing the other anthropometric measurements, most features showed no significant variation between the sporting and the non-sporting people in each gender.

It was noted only that the width of the shoulders and the knee was significantly greater in the sporting women than in the non-sporting ones (Table 2). It was also noted that a slightly greater humerus massiveness was found in the sporting compared to the non-sporting people.

The men in the study also had significantly higher values of all examined features than the women in the study.

Table 2. Statistical characteristics of the anthropological features in the groups of sporting and non-sporting men and women

Feature	Training men	Training women	No training men	No training women
Body mass [kg]	77.05 ±9.03[34]	61.19 ±8.32[35]	76.09 ±9.89[56]	59.25 ±8.03[46]
Body height [cm]	180.86 ±6.46[34]	167.37 ±5.91[35]	178.89 ±7.03[56]	165.65 ±6.31[46]
Lower limb length [cm]	93.36 ±4.59[34]	87.58 ±4.34[35]	91.79 ±5.21[56]	86.51 ±5.02[46]
Sitting height [cm]	95.09 ±3.27[34]	88.98 ±3.18[35]	93.88 ±3.76[56]	88.36 ±2.82[46]
Arm span [cm]	182.28 ±7.84[34]	166.14 ±6.72[35]	180.72 ±7.86[56]	164.46 ±7.37[46]
Biacromial diameter [cm]	41.46 ±2.27[34]	37.24 ±1.89[35]	40.97 ±2.532[56]	36.42 ±1.932[46]
Biiliocristal diameter [cm]	28.58 ±1.85[34]	27.66 ±1.69[35]	28.29 ±1.79[56]	27.50 ±1.89[46]
Elbow breath [cm]	7.05 ±0.26[34]	6.27 ±0.40[35]	7.00 ±0.27[56]	6.18 ±0.24[46]
Knee breath [cm]	9.87 ±0.56[34]	9.36 ±0.64[35]	9.75 ±0.532[56]	9.01 ±0.532[46]
Chest circumference [cm]	88.85 ±5.68[34]	77.28 ±6.26[35]	88.54 ±6.60[56]	77.00 ±6.54[46]
Waist circumference [cm]	81.09 ±6.19[34]	71.03 ±6.35[35]	80.50 ±7.37[56]	71.06 ±7.19[46]
Arm at rest circumference [cm]	30.37 ±2.71[34]	26.55 ±2.56[35]	30.69 ±3.06[56]	26.18 ±2.49[46]
Flexed and tensed arm circumference [cm]	34.08 ±2.92[34]	28.58 ±2.65[35]	34.20 ±3.38[56]	27.89 ±2.41[46]
Hip circumference [cm]	98.85 ±5.33[34]	97.11 ±6.22[35]	98.77 ±6.18[56]	96.22 ±5.77[46]
Subscapular skinfold [mm]	10.03 ±2.92[34]	12.06 ±4.33[35]	10.17 ±3.50[56]	11.54 ±3.78[46]
Triceps skinfold [mm]	6.61 ±2.82[34]	11.07 ±3.31[35]	6.40 ±2.76[56]	10.60 ±3.31[46]
Suprailiac skinfold [mm]	10.55 ±5.59[34]	14.42 ±5.82[35]	11.00 ±5.83[56]	15.90 ±5.93[46]
Abdominal skinfold [mm]	12.23 ±5.77[34]	15.69 ±5.02[35]	12.72 ±6.92[56]	16.18 ±5.31[46]

Significant differences are marked as follows:
1 – differences between SM and NSM; 4 – differences between SM and NSW; 2 – differences between SW and NSW; 5 – differences between NSM and SW; 3 – differences between SM and SW; 6 – differences between NSM and NSW.

Motor fitness

The only important differences in motor fitness were found for the sit-up test for the women, where those practising sports scored higher than the non-sporting women (Table 3). Analysis of the standing long jump did not show any significant differences; however, some tendencies to better results were noticed for the active persons in comparison to the non-active, both men and women.

The men from both groups had significantly higher values of all motor fitness tests than the women under the study, apart from sit-and-reach. Here, significantly better results were achieved by the sporting women. The results of the non-active women were similar to the men's results.

Table 3. Statistical characteristics of motor fitness in the groups of sporting and non-sporting men and women

Feature	Training men	Training women	No training men	No training women
Right hand grip strength [kg]	47.28 ±7.71[34]	30.78 ±7.36[35]	47.20 ±7.99[56]	28.95 ±6.24[46]
Left hand grip strength [kg]	44.65 ±7.77[34]	28.24 ±4.43[35]	45.20 ±7.92[56]	26.71 ±4.34[46]
Sit-ups	27.55 ±4.26[34]	22.92 ±4.86[235]	26.93 ±4.96[56]	21.35 ±4.48[246]
Standing long jump [cm]	2.23 ±0.23[34]	1.70 ±0.24[35]	2.17 ±0.25[56]	1.63 ±0.23[46]
Sit-and-reach [cm]	25.10 ±8.04[3]	28.23 ±8.74[35]	24.63 ±8.08[5]	27.72 ±8.40

Significant differences are marked as follows:
1 – differences between SM and NSM; 4 – differences between SM and NSW; 2 – differences between SW and NSW; 5 – differences between NSM and SW; 3 – differences between SM and SW; 6 – differences between NSM and NSW.

Correlations of the digit ratio with somatic features and motor fitness test results

For the women as a whole, in evaluating the correlations of the digit ratio with the somatic structure and the results of motor fitness tests, there were only low values of correlation coefficients. Otherwise, significant relations were found (Table 4).

Table 4. Correlation of the digit ratio in the right and left hand with features of the somatic structure and motor tests in the group of women

Feature	2D:4DR	2D:4DL	Feature	2D:4DR	2D:4DL
Body mass	0.00	0.01	Flexed and tensed arm circumference	0.06	0.04
Body height	–0.10	**–0.12**	Hip circumference	0.04	0.09
Lower limb length	–0.08	–0.11	Subscapular skinfold	0.07	0.09
Sitting height	–0.10	–0.09	Triceps skinfold	0.06	**0.12**
Arm span	**–0.13**	**–0.14**	Suprailiac skinfold	0.09	0.10
Biacromial diameter	–0.11	–0.08	Abdominal skinfold	0.05	0.09
Biiliocristal diameter	–0.05	–0.02	Right hand grip strength	–0.10	**–0.14**
Elbow breath	–0.08	0.02	Left hand grip strength	**–0.12**	**–0.15**
Knee breath	–0.07	0.03	Sit-ups	–0.07	–0.06
Chest circumference	0.07	0.05	Standing long jump	**–0.14**	–0.09
Waist circumference	0.10	0.09	Sit-and-reach	–0.03	–0.06
Arm at rest circumference	0.07	0.07			

Important negative dependencies were observed between the arm span and digit ratio for both hands. It means that the more masculine was the structure of the 2D:4D fingers, the greater the span of the upper limbs. The digit ratio of the left hand was negatively significantly related to body height and the length of the upper limb, while the arm skinfold was positively significantly related.

The correlation of the digit ratio with the results of the motor tests in women are poor. Significant negative dependencies were noted only between the digit ratio and the handgrip strength and standing long jump.

In the whole group of men, as in the group of women, there are poor correlations between the digit ratio with the somatic structure and physical fitness tests (Table 5). As for the somatic features, a significant dependence between the digit ratio of the right hand with the sitting height was found. For the motor tests, a significant negative dependence was noted between the digit ratio of the right hand with handgrip strength. The digit ratio of the left hand was significantly correlated with the standing long jump.

Table 5. Correlation of the digit ratio in the right and left hands with features of the somatic structure and motor tests in the group of men

Feature	2D:4DR	2D:4DL	Feature	2D:4DR	2D:4DL
Body mass	–0.03	0.04	Flexed and tensed arm circumference	–0.03	0.04
Body height	–0.08	–0.02	Hip circumference	0.02	0.08
Lower limb length	–0.08	–0.02	Subscapular skinfold	0.00	0.03
Sitting height	**–0.11**	–0.05	Triceps skinfold	0.05	0.02
Arm span	–0.06	–0.03	Suprailiac skinfold	–0.02	0.02
Biacromial diameter	–0.02	0.00	Abdominal skinfold	0.01	0.01
Biiliocristal diameter	–0.01	0.00	Right hand grip strength	**–0.10**	–0.02
Elbow breath	0.01	0.02	Left hand grip strength	**–0.09**	–0.04
Knee breath	–0.05	0.04	Sit-ups	0.03	–0.03
Chest circumference	0.00	0.08	Standing long jump	–0.07	**–0.10**
Waist circumference	–0.01	0.04	Sit-and-reach	0.01	0.03
Arm at rest circumference	–0.02	0.06			

Discussion

The results of this research showed that the mean values of the digit ratio in the men were typical for males. The representatives of the sporting group did show significantly lower values of digit ratio than the non-sporting men: 0.9733R vs 0.9736L. The non-sporting men had values of 0.9931R and 0.9875L. Similarly, in the women; the mean values of the digit ratio in the sporting group were significantly lower than in the non-sporting group. In the right hand, the sporting women averaged 0.9735, and in the left hand 0.9722. In the group of non-sporting women, the digit ratio values were 1.0025R and 0.9945L, respectively.

Own results agree with those reported by other authors. N.A. Giffin et al. (2012) found the digit ratio in a group of competitors averaged 0.97 in the men and 0.98 in the women, while the non-sporting group recorded a significantly higher digit ratio (men: 0.99, women: 1.00). A comparative analysis for skiers of both sexes presented by J.T. Manning (2002b), as well as by M. Bennett et al. (2010) in rugby players, also showed significantly lower digit ratios compared to the control (non-sporting) group. It suggests that those with a more masculine digit ratio are predisposed to sports. Both women and men with a lower value of digit ratio represent, in general, a higher sporting level. One can thus assume that a high exposure to prenatal testosterone, seen in the lower values of the digit ratio, coincided with the tendency to taking up physical activity in childhood, which, in turn, enhanced the sports skills and motor fitness, as well as a motivation for physical competition in various disciplines (Giffin et al., 2012; Kozieł et al., 2017). The dimorphic nature of the features studied matches many earlier reports on males showing lower values of digit ratio than in women (Manning et al., 1998; McFadden, Westhafer, Pasanen, Carlson, Tucker, 2005; Mularczyk, Ziętek-Czeszak, Ziętek, 2014; Okten, Kalyoncu, Yaris 2002). Our own results showed this difference between the sporting men and non-sporting women. Sportsmen showed significantly lower values of digit ratio than did the female representatives of the control group. However, the sporting women did not differ considerably in terms of the mean value of the digit ratio from the sporting men. No definite dimorphism in digit ratio in the professional sportsmen, and significantly lower mean values of digit ratio in sportswomen compared with non-sporting men, were also shown by N.A. Giffin et al. (2012), C.C. Hsu et al. (2015) and by M. Kociuba, S. Kozieł and R. Chakraborty (2016). It can thus be assumed that women with a more masculine digit ratio are better predisposed to various sports disciplines and better sport results.

Referring to the control groups, no considerable gender differences were found. However, the subjects showed a gender-typical tendency; in non-sporting men the second finger was shorter than the fourth one, whereas in the women it was the opposite (a digit ratio above 1).

Interestingly, a digit ratio of 1 or above occurred in some men both from the sporting and non-sporting groups. However, in the sporting groups that frequency was definitely lower than in the control groups. N.A. Giffin et al. (2012) found that in the sporting men a ratio below 0.98 was more frequent with 68% of the subjects of that group, while just 28% in the non-sporting persons, and in the sporting women, the digit ratio 0.98 was recorded in 44% of the subjects, but only 14% in the control group. Similar results were noted by D.M. Moffit and C.B. Swanik (2011), as well as by J.T. Manning (2002a) who observed in professional football players that in as many as 90% of them the digit ratio was below 0.98. In the control group, only half of the individuals were so low.

The results of this study are similar to the results provided above. In the sporting men, a digit ratio of 0.98 or below occurred in almost 71% of the subjects, and in 75.5% of the sporting women. Among the sportspeople (both sexes) there were some people with a digit ratio above 0.98, but relatively few; 29% of men and 24.5% of women. A typically feminine ratio (≥1) was found in 15.3% of sporting men and 12.2% of sporting women. In the non-sporting groups the percentage of persons with a digit ratio ≤0.98 was definitely lower than in the sporting groups, at 47% for men and 30% for women. A typically feminine digit ratio (≥1) was found in 38.5% of the men and in as many as 52.2% of the women. In the others the values ranged down to 0.981.

Lower values of the digit ratio are the effect of a high exposure to testosterone in the uterus. A study focusing on the biological grounds for this behaviour has identified the effects of the prenatal impact of testosterone on other adult psycho-physiological parameters (Neave, Laing, Fink, Manning, 2003). It suggests that a high level of testosterone in the prenatal period can have a constant masculinising effect on human behaviours (Manning, 2002a). One can thus assume that testosterone in the prenatal period has a stronger effect on physical aggression than does the level of testosterone in adults, which can potentially account for the dependence between the sports efficiency and the digit ratio (Hönekopp, Manning, Müller, 2006). Such a conclusion is partially based on the assumption that the digit ratio reflects the organisational effect of androgens on brain functions (Bailey, Hurd, 2005; Perciavalle et al., 2013).

The objective of the further analyses in our study was to evaluate differences in the somatic body structure and motor fitness in the sporting and non-sporting groups within each sex. Following the earlier studies, one should assume that they would be significant. However, this study has not identified a clear variation in the basic somatic features or in motor fitness in sporting and non-sporting people. It can be assumed that the relatively poor differences between the representatives of the two groups within a given sex are due to the fact that the study group included representatives of various sports disciplines, e.g. team games, athletics, swimming, combat sports, which are specific in terms of various aspects of somatic structure (varied length and width, body muscles). However the control group was made up of the students of University of Physical Education, which can suggest that students of such universities are morphologically better predisposed to practise various forms of physical activity and, in general, are more willing to take up a recreational physical activity, thus showing also a greater care of their figure by adequate nutrition. Additionally, the study syllabus forces them to a greater than average physical effort.

The correlations of the digit ratio were low with features of the somatic structure and the results of motor tests. However, women showed negative correlations of the ratio with almost all the features describing the skeleton, in terms of its length and massiveness. It means that the higher the digit ratio, the lower the length and width measurements, which is typical for the anatomy of the feminine body and accounts for such dependencies. Positive correlations of the digit ratio with skinfolds well reflect the specificity of a greater fat content in women.

The digit ratio in the group of women also showed mostly low correlations with the results of motor tests. Significant dependencies were noted, however, between the digit ratio in the right hand and the long jump length and the handgrip strength. The lower the ratio, the better the test results. Such direction of the correlations was also observed by H. Lu et al. (2017). The tests cover strength and time-trial, where a high muscle content is significant (a feature not characteristic for women). A more feminine body composition is connected to relatively higher share of the fat tissue in the body mass and a lower share of muscle.

Referring to the correlations in the male group, as in the female group, a poor relation of the digit ratio with the features of the body structure was observed. A negative correlation coefficient points to increases in all the body measurements with a decrease in the digit ratio. As for motor fitness tests, there was a considerable negative correlation of the digit ratio of the right hand with handgrip strength of both hands. Similar results are reported by other authors (Fink et al., 2006; Zhao, Li, Yu, Zheng, 2012), who found the occurrence of negative significant correlations between the digit ratio for the right hand with handgrip strength. Our own analysis found significant correlations with the long jump. It must be due to the fact that the more masculine body composition (more muscle content, lower fat content, and longer limbs) helped in strength and speed tests (Zatsiorsky, Kraemer 2006).

With our own results and the reports of other authors, it can be stated that the digit ratio can be an additional element defining a predisposition to sports activity in both sexes. Due to the unchanging value of the digit ratio over lifetime, this feature seems especially useful in the selection of young people for professional sports. It is most important at a preliminary selection made during the period of progressive development, where morphological variables undergo dynamic changes and sometimes it is difficult to predict their final effect. It seems, however, that the digit ratio does not allow to make a definite selection of a person for a specific sports discipline due to the low correlation of the ratio with feature of the somatic structure and the level of motor fitness. It is also confirmed by similar reports of other authors (Manning et al., 2000; Manning, 2002a; Muller et al., 2012). The ambiguous results presented in literature are probably due to research being performed in various ethnic groups residing in various latitudes (Danborno, Adebisi, Adelaiye, Ojo, 2008; Fink et al., 2003; Kalichman, Batsevich, Kobyliansky, 2017; Krakowiak, Čabrić, Sokołowska, 2013).

Conclusions

This study showed significant differences in the digit ratio between sporting and non-sporting persons, both in men and in women. Men and women from sporting groups showed definitely lower values of the digit ratio than did those from non-sporting groups. Sportswomen showed a typically masculine digit ratio, the mean values of which were significantly lower than the mean values in non-sporting men. Non-sporting women showed higher values of the digit ratio in both hands, and just the right hand presented a typically feminine digit ratio (≥1). The correlations between the digit ratio and features of the body structure were low. We found significant negative correlations between the digit ratio and sitting height in the whole group of men. In the women we noticed a significant negative correlation of digit length with arm span and body height, as well as a positive correlation with arm skinfold. As for motor tests in both sexes, significant negative correlations between the digit ratio and handgrip strength as well as with the long jump length were recorded. The formula of finger lengths can be an additional element determining the predisposition to engage in sports activities in both sexes.

Disclosure of interest

The authors declare that they have no competing interests.

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