

CHARACTERISTICS AND ANALYSIS OF DETERMINANTS FOR TWO-HANDED FOREHAND IN TENNIS

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- tennis,
- two-handed forehand,
- ambidexterity

Abstract:

The aim of the paper is to present subject of using two-handed forehand in modern tennis as well as an attempt to analyze determinants for such preferences among female and male competitors. The analysis of the data collected made it possible to verify hypothesis concerning the determinants mentioned above. The main factors influencing both hands forehand by adults are among others: inborn ambidexterity, medium body posture and using both hands forehand since many years of trainings.

INTRODUCTION

Modern tennis technique divides hits into forehand, i.e. internal hand wise, made from the right by right-handed and from the left by left-handed, as well as backhand hits, i. e. the tennis ball is hit towards back part of hand – from the left in right-handed and from the right in left-handed [9]. The methodology of tennis presents the division on backhand with one-hand and two-hands grip of the racket. Both of the techniques are treated equally because none of them reveals a significant advantage in the elements as follows: ball's control, speed or effectiveness of the game [10]. Classical teaching method does not mention about two-hands forehand grip in spite of the fact, that this kind of hit is used both by amateurs and professionals.

Despite the exact characteristics of tennis as a game, one can enumerate hits that are difficult to classify into situational and untypical hits group. Two-hands hit on the bounce from forehand as well as two-hands volley from forehand are such hits that in spite of the fact that they are not classical tennis hits, they are used more and more often by female and male competitors as well as world leaders [9]. A very similar reserve and attitude towards two-hand forehand was observed in the beginnings of the 70s. When Borg, Connors and Evert proved that two-hands forehand can constitute an element of the technique allowing playing on the highest level, only after 20 years it was accepted by the generation of professional players. In the beginnings of the 50s, Jack Kramer, a legend of tennis (notabene Pancho Segura partner in the doubles), called two-hands backhand as a hit that “limits the power and gives psychological advantage to the rival” [16]. As mentioned before, in the end of 70s one could observe an expansion of two-hands grip to backhand. Nowadays, it belongs to technical canon but if it is going to be in this way with two-hands grip to forehand? With absolute certainty a number of female and male competitors using the hit increases systematically [16].

DETERMINANTS FOR TWO-HANDS FOREHAND GRIP

Anthropomotor determinants

Using two-hands grip during a play can be caused by a lack of functional advantage of one body side over another (the so-called ambidexterity). Ambidexterity is when one can observe the same precision, accuracy and speed of manual activities made by both right and left hands [14]. Functional advantage of one side is called laterality that can occur in different forms. Laterality means advantage of one side (upper/lower limbs) over the another in the range of accuracy and movement's coordination, what is more beneficial in comparison to ambidexterity. Laterality means not only the advantage of one limb or organ but a tendency to using it [14].

Right-handed players have smaller tendency to ambidexterity than left-handed because the last ones were encouraged to use right hand in their childhood. The additional determinants for left-handed to use right hand are culture reasons. Because of the fact that social pressure is not aimed at right-handed, they demonstrate smaller ambidexterity [11]. Among competitors who are ambidextrous one can list Luke Jensen and Maria Szarapowa. Rafael Nadal uses right hand to majority of the activities but he plays tennis by left hand, and till the age of 12 years old he played two-hands forehand. There are many players who are right-handed naturally, but they play by left-hand and vice versa. Evgenia Kulikovskaya and Beverly Baker Fleitz - the winner of the grand slam doubles Roland Garros tournament from 1955, are the great examples of ambidexterity, because they use two one-hand forehands on both right and left sides.

Research conducted among tennis players show that 3,6 per cent of female and male competitors during game use different hand they write. Additionally, among 30 per cent of respondents, the dominant eye is left one, despite their right-handedness [5]. The research concerning individual level of coordination skills showed that two-handed children as well as left-handed ones had a great advantage over right-handed peers in the range of many tasks demanding coordination [13, 18].

Research results conducted among left-handed tennis players show, that they have advantage based on neuro-anatomical mechanisms over right-handed players in neuro-cognitive and visual and spatial tasks. The best proof for the thesis is a significant number of representatives of champion competitors of Open era around the world [6, 13]. Ambidexterity, which means a lack of functional advantage of one of cerebrals, is caused mainly by laterality process, it cannot be identified with re-ambidexterity, which can occur as the result of less able hand exercises by people who were previously laterally normal.

One of main problems occurring among tennis players are pathological changes that can be caused by long-term functional asymmetry that can be result of being overload on one side of the body too often. To avoid undesirable changes in bone and articular structure as well as muscular structure one can use trainings of the less effective side of body and also take into account making a balance between asymmetric and symmetric motor preparation [18]. The essence of modern tennis became development of symmetry and asymmetry alternately among lateralized competitors as well as comprehensive creation of motor functions. The main justification for creating asymmetry and symmetry is the rule of motor functions transfer what is proved by scientific research [18]. The transfer mentioned above means that skills of one body side are moved to the other. The mechanism is called bilateral (two-sided) transfer [18]. The bilateral transfer creates a kind of road in nervous system with two-ways flow of impulses from the right cerebral to left one and the other way round. A positive result of symmetry training is active relax that is felt by competitors as "feeling of freshness" on the dominant side with making exercises with the use of the weaker side at the same time. To sum up, one can assume that using both-hands forehand during playing tennis is probably the result of lack of motor advantage of both cerebrals, which means ambidexterity.

Methodological determinants

Sport technique is seen as a way of doing motor task. Technical preparation is seen as a process of mastering resources of motor tasks (activity technique), that in relation with body characteristics, its fitness, etc., can influence the best sport results in accordance with the law of the discipline chosen [17]. To the main characteristic features of technical preparation one can recognize freedom, economics as well as adjusting technique to individual features of sportsman (height, strength, etc.). A suitable level of fitness is necessary for making exercises. Teaching process in sport is linked to learning technical skills, which means with consolidation of feeling and motor habits. Sport technique components are as follows [17]:

- a) rational basic elements, that have to be learnt unconditionally without disturbing individual identities of competitor;
- b) minor identity, based on individual strength and body posture;
- c) physical elements in the form of objective conditions of environment in which the motion is done as well as in the range of rules of the motion;
- d) forms of sport contest depending on its course variability;
- e) law element of the competitions and the limitations concerning changes of technique.

Treating forehand grip technique as an unchangeable pattern makes the situation in where one can think about static take, whereas continuous research development as well as changes in techniques, allow for more dynamic take. Both-hands forehand will be analyzed in this context. If determinants influencing techniques' changes will be our interpretation, we can point probable causes of such a hit. During tennis initiation of 4-5 years old children, in some cases a natural way of using racket is two-hands grip. Despite using more and more lightweight equipment (19, 17 and even 15 inch rackets) small children can operate racket by both hands both on forehand and backhand. Some percentage of these children may stay with two-hands grip for the rest of their life.

More and more American coaches of initial children teaching recommend using two-hands forehand in the youngest groups. Among significant reasons of the recommendation are for example: more control of the racket in two hands, increased rotation of upper body part as well as lack of "not-playing" hand muscles disproportions, what is visible when using one-hand forehand [12]. Additional incentive to two-hands forehand in tennis can be educational system, for instance in Japan. W. Starosta pointed at ambidexterity cultivated among Japanese as a motor education system in school and at home. Using the special system of ambidexterity shaping is to influence high results in industry and in sport, as well as increase intellectual competence/fitness [18].

Somatic determinants

Undoubtedly, motor skills which determine competitor's sport level, have influence on the final form of hit. One can enumerate coordination, nimbleness as well as keep-fit determinants such as start speed, dynamic strength, oxygen endurance and specific resistance and power [20]. The next group of determinants conditioning somehow "the choice of hit" are the elements of body posture such as: body height, weight, composition (among others fat content) and also level of biological development [19].

Somatic structure supports achievement of definite sport results. High and slim body posture translates into the speed of most hits. According to data analysis concerning the height and weight of Open Era competitors, one can claim that an average body height and slenderness indicator point at increase tendency. Additionally, one can say that the majority of female and male competitors of the last generation, is rather high, strong built and slim simultaneously [8].

Average body height and weight of female champion competitors on 1-10 places according to WTA ranking within 1968-1997 was 171,47 cm and 59,94 kg respectively and

their slenderness indicator was on average 43,84. While competitors from 1-10 places according to ATP ranking within 1968-1997 were on average 184,19 cm high and 75,55 kg in weight, and slenderness indicator on average 43,61 [8]. Slenderness indicator is presented in table 1 below.

Table 1. Values classification of slenderness indicator (source: the authors' elaboration)

Indicator's categories	women	men
Stout build	less than 40,7	less than 39,5
Medium build	from 40,7 to 44,2	from 39,5 to 43,2
Slim build	From 44,3 to more	from 43,3 to more

One can suppose that some female and male competitors using their two-hands hits do not have such good somatic indicators as champions presented above. Therefore, the choice of two-hands forehand was somehow to compensate less power of arms presented above.

Two-hands forehand and its advantages and disadvantages

Two-hands forehand brings both benefits and some limitations as well. The analysis of the literature of the subject made it possible to make some conclusions about its advantages [4, 16]:

- More powerful hit – two-hands grip demands engagement of two arms and the whole upper torso, which makes it possible to hit with a great strength. Moreover, two-hands forehand is more “understanding”. One can hit the ball late, without a proper balance and without proper weight transfer. It also allows to have more power with the use of wrists, without control lost.
- More control – wrists not only improve the power of hit but also direct the flight of the ball in the phase of hit. Players using the hit are well-known from high level of angular hits.
- Limited sensitivity on injuries – when engaging two arms, the pressure after hit is dispersed on two times more muscles and bones what leads to significant decrease of muscles and tendons injuries.
- Stronger volleys – two-hands volleys are mostly hit on short turn opposite to classical volley, therefore they generate more power and have the broader scope of control and feeling.
- Lack of grip change between hits – by eliminating the necessity of grips' change, one increases a possibility of hit through its simplification.

One of the disadvantages of two-hands forehand is shorten range of arms when hitting, whereas the biggest limitation seems to be huge expend of energy during long exchanges.

MATERIAL AND METHODS

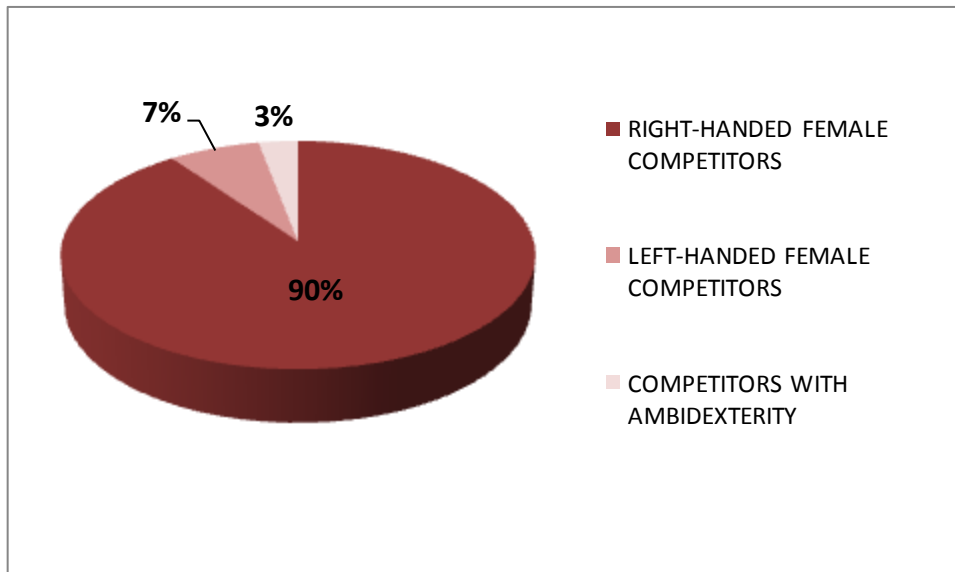
The subject of research was the use of two-hands forehand in a contemporary tennis. The aim of the research, that had cognitive character, was to explain conditions that make some female and male competitors use the hit during sport rivalry on the court.

The authors analyzed professional literature such as: journals, books, documents and statistical data. Additionally, official web pages of ATP, WTA, and ITF [1, 2, 3] were verified as well as statistically analyzed.

A group of respondents consists of female (n=59) and male competitors (n=33) classified on WTA and ATP lists as well as on ITF juniors' lists from 1968 to 2013 using two-hands forehand.

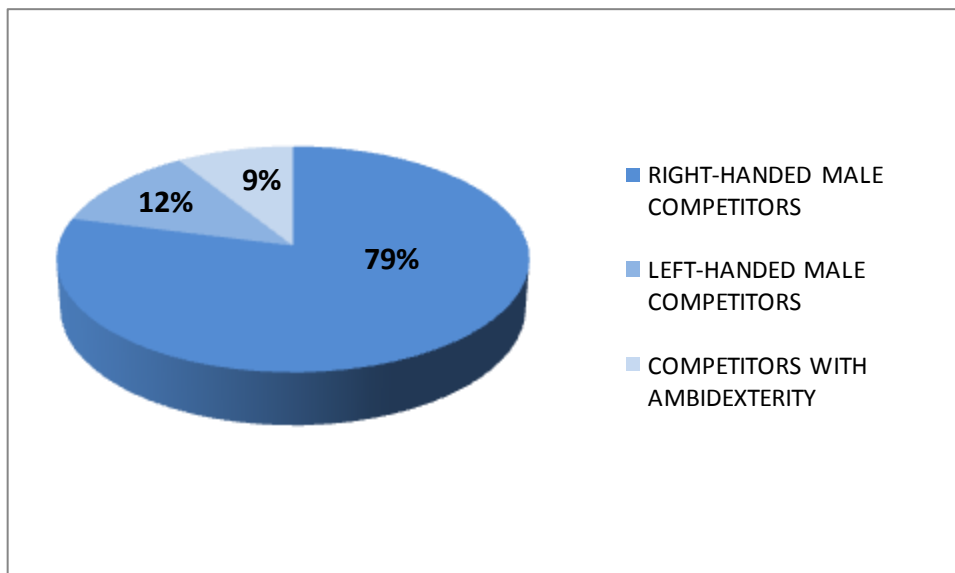
RESULTS

Statistical analysis of parameters connected with female competitors using two-hands forehand indicates, that 90 per cent of them are right-handed, 7 per cent is left-handed, whereas only 3 per cent of the respondents declare ambidexterity, what is presented on graph 1.



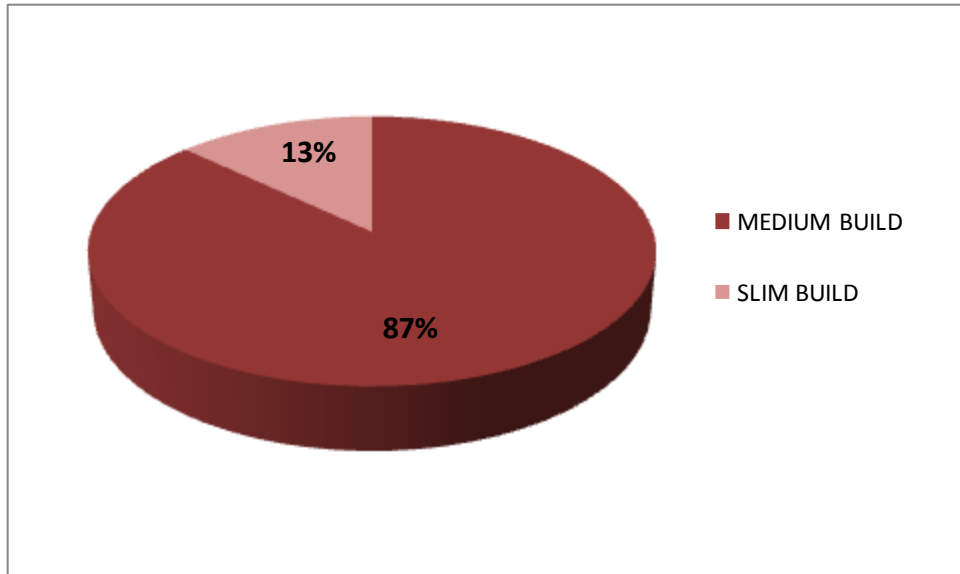
Graph 1. The percentage share of laterality among female competitors playing two-hands forehand (source: the authors' elaboration)

While among male competitors, as shown on graph 2, 79 per cent of the respondents is right-handed, 12 per cent – left-handed, and as much as 9 per cent – two-hands players.



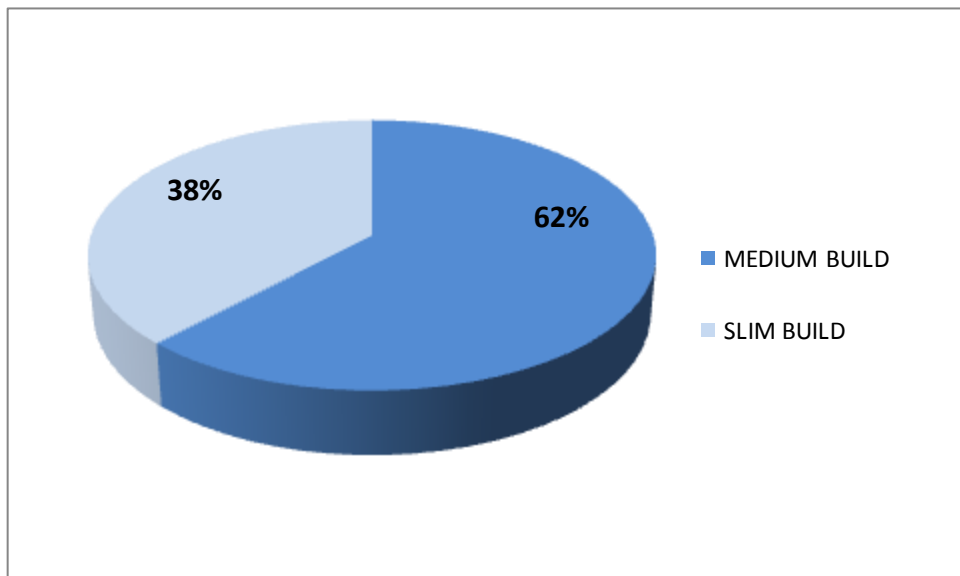
Graph 2. The percentage share of laterality among male competitors playing two-hands forehand (source: the authors' elaboration)

The research determined also the percentage share of body build based on slenderness indicator. In connection with that, 87 per cent of female competitors has got medium build, i.e. between 40,7 and 44,2 of slenderness indicator, whereas body build determined as slim was in 13 per cent of female tennis players (graph 3). The average height was 167,31 cm and average weight was 58,69 kg.



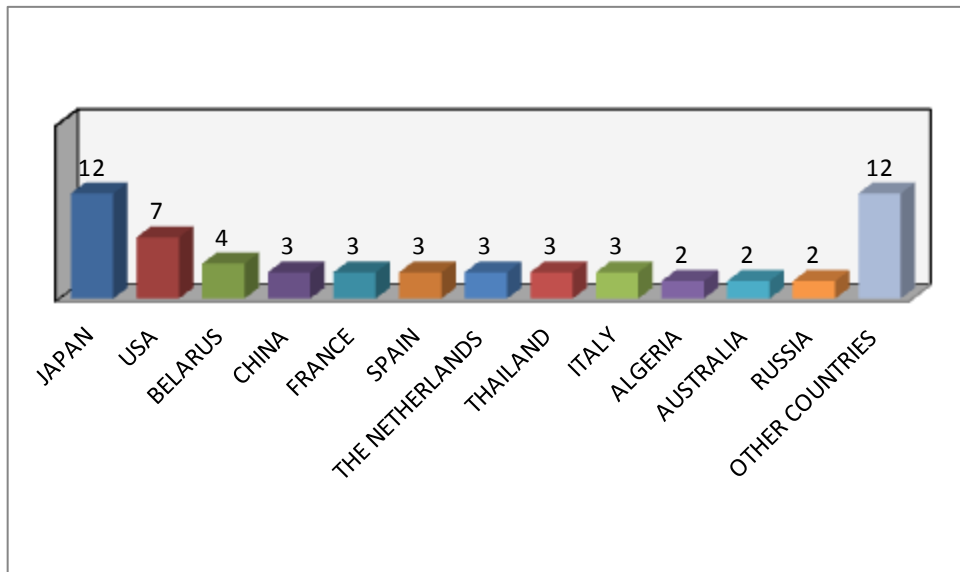
Graph 3. The percentage share of body build model of female competitors playing two-hands forehand (source: the authors' elaboration)

Among male tennis players slenderness indicator, presented on graph 4, looks a little different because as much as 38 per cent of the respondents is slim, and only 62 per cent – people with medium build. The average height was 181,79 cm and average weight – 76,24 kg.



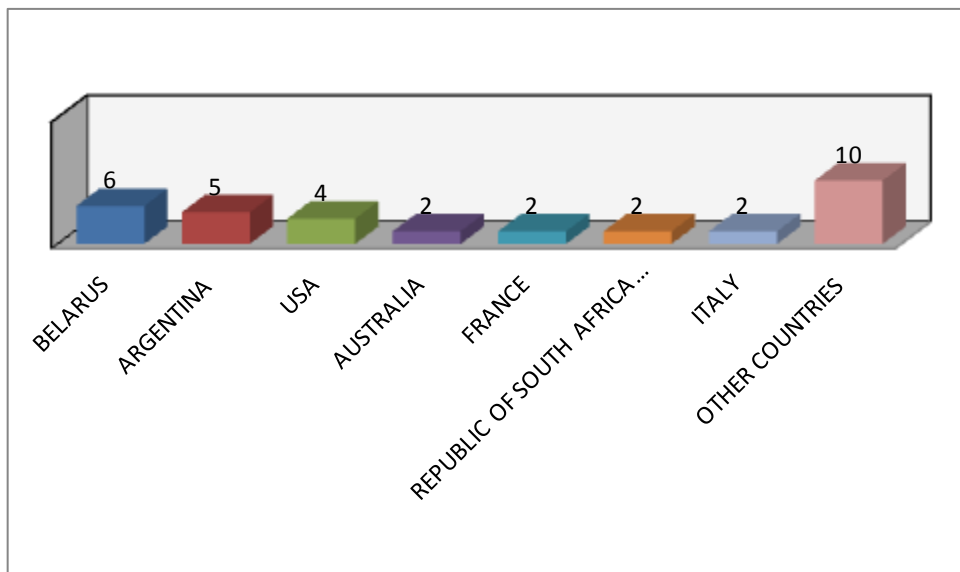
Graph 4. The percentage share of body build model of male competitors playing two-hands forehand (source: the authors' elaboration)

The next stage is to present statistical data connected with country of origin of the respondents. The biggest number of female players with two-hands forehand has got Japan. United States of America are placed as the second on the list, next is Belarus, what is presented on the graph 5 below.



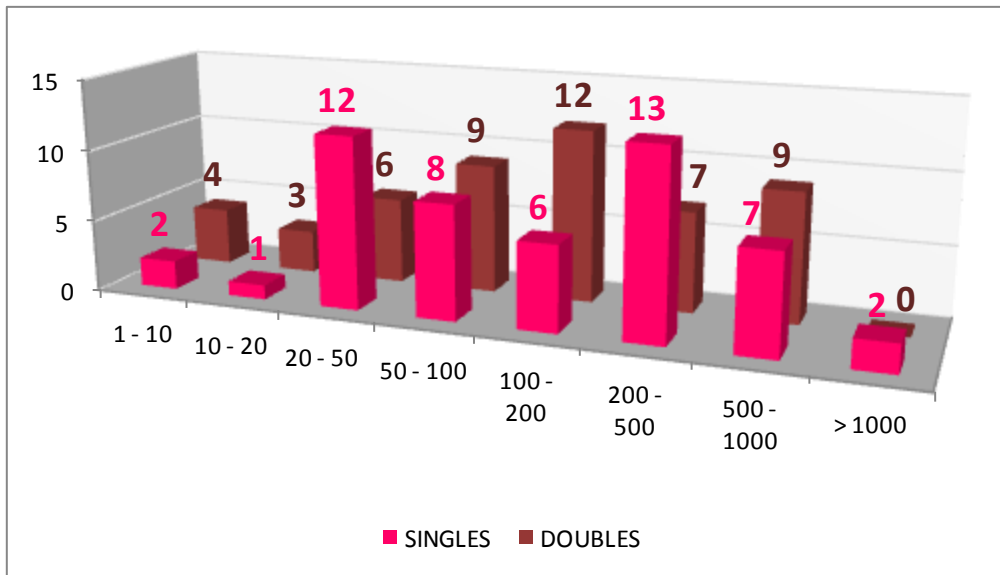
Graph 5. Countries of origins of female two-hands forehand players (source: the authors' elaboration)

The country with the biggest number of male two-hands forehand players is Belarus, next USA and Argentina (as shown on graph 6).



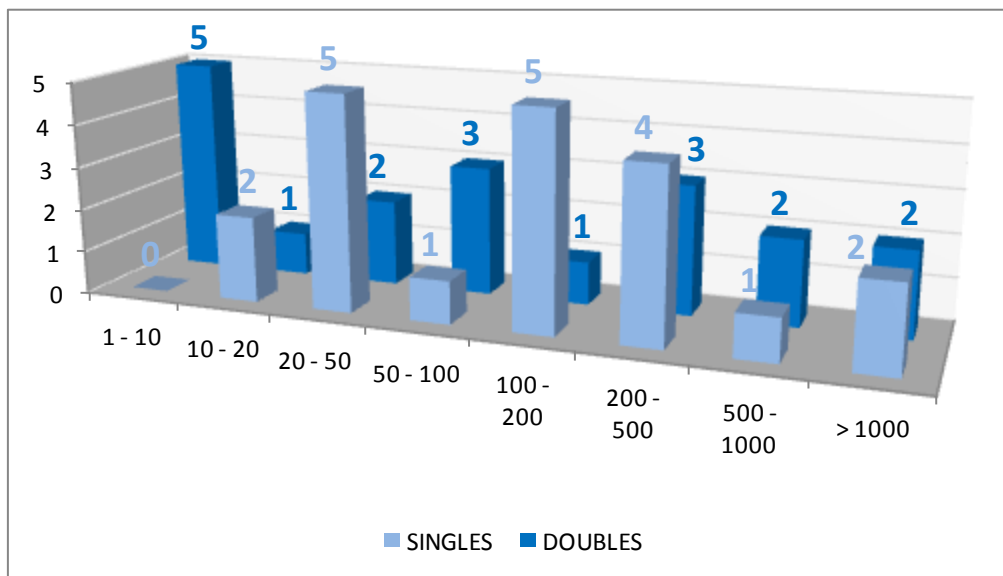
Graph 6. Countries of origins of male two-hands forehand players (source: the authors' elaboration)

An interesting research problem was the influence of using two-hands forehand on single and double game quality and place in rankings. One can observe (on graph 7) that there were only two female competitors in the first ten places according to WTA ranking. Majority of female tennis players had their best ranking between 200 and 500 place as well as 20 and 50 suitably. Different situation takes place in the doubles where as much as four competitors were in the first ten places.



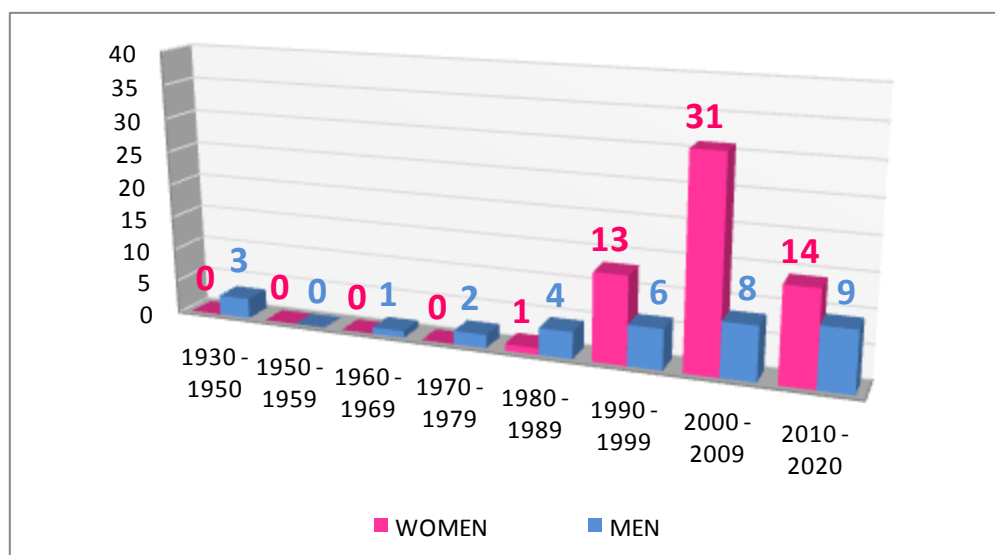
Graph 7. Number of female tennis players using two-hands forehand in the single and the doubles rankings (source: the authors' elaboration)

Five doubles players using two-hands forehand grip were in the first ten places according to ATP ranking, while only two competitors were in the first twenty places in the singles, what is shown on graph 8.



Graph 7. Number of male tennis players using two-hands forehand in the single and the doubles rankings (source: the authors' elaboration)

The last analysis shows changes in number of female and male competitors using two-hands forehand within last 80 years. As shown on graph 9, the number of male competitors is increasing slowly but systematically, whereas one can see that among female competitors the interest of this hit increased in 90s.



Graph 9. Change of number of female and male tennis players using two-hands forehand in the last 80 years (source: the authors' elaboration)

DISCUSSION

The analysis of collected data made it possible to verify hypothesis concerning determinants influencing choice of two-hand forehand. One of main guidelines for two-hands forehand was to be an inborn ambidexterity. The results show a significant percentage share of two-hands players in all the respondents, 3 per cent – women and 9 per cent – men suitably. Additionally, one can assume that some people with two-hands laterality use one favourite limb during game more often, what is observed in ITF statistical data [2]. One should claim, that the percentage share of female tennis players' laterality is three time bigger than among "normal" population [15], whereas 9 per cent of male tennis players use two-hands forehand.

Taking into account the premise of using two-hands forehand hits by short and small weight competitors, what is connected with length of limbs' lever, especially upper limbs, thanks to analysis and research results one can confirm the hypothesis. Two-hands hit is a kind of compensation of player's somatic drawbacks. It can be seen especially with women because their average height and weight is 167,31 cm and 58,69 kg, and 62 per cent of them is placed in medium body build category.

The next step in hypothesis verification is the assessment of regional training influence on hits' technique, what seems to be confirmed by great number of Japanese representatives as well as American competitors, both female and male. A high position of Japan is linked to their school education system focused on ambidexterity [18] and undoubtedly with their physical conditions. Position of American players has lots in common with early-tennis trainings, where two-hands grips are promoted and also taking part in national games, such as baseball for boys and softball for girls. A big surprise is the position of Belarus in both of the categories.

The results and positions in rankings of the competitors mentioned above deserve attention. In the first ten places according to WTA singles ranking, there were only two female competitors using two-hands forehand - Monica Seles and Marion Bartoli and only Monica Seles was the leader. According to the doubles WTA rankings the highest positions achieved the following competitors: Su-Wei Hsieh (third position) and Shuai Peng, Zi Yan, Lucie Hradecka – all gained fourth position. According to ATP classification, five doubles players using two-hands forehand was in the first ten places, and three of them won leadership – Frew Mcmillan, Jim Pugh and Byron Black. Julian Knowle and Fabrice Santoro were on the

sixth position, while the highest position in singles classification among two-hands forehand players gained Jan-Michael Gambil, who was on the 14th position.

The higher position in the doubles rankings may seem to be connected with a high effectiveness of two-hands volley, that means higher effectiveness than its one-hand version. Number of male competitors using the hit mentioned above, is increasing slowly but systematically, while among female competitors the interest of the hit was increasing rapidly in 90s. The additional conclusion is that two-hands forehand is women domain. A specific feature of the competitors using the hit is a high level of muscles and joints sensation as well as motor coordination and powers of observation according to many specialists are unattainable to the competitors using one-hand grips [7].

CONCLUSIONS

Two-hands forehand is not a curiosity and competitors' whim any more. One should appreciate the advantages of the hit and understand reasons why the hit was chosen by some players. It is dictated by some somatic factors and training process. Summing up, the authors conclude that firstly, ambidexterity is one of the reasons of two-hands forehand using. Secondly, the forehand is used by medium body build female and male competitors more often. Lastly, using of two-hands forehand is mainly caused by trainings in childhood.

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