# DISPROPORTION OF THE DOMINANT AND ANCILLARY EXTREMITIES IN DISPLAYING EXPLOSIVE POWER WITH YOUNG BASKETBALL PLAYERS

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***Abstract***
*Disproportion is an omnipresent occurrence typical for both man and the natural world. Everything that is not identical on both sides of the axis can be considered disproportionate. Explosive (speed) power represents the ability of placing the maximum amount of energy in one movement in the shortest period of time possible. Basketball is comprised of the following activities: running, jumping, changes of direction, abrupt stops, dribbling, passes, shooting, etc. All the activities mentioned represent the essential part of the game but with all of them there is a tendency towards the disproportionate uses of the extremities so the left and the right sides of the body are employed differently. The aim of this research was to determine mutual disproportion, which occurs as the consequence of the quality of life and the sport the examinees play. One of the key things was finding out all the possible differences among the three age categories, that is, among the relevant variables and the extent to which they are manifested. 64 young basketball players took part in the research. They were divided into three age groups according to the propositions of the Serbian Basketball Association. The set of measuring instruments comes from the anthropometrical and the motoric space and the examinees had to fill in the questionnaire, the function of which was to determine the dominant extremity on the grounds of the answers given. A formula for calculating the disproportion coefficient (Jatrjembskaia & Titov, 1999) was used in this research for all the measured variables related to extremities. The formula is as follows: AS=D-ND/D×100. Along with the given formula which was used for determining the mutual relation between the dominant and ancillary parts of the body, another formula which unified all the relevant variables was used: AS(n)=ΣAS/n. The methods used from the field of comparative statistics were: T –test and the variance analysis (ANOVA), and in the post-hoc analysis Tuckey test was used. The results show the anticipated differences in the explosive power between the extensors of the lower extremities and the dominant ones. The explosive power of the upper extremities is bigger in dominant extremities.*

***Key words****: disproportion, extremities, explosive power, young basketball players*

## INTRODUCTION

Disproportion is viewed in the context of lateral dominance, which, according to Harris (1958), implies that one side of the body is more employed and more capable of achieving things than the other. This is caused by the central nervous system (CNS) dominance phenomenon, which means that one hemisphere of the brain is responsible for specific functions (Touwen, 1972). Another term, laterality, is also present in scientific studies. It denotes the unequal usage of even extremities and sensory organs (Annet, 1985). The brain is the only organ which exhibits functional disproportion or laterality with both hemispheres taking part in performing tasks but one being dominant when it comes to certain functions or certain aspects of the same function (Kosslyn et al., 1999). Functional disproportion of the hemispheres can be observed when visual, auditory, verbal, emotional (both verbal and non-verbal), olfactiv, tactile and nociceptive information is processed (Hedrih, Nešić, 2006).

Explosive (speed) power represents the ability of placing the maximum amount of energy in one movement in the shortest period of time possible (Malacko and Rađo, 2004). With speed power the mass or the endurance rarely remain unchanged but there is a tendency of achieving acceleration (in athletics those are the specialties of throwing and jumping). Some authors define this property as explosive power (Karalejić and Jakovljević, 2001).

When it comes to structural complexity, basketball is described as a complicated game, comprised of simple and complex movements, which are made during team cooperation. When it comes to ability dominance, basketball is a mixture of speed and power abilities, coordination, stamina and precision. The activities of high intensity (maximum and sub maximum) are interchanged with the periods of active or passive rest (interruptions in the game) within specific time and space. From the aspect of movements, basketball is a complex activity that employs different energy and motoric systems, that is, their manifestation. Basketball is comprised of the following activities: running, jumping, changes of direction, abrupt stops, dribbling, passes, shooting, etc. All the activities mentioned represent the essential part of the game but with all of them there is a tendency towards the disproportionate uses of the extremities so the left and the right sides of the body are employed differently.
The aim of this research was to determine mutual disproportion, which occurs as the consequence of the quality of life and the sport the examinees play. One of the key things was finding out all the possible differences among the three age

categories, that is, among the relevant variables and the extent to which they are manifested.

## METHODS

*Participants*

The examinees who took part in the research are the boys who play basketball for the basketball club KK SPORT EKO, Belgrade. When the players are young the main motive for playing the sport is the desire for the game exclusively, whereas with older players there is a type of selection. The number of children influences the quality group formation. 64 young basketball players took part in this research (the age of 15.05±1.64, the average height of 173.41±11.81cm and the average weight of 62.71±13.09 kg) divided into three groups depending on their age. According to the rules of the Serbian Basketball Association there are three following categories: pioneers – 28 examinees (aged 13.43 ± 0.50, 165.05 ± 10.20 cm and 55.27 ± 11.32 kg), cadets – 21examinees (aged 15.62 ± 0.50, 177.02 ± 8.27 cm and 63.83 ± 8.93 kg) and juniors – 15 examinees (aged 17.26 ± 0.46, 183. 95 ± 7.14 cm and 75.03 ± 11.61 kg).

*Instruments*

The set of measuring instruments comes from the anthropometrical and the motoric space and when it comes to the place of testing the type is combined. This means that a certain number of variables was tested out into the field whereas some other variables were tested in the controlled conditions of the laboratory. Apart from the previously mentioned set of measuring instruments from the anthropometrical and the motoric space, the examinees had to fill in the questionnaire, the function of which was to determine the dominant extremity on the grounds of the answers given. The questionnaire was comprised of the following questions: (related to determining the more dominant hand) about the hand used for writing, the one used for shooting and the one with which passes are more efficient; (related to determining the more dominant leg) about the one used when shooting, the one used as the takeoff point and the one that the examinee first puts on the stairs. The more dominant extremity is the one mentioned in at least two answers. The set of measuring instruments for evaluating anthropometrical characteristics of the examinees was: body height (AVIS) and body mass (AMAS). The standardized measuring instruments (GPM, Switzerland) were used for measuring the anthropometrical characteristics. The measuring was done following the international procedure (Eston & Reilly, 2005; ACSM, 2006). The results were read including the tenth part of the measuring unit. The data shown will not be the subject of the statistic processing. They will be used as the identification of the height and the mass of the examinees that took part in the research. The set of measuring instruments for evaluating motoric characteristics of the examinees was: explosive hand power (dominant and ancillary) – BKLDR and BKLNR, and explosive leg power (dominant and ancillary) SUDDN and SUDNN. The explosive power of the hand extensor was tested by one arm hoop test and the explosive power of the legs by the long jump with one leg takeoff.

*Data processing methodology*

The following statistic methods were used for processing the collected data: from the descriptive statistics: arithmetic mean (*mean*), minimum (*minimum*) and maximum (*maximum*) values and standard deviation (*std deviation*) of all the measured variables. Apart from the mentioned standard statistic methods used in data presentation and analysis, a formula for calculating the disproportion coefficient (Jatrjembskaia & Titov, 1999) was used in this research for all the measured variables related to extremities. The formula is as follows: AS=D-ND/D×100. AS stands for the disproportion coefficient, D for the dominant and ND for the ancillary side.

Along with the given formula which was used for determining the mutual relation between the dominant and ancillary parts of the body, another formula which unified all the relevant variables was used: AS(n)=ΣAS/n, n representing the number or analyzed variables or elements analyzed by the disproportion coefficient. The results above 5% were considered significant. The methods used from the field of comparative statistics were: T –test and the variance analysis (ANOVA), and in the *post-hoc* analysis Tuckey test was used.

## RESULTS AND DISCUSSION

Table 1
*The explosive power of the hand extensor, dominant and ancillary in groups*

| MI-Group | N | Min. | Max. | Mean | SD |
|---|---|---|---|---|---|
| BKLDR-P | 28 | 9.02 | 16.7 | 12.137 | 1.7752 |
| BKLNR-P | 28 | 6.59 | 12.8 | 9.8764 | 1.5149 |
| BKLDR-K | 21 | 13.2 | 20 | 15.571 | 1.5991 |
| BKLNR-K | 21 | 10.8 | 15.2 | 12.839 | 1.268 |
| BKLDR-J | 15 | 17 | 21.2 | 18.985 | 1.3136 |
| BKLNR-J | 15 | 14.7 | 17.2 | 16.071 | 0.9198 |

Table 2
*The explosive power of the leg extensor, dominant and ancillary, in groups*

| MI-Group | N | Min. | Max. | Mean | SD |
|---|---|---|---|---|---|
| SUDDN-P | 28 | 104 | 204 | 151.929 | 21.568 |
| SUDNN-P | 28 | 104 | 200 | 152.464 | 21.0686 |
| SUDDN-K | 21 | 154 | 211 | 184.762 | 15.0762 |
| SUDNN-K | 21 | 159 | 210 | 188.095 | 14.4738 |
| SUDDN-J | 15 | 178 | 234 | 205.333 | 13.8856 |
| SUDNN-J | 15 | 179 | 241 | 207.667 | 15.864 |

Table 3
*The values of all the measuring instruments for evaluating the explosive power of upper and lower extremities for all the examinees*

| MI | N | Min. | Max. | Mean | SD |
|---|---|---|---|---|---|
| BKLDR | 64 | 9.02 | 21.2 | 14.8686 | 3.17188 |
| BKLNR | 64 | 6.59 | 17.2 | 12.3003 | 2.78829 |
| SUDDN | 64 | 104 | 234 | 175.219 | 28.3148 |
| SUDNN | 64 | 104 | 241 | 177.094 | 29.0717 |

Table 4
*The disproportion coefficient for all the examinees and groups (PIO/ AS, KAD/ AS and JUN/ AS) and for the measuring instruments: explosive hand power (BKL/ AS) and explosive leg power (SUD/ AS)*

| | TOTAL/AS | PIO/AS | KAD/AS | JUN/AS |
|---|---|---|---|---|
| BKL/AS | **17.27*** | **18.28*** | **17.38*** | **15.21*** |
| SUD/AS | -1.22 | -0.60 | -1.98 | -1.09 |

Table 5
*T-test, a two-way one for the dependent measuring instruments, of the examinees in groups*

| GROUPS | VARIABLES | t | df | Sig. (2-tailed) |
|---|---|---|---|---|
| PIONEERS | BKLDR - BKLNR | 9.581 | 27 | **.000*** |
| PIONEERS | SUDDN - SUDNN | -.288 | 27 | .776 |
| CADETS | BKLDR – BKLNR | 13.321 | 20 | **.000*** |
| CADETS | SUDDN - SUDNN | -1.655 | 20 | .114 |
| JUNIORS | BKLDR - BKLNR | 13.058 | 14 | **.000*** |
| JUNIORS | SUDDN - SUDNN | -2.457 | 14 | **.028*** |

Table 6
*T-test, a two-way one for the dependent variables (the motoric variables) for all the examinees*

| TOTAL | t | df | Sig. (2-tailed) |
|---|---|---|---|
| BKLDR - BKLNR | 18.805 | 63 | **.000*** |
| SUDDN - SUDNN | -1.753 | 63 | .085 |

Table 7
*ANOVA for the motoric variables of the groups in relation to the age group the examinees belong to*

| | | Zbir kvadrata | df | Mean | F | Sig. |
|---|---|---|---|---|---|---|
| BKLDR | Among groups | 473.448 | 2 | 236.724 | 90.036 | .000 |
| | Within groups | 160.382 | 61 | 2.629 | | |
| | Total | 633.830 | 63 | | | |
| BKLNR | Among groups | 383.834 | 2 | 191.917 | 110.482 | .000 |
| | Within groups | 105.963 | 61 | 1.737 | | |
| | Total | 489.797 | 63 | | | |
| SUDDN | Among groups | 30703.938 | 2 | 15351.969 | 47.285 | .000 |
| | Within groups | 19805.000 | 61 | 324.672 | | |
| | Total | 50508.938 | 63 | | | |
| SUDNN | Among groups | 33547.330 | 2 | 16773.665 | 51.944 | .000 |
| | Within groups | 19698.107 | 61 | 322.920 | | |
| | Total | 53245.438 | 63 | | | |

Table 8
*Tuckey test for the knee extensor of the ancillary leg variable (EKON)* Tukey HSD

| AGE | N | Subset for alpha = .05 | |
|---|---|---|---|
| | | 1 | 2 |
| PIONEERS | 28 | 189.643 | |
| CADETS | 21 | 225.238 | |
| JUNIORS | 15 | | 310 |
| Sig. | | 0.082 | 1 |

The value of the explosive power of the ancillary lower extremity extensors is higher than the value of the dominant extremities. The explosive power of the legs was tested by the long jump done with one leg takeoff (SUDDN and SUDNN) and no statistically significant difference was discovered with all the examinees. This result matches the one of the research conducted by Schlitz et al. (2009). At the group level there is a statistically significant difference in the junior group, the value of which is P=0.05, t=-2.457. All the groups have the negative disproportion coefficient, which just supports the claim that the ancillary leg is stronger than the dominant one. The reason for this lies in the fact that with all the examinees the ancillary leg is the one used as the takeoff support so the difference, even though it is statistically insignificant, is probably the result of a sport specialty, that is, the specific basketball training process.

The value of the explosive power of the dominant upper extremities is higher than the value of the ancillary ones. The explosive power of the hand extensors was tested by one arm hoop (BKLDR and BKLNR) and it was determined that there were statistically significant differences among all the examinees and among all the groups as well. For all the examinees the value of the disproportion coefficient is 17.27%, which shows that the dominant extremity is stronger than the ancillary one. For groups, the results are as follows: PIONEERS 18.28%, CADETS 17.38% and JUNIORS 15.28%. The values of the two-way T-test are as follows: among all the examinees t=18.805; PIONEERS t=9.581, CADETS t=13.321 and JUNIORS t=13.058. ALL the results prove that there is a statistically significant difference to the advantage of the dominant extremity, which supports the results of the research conducted by Falson et al. (2002). It is important to point out that disproportion has the declining tendency in relation to the age group. It means that the older the examinees are, the lower the disproportion value is. This result is in accord with the one of the research conducted by Stöckel & Weigelt (2007). However, the data should be rechecked by a large-scale research, which would involve more examinees within the existing age groups. The reason for the declining tendency might lie in the fact that the motoric stereotype has been stabilized through a long-lasting training process in which the dominant extremity reaches a certain level whereas there is still enough room for upgrading the potential of the ancillary one. The whole process reduces the difference in disproportion.

## CONCLUSION

The research presented in this work shows that there is certain level of disproportion in certain variables and with all the examinees. The most conspicuous variable is the hand extensor explosive power. It appears to be the consequence of not just common everyday activities but also the training process in which the extremities are unequally used. The fact is that we live in the right-oriented world so it is very difficult to achieve the equal use of extremities. When it comes to sports, in this case basketball, there is more space for achieving equality of extremity use. The results show that there are no differences in the explosive power of the legs, which proves that disproportion appears in those variables where the influence of the outside factors is strong. This fact should not worry but ignite the research into new methods for reducing disproportion to an acceptable degree.
Future researches should be conducted with a larger number of examinees, follow them in different phases of their biological development and result in successful methods for reducing disproportion. It would be a good thing if the best methods for the research into disproportion and its tracking could be defined. Then certain standards of testing in sports could be set.

Reducing disproportion is the task of sports experts who should learn more about the problem and apply the gained knowledge to working with athletes. The experts who work with beginners should have the biggest influence. The most common mistake is deliberately forcing the use of dominant extremities when a new movement is being taught. It just causes further damage to the already disturbed proportion. The opposite process could have a better transfer on bilateral balance.

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# ASIMETRIJA DOMINANTNIH I NEDOMINANTNIH EKSTREMITETA U ISPOLJAVANJU EKSPLOZIVNE SNAGE KOD KOŠARKAŠA MLAĐIH UZRASNIH KATEGORIJA

*Originalni naučni rad*

***Sažetak***

*Asimetrija je pojava koja je prisutna u našem okruženju i svojstvena je ne samo čoveku, već se javlja u čitavom živom svetu. Sve što nije identično sa obe strane ose može se smatrati asimetričnim. Eksplozivna ili brzinska snaga predstavlja sposobnost da se uloži maksimalna energija u jednom pokretu za što kraće vreme. Aktivnosti trčanja, skokova, promena pravca kretanja, driblinga, dodavanja, šutiranja i sl predstavljaju sastavni deo košarkaške igre i javlja se tendencija da se ekstremiteti ne koriste uvek proporcionalno i u istoj meri, pa imamo razliku u angažovanosti leve i desne strane tela. Osnovni cilj istraživanja je utvrđivanje međusobne asimetrije koja se javlja kao posledica načina života i specifičnosti sportske igre kojom se ispitanici bave u eksplozivnoj snazi između donjih i gornjih ekstremiteta, te da se utvrde eventualne razlike u odnosu na tri različite uzrasne kategorije, odnosno da li postoje međusobne razlike među grupama u pogledu svih ispitivanih varijabli i u kojoj meri su izražene. Uzorak ispitanika čine 64 dečaka, mladih košarkaša, raspoređenih u tri grupe na osnovu starosti, odnosno uzrasne kategorije kojoj pripadaju na osnovu propozicija KSS. Uzorak mernih instrumenata je iz antropometrijskog i motoričkog prostora, a ispitanici su popunjavali i upitnik koji se tiče utvrđivanja dominantnog ekstremiteta, a utvrdjuje se na osnovu dobijenih odgovora. Za prezentaciju i analizu podataka u ovom istraživanju je korištena formula za izračunavanje koeficijenta asimetrije (Jatrjembskaia & Titov 1999;) za sve merene varijable koje se odnose na ekstremitete, a ona je sledeća: AS = D – ND / D x 100. Osim navedene formule koja utvrđuje međusobni odnos dominantnog i nedominantnog dela tela, upotrebljena je i formula koja objedinjuje sve varijable koje su opservirane a glasi: AS(n) = ∑ AS / n. Iz oblasti komparativne statistike: T- test i analiza varijanse (ANOVA), a za post-hoc analizu korišten je Takijev test (Tukey). Dobijene su očekivane razlike u eksplozivnoj snazi ekstenzora donjih ekstremiteta u odnosu na dominantne. Eksplozivna snaga gornjih ekstremiteta je veća kod dominantnog ekstremiteta.*

***Ključne reči****: asimetrija, ekstremiteti, eksplozivna snaga, mladi košarkaši.*

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