# BODY AND FUNCTIONAL CAPACITY OF LITHUANIAN DEAF BASKETBALL TEAM PLAYERS AND CHARACTERISTICS OF GAME INDICES

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## ABSTRACT

*Background.* The purpose of the present study was to establish and evaluate body capacity and functional capacity of Lithuanian deaf basketball national team players, 2013 Deaflympic champions, and to provide the data analysis of the players' participation in Deaflympic Games comparing it with the data of participation in the Games of 2005 and 2009.

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*Methods.* The group of investigated persons included 12 Lithuanian deaf basketball national team members. Basketball players' body development, body and functional capacity testing was performed. Method of systemic analysis was employed to perform comparative analysis of Lithuanian deaf basketball national team players' game indicators.

*Results.* The results of our research showed that body development and physical capacity indices of Lithuanian deaf basketball national team players who participated in 2013 Deaflympic Games allowed accomplishing the technical and tactical requirements of contemporary basketball for players of such level. Lithuanian deaf basketball national team members have demonstrated better results in muscle mass and reached higher physical capacities comparing to those of the participants of the previous Games. This increase resulted in improved quality of the game and for the first time becoming gold medals winners.

*Conclusion.* Comparative analysis of game indices of the teams having participated in various Games showed that the majority of the competitive activity indices were better in 2013 Games in Sofia: field of goals precision was 49.2%, the high number of defensive rebounds and less turnovers during competitions allowed very effective fast breaks.

**Keywords:** muscle power, body composition, psychomotor functions, agility game activity.

## INTRODUCTION

Deaf people in Lithuania form a social group which easily enough integrates into general society as its counterpart. This social group is rather active in sports life. Deaf athletes have been playing basketball for already 60 years, same as people without disability. Lithuanian deaf basketball players are the numerous prize winners in World, European Deaf Championships, as well as in Deaflympics. Recent significant achievement of Lithuanian deaf basketball players is becoming gold medallists in the XXII Deaflympics in 2013. Investigations have already been carried out on body and functional capacity of these athletes, as well as on their adaptation to training loads and sports activity (Dadelienė, Paulauskas, Skernevičius, & Šatas, 2011; Milašius, Šatas, & Dadelienė, 2007).

A person with deafness disability confronts with the problems of self-improvement, adaptation and social integration. However, physical education and active sport involvement provide conditions for good social adaptation and self-expression (Palmer, Katbeen, & Weber, 2006). Basketball game, teaching it and participation in competitions is one of the ways for self-expression.

Deaf basketball game has a lot in common with the basketball played by healthy people, but certain differences still exist (Steward, Robinson, & McCarty, 1991). Deaf basketball players' game activities, as well as investigations of their physical fitness, working and functional capacity provide background for projection of their development trend and management of players' preparation for the most important competitions. For thorough evaluation of team members' fitness, informative criteria need to be employed. Scientific criteria can be used to establish fitness and the quality of the game for both healthy and deaf basketball players (Gocentas, Landor, & Andziulis, 2004; Laplaud, Hug, & Menier, 2004). Existing scientific data on deaf basketball players' preparation (Milašius et al., 2007; Šatas & Milašius, 2008 a, b; Šatas, Milašius, & Dadelienė, 2005, 2010; Šatas & Radžiukynas, 2003) has not yet covered analysis of players' body and functional capacity, nor change in their game activity. The sport results of Lithuanian deaf basketball players prove that people of this social group are able to strive for remarkable sport achievements. This presumes that in the process of deaf basketball players' preparation for competitions, it is important to perform scientific investigation on their body and functional capacity change during preparatory period, and to carry out comparative analysis on the players' game activity in three Deaflympic Games.

**The aim of the study** was to establish and evaluate body capacity and functional capacity of Lithuanian deaf basketball national team players, 2013 Deaflympic champions, and to provide the data analysis of the players' participation in Deaflympic Games, comparing it with the data of participation in the Games of 2005 and 2009.

## METHODS

The group of investigated persons included 12 Lithuanian deaf basketball national team members; they were the participants in the 20th Summer Deaflympic Games in Melbourne, 2005, the mean of age (± *s*) was 28.2 ± 5.5, in the 21st Summer Deaflympic Games in Taipei, 2009 it was 24.9 ± 4.8, and the 22nd Summer Deaflympic Games in Sofia, 2013 – 28.0 ± 5.0 years. The hearing loss of all the players, having participated in the latter Deaflympics, exceeded 55 decibels. Basketball players' body development, body and functional capacity testing was performed at the Institute of Sport Science of Lithuanian University of Educational Sciences, two weeks prior to each of the Games. Body height was measured to the nearest centimetre using a stadiometer (SECA 225, Seca GmbH & Co). Weight was measured using body composition analyzer TANITA BC418 MA (Japan), muscle and fat mass were measured using the methodology of Norton, Whittingham, Carter, Kerr, and Gore (1996) and body mass index (BMI) was established.

Basketball players' single muscle contraction power (SMCP) (Bosco, Luchtanen, & Komi, 1983) was established. For measuring anaerobic alactic muscle power, step ergometry test by recording running speed and lifting height (Margaria, Aghemo, & Rovelli, 1966), modified by Kalamen (1968), was employed. Psychomotor reaction time (PRT) and frequency of movements (FM) in 10 s, which reflects mobility of central nervous system, was measured by electric reactiometer (Baltec Sport, Lithuania). Repeated anaerobic alactic working test of 5x6 seconds duration with 24 seconds rest intervals performed with ergometer "Monark 894 E" (Sweden) was included into testing program (Ellis et al., 2000). Average capacity for each working interval was calculated, and fatigue index estimated with regard to capacity decrease after each time carrying out the load. "Hexagon" test was used to measure agility, performing 18 jumps on the special platform (Brittenham, 1996). Circulatory and respiratory systems' functional capacity was evaluated by Ruffier index (RI) and resting heart rate (Skernevičius, Raslanas, & Dadelienė, 2004).

Method of systemic analysis was employed to perform comparative analysis of Lithuanian deaf basketball national team players' game indicators. Results of the matches, which were achieved by the team in 2013 Deaflympics, were compared to the results of the same matches in 2005 and 2009, in which Lithuanian players became the winners of bronze and silver medals, respectively.

Using official FIBA game registration protocols during the matches, the following average indices were analysed:

1) total field goals (percentage);
2) two-points field goals (percentage);
3) three-points field goals (percentage);
4) free throws field goals (percentage);
5) defensive rebounds;
6) steals;
7) assists;
8) turnovers;

9) personal fouls;
10) number of fast breaks;
11) effectiveness of fast breaks during matches (percentage).

The research data were analysed using the methods of mathematic statistics. Mean ($\bar{X}$), standard deviation *(S)* and standard error of the mean *(Sx)* were calculated. Maximum and minimum values of indices of the investigated are provided, coefficient of variation (*V, %*) calculated. For establishment of reliability of mean differences for the investigated groups, Student's *t* criterion was applied, considering significant difference at $p < .05$.

The participants were fully informed of any risks and discomforts associated with the study. The health screen was repeated before each laboratory visit in Lithuanian Sports Medicine Centre. The study received approval from the institution's Ethics Advisory Committee.

## RESULTS

The data of deaf basketball players' height shows (Table 1) that due to little change of team members, this index did not experience much change in all three Games. The highest index of a player of Lithuanian deaf basketball teams, having participated in all three Games, reached 198.5 cm. As for the 2013 basketball team members, average body mass was greater by 1.9 kilos and muscle mass – by 1.4 kilos comparing to 2009 team members body and muscle mass indices, while the data of 2005 body and mass results was exceeded by 6.0 kilos and 3.5 kilos respectively. However, these differences do not possess significance. Results of 2013 team members demonstrate rather wide area of muscle mass dispersion – it ranged from 37.9 to 60.0 kilos. Muscle mass of 2013 basketball team members was greater 3.5 times comparing to 2005 results, and this difference is statistically significant ($p < .05$).

Table 1. **Body development indices of Lithuanian deaf basketball national team members in 2005, 2009 and 2013**

| Indices | Height (cm) | Body mass (kg) | BMI (kg/m²) | Muscle mass (kg) | Fat mass (kg) |
|---|---|---|---|---|---|
| 2005 | | | | | |
| *X* | 189.3 | 81.3 | 22.7 | 43.4 | 9.1 |
| *Sx* | 1.7 | 2.8 | 0.6 | 1.5 | 0.7 |
| *S* | 6.0 | 9.7 | 2.2 | 5.2 | 2.5 |
| 2009 | | | | | |
| *X* | 189.8 | 85.4 | 24.0 | 45.5 | 8.7 |
| *Sx* | 1.9 | 2.5 | 0.5 | 1.5 | 0.7 |
| *S* | 6.7 | 8.5 | 1.8 | 5.2 | 2.3 |
| 2013 | | | | | |
| *X* | 190.1 | 87.3 | 24.2 | 46.9 | 9.0 |
| *Sx* | 1.5 | 2.5 | 0.7 | 1.4 | 0.5 |
| *S* | 5.4 | 9.1 | 2.4 | 5.0 | 1.7 |
| *p* between testing I and III | | | | <.05 | |

Comparison of absolute indices of SMCP shows that the indices of 2009 team players were higher than those in 2005 and 2013 (Table 2), with statistically significant difference ($p < .05$). Same as in 2005 and 2009, in 2013 the relative lowest SMCP of the team player was twice lower than the highest SMCP value of the player. Dispersion of this index in all the investigations ranged from 17.0 to 23.8%. Players' relative AAMP dispersion at the average was rather low ($V = 5.0–5.9$). The highest values of average relative AAMP were reached in 2013 and exposed 17.2 W/kilo. Difference of this value, comparing to the result of 2005, is 1.9 W/kilo, which is statistically significant ($p < .001$). In 2013, value of absolute AAMP also was the highest – it used to increase from 2005 to 2013 in average by 264.5 W, the increase being statistically significant. Psychomotor reaction time used to increase in each of the Games and reached a rather good level as for the persons of this social group. Dispersion of the latter indices also was rather small. PRT and frequency of movements in 10 sec indices of the deaf basketball players underwent not statistically significant changes during preparation for 2005, 2009 and 2013 Deaflympic Games. Agility test result of team members in 2013 was in average higher by 2.6 s than of 2005 team ($p < .05$).

Circulatory and respiratory systems' functional capacity data of 2013 team members were of little difference from 2005 and 2009 team members' average results. In 2005, team Ruffier index was 4.5 ± 1.8, in 2009 it was 4.6 ± 3.1; in 2013 this index increased on average to 3.6 ± 3.0, however, the changes were not significant. Dispersion area of this index for 2013 team members was from –0.4 to 8.4. Resting heart rate was slower (not significantly) for the players-Deaflympic Champions in 2013. For the 2005 team members it was in average 58.3 ± 6.6, for the players in 2009 – 58.8 ± 8.4, and for the 2013 – 54.2 ± 7.6 b/min.

Team players of 2013 were tested for 5 x 6 s duration anaerobic alactic repeated maximum load, as it allows presumption on players'

anaerobic alactic muscle capacity and endurance in performing repeated work. Fatigue index after each load used to be established, comparing it to the result of the first load. The data of this test are presented in Table 3 and show decrease in the result by 14.64 after the third load, by 20.16 after the fourth load, and by 21.60% after the fifth load.

Comparison of Lithuanian deaf basketball team game results in the 20th (2005), 21st (2009) and 22nd (2013) Deaflympic Games (Table 4) shows that the majority of competitive activity indices of the Lithuanian team in the Games of 2013 were higher than those of 2005 and 2009.

It is worth mentioning the number of matches played: in 2013 Games, 6 matches were played, and in 2009 – 5 matches. In 2009 Games in Taipei, Lithuanian team met Hong Kong, Taipei, Venezuela, Israel and the USA national teams, and in finals was defeated by the latter. In 2013, their opponents were the national teams of Taipei, Argentina, Greece, Russia, Ukraine, and Venezuela. Decreased precision of throws during

Table 2. **Comparative characteristics of Lithuanian deaf basketball national team members' muscle capacity, psychomotor functions, agility and blood circulatory system's functional capacity results in 2005, 2009 and 2013**

| Indices | SMCP | | AAMP | | PRT, (ms) | FM (t/10 sec) | Agility (sec) | RI | Resting HR (b/min) |
|---|---|---|---|---|---|---|---|---|---|
| | W | W/kg | W | W/kg | | | | | |
| **2005** | | | | | | | | | |
| *X* | 1741.0 | 21.8 | 1228.3 | 15.3 | 192.8 | 71.6 | 14.7 | 4.5 | 58.3 |
| *Sx* | 82.3 | 1.1 | 43.4 | 0.2 | 6.5 | 2.2 | 0.6 | 0.5 | 1.9 |
| *S* | 285.4 | 3.9 | 196.8 | 0.8 | 22.6 | 7.6 | 2.2 | 1.8 | 6.6 |
| *V, %* | 16.4 | 17.7 | 7.8 | 5.0 | 11.7 | 10.6 | 15.0 | 39.8 | 11.3 |
| *Min* | 1224 | 12.8 | 899 | 14.41 | 164 | 60 | 11.5 | 0.0 | 44 |
| *Max* | 2182 | 26.2 | 1425 | 17.0 | 250 | 84 | 18.9 | 6.8 | 69 |
| **2009** | | | | | | | | | |
| *X* | 2121.1 | 26.0 | 1407.8 | 16.6 | 177.5 | 78.1 | 12.5 | 4.6 | 58.8 |
| *Sx* | 137.4 | 1.8 | 33.9 | 0.3 | 4.5 | 1.9 | 0.3 | 0.9 | 2.4 |
| *S* | 476.1 | 6.2 | 117.6 | 1.0 | 15.7 | 6.6 | 1.1 | 3.1 | 8.4 |
| *V, %* | 22.4 | 23.8 | 8.4 | 5.9 | 8.9 | 8.4 | 9.0 | 66.7 | 14.7 |
| *Min* | 1511 | 16.1 | 1257 | 15.1 | 150 | 64 | 10.8 | –1.6 | 44 |
| *Max* | 3184 | 38.8 | 1607 | 18.2 | 200 | 88 | 14.7 | 10.0 | 72 |
| **2013** | | | | | | | | | |
| *X* | 2113.1 | 24.2 | 1492.8 | 17.2 | 173.8 | 77.7 | 12.1 | 3.6 | 54.2 |
| *Sx* | 129.0 | 1.1 | 31.5 | 0.3 | 2.5 | 2.0 | 0.3 | 0.8 | 2.1 |
| *S* | 465.1 | 4.1 | 113.5 | 1.0 | 9.1 | 7.1 | 1.1 | 3.0 | 7.6 |
| *V, %* | 22.0 | 17.0 | 7.6 | 5.7 | 5.2 | 9.1 | 8.7 | 82.5 | 14.0 |
| *Min* | 1397 | 16.4 | 1287 | 15.5 | 159 | 62 | 10.7 | -0.4 | 40 |
| *Max* | 3170 | 29.7 | 1736 | 18.6 | 195 | 92 | 13.8 | 8.4 | 68 |
| *p – I–III* | < .05 | | < .01 | < .001 | | | < .05 | | |

Table 3. **Lithuanian deaf basketball national team members' anaerobic alactic muscle power in performing repeated 5 x 6 s load and index of fatigue**

| Indices | Load 1 | | Load 2 | | Load 3 | | Load 4 | | Load 5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | W | W/kg | W | W/kg | W | W/kg | W | W/kg | W | W/kg |
| *X* | 898.1 | 10.4 | 853.9 | 9.9 | 766.5 | 8.9 | 716.1 | 8.3 | 669.2 | 7.8 |
| *Sx* | 65.1 | 0.5 | 57.0 | 0.4 | 57.5 | 0.4 | 51.1 | 0.4 | 51.9 | 0.4 |
| *S* | 234.8 | 1.8 | 205.5 | 1.5 | 207.3 | 1.6 | 184.4 | 1.3 | 187.0 | 1.5 |
| *V, %* | 26.1 | 17.3 | 24.1 | 15.2 | 27.0 | 17.6 | 25.8 | 16.1 | 27.9 | 19.7 |
| *Min* | 572.0 | 7.2 | 607.0 | 7.6 | 528.0 | 6.6 | 526.0 | 6.6 | 465.0 | 5.8 |
| *Max* | 1486.0 | 14.4 | 1403.0 | 13.6 | 1330.0 | 12.9 | 1188.0 | 11.5 | 1120.0 | 10.9 |
| *Fatigue (%)* | | | 1–2 | 4.91 | 1–3 | 14.64 | 1–4 | 20.26 | 1–5 | 21.60 |

Table 4. **Characteristics of Lithuanian deaf basketball national team members in three Deaflympic Games**

| No | Indices | 2005 Melbourne | 2009 Taipei | 2013 Sofia |
|---|---|---|---|---|
| 1. | Rank in the Deaflympic Games | 3 | 2 | 1 |
| 2. | Precision of throws during the game, % | 45.7 | 56.0 | 49.2 |
| 3. | Two-points field goals, % | 51.1 | 64.0 | 55.3 |
| 4. | Three-points field goals, % | 32.6 | 33.0 | 33.4 |
| 5. | Free throws field position, % | 69.4 | 56.0 | 67.5 |
| 6. | Defensive rebounds | 31.8 | 28.0 | 30.0 |
| 7. | Offensive rebounds | 10.6 | 17.0 | 12.2 |
| 8. | Steals | 10.2 | 17.8 | 14.7 |
| 9. | Assists | 16.2 | 22.4 | 14.5 |
| 10. | Turnovers during the game | 18.2 | 21.4 | 22.8 |
| 11. | Fouls during the game | 26.6 | 21.0 | 22.7 |
| 12. | Number of fast breaks during the game | 18.0 | 21.6 | 13.8 |
| 13. | Effectiveness of fast breaks, % | 57.0 | 62.0 | 62.3 |

the matches was due to stronger opponents, victories were harder to achieve, and Lithuanian team's advantage was not so great comparing to Taipei Games.

Comparison of two-point throws precision results shows that it reached 51.5% in 2005, 64% in 2009, and 55.3 in 2013. Three-point throw precision since 2005 had a tendency to increase from 32.6 to 33.0 in 2009 and to 33.4 in 2013; in the last Games, free throws were also more precise (67.5%) than in Taipei. More successful participation of the Lithuanian team in 2013 was due to the increase of several other game parameters, such as the number of defensive rebounds, also more effective fast breaks. Even though the number of defensive rebounds was in a little increase, the number of offensive rebounds was less. Average number of steals and assists during the matches in 2013 Games was less, but it was covered by more effective fast breaks.

## DISCUSSION

The presented review of Lithuanian deaf basketball players' sport results proves their strong position at international level for a number of years. The players' preparation and aspects of competitive activity have been constantly investigated (Dadelienė et al. 2011; Milašius et al., 2007; Šatas et al., 2005, 2010; Šatas, & Milašius, 2008 a, b; Šatas, & Radžiukynas, 2003). Indices of basketball players' height experienced little change during the period of investigation due to little change of the team players, however, muscle mass used to increase significantly ($p < .05$). Considering rather small number of people with deafness disability in general, some indices of basketball players selected to Lithuanian national team fall behind those of the healthy subjects in this sport (Paulauskas, Skernevičius, & Paulauskienė, 2009). The greatest lack is felt for high centre forward over 200 cm (Šatas, Milašius, & Dadelienė, 2010). Due to significant increase in muscle mass, body mass indices dispersion was rather wide – from 76.2 and 106.7 kilos.

Physical capacity analysis of deaf basketball players showed muscle mass increase due to training process, which was of influence for game activity. The same results were obtained by other authors who were investigating preparation of healthy basketball players (Apostolidis, Narsis, Balatoglaut, & Geloudas, 2004; Dembinski, 2003; Paulauskas, 2008). Comparison of Deaflympic champions' physical capacities, such as single muscle contraction capacity and anaerobic alactic muscle capacity with the indices of team players in previous years highlights the fact that in 2013, Lithuanian deaf basketball national team members were of greater physical capacity (Šatas et al., 2005, 2010; Šatas & Milašius, 2008 a, b). Capacity is very important in basketball players' take-off phase in performing jump, as well as in the first step and next three steps, as it determines the number of rebounds, quality of technique elements and game speed. We presume that higher values of capacity and agility indices before 2013 Games had positive impact on the game quality. Nevertheless, comparison of these indices with the ones of healthy basketball players shows lower

results for deaf players (Balčiunas, Garastas, & Stonkus, 2009; Paulauskas et al., 2009). 5 x 6 s repeated anaerobic alactic capacity and endurance test showed that working capacity after the fifth load had decreased by 21.6%, comparing to the first workload. These results, compared with Paulauskas et al.'s (Paulauskas, Dadelienė, Paulauskienė & Skernevičius, 2012) research data on elite and young basketball players' anaerobic alactic capacity and endurance, show the data difference of the healthy basketball players being only 9.48 and 9.12%. Circulatory and respiratory systems' functional capacity of deaf basketball players' national team members in the last period of preparation for 2013 Games was of good level and this allowed to keep sufficient working capacity throughout tournament.

Lithuanian deaf basketball national team performance in Deaflympic Games tournament was effective, which is confirmed by winning gold medals. Lower level of certain game components was covered by better quality of the other components.

## CONCLUSIONS

1. Lithuanian deaf basketball national team members have demonstrated better results in muscle mass and reached higher physical capacities comparing to the participants of the previous Games. This increase resulted in improved quality of the game and for the first time becoming gold medal winners.

2. Comparative analysis of game indices of the teams, having participated in various Games showed that the majority of the competitive activity indices reflected certain positive trends of change in 2013 Games in Sofia: field of goals precision was 49.2%, the high number of defensive rebounds and fewer turnovers during competitions allowed very effective fast breaks.

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