RELATIONSHIP BETWEEN SPORTS EXPERIENCE AND ANTHROPOMETRIC INDICES AND SPORT PERFORMANCE IN WORLD WOMEN'S HANDBALL CHAMPIONSHIP'2009

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ABSTRACT

Research background and hypothesis. The increasing demand for ever higher top level has meant greater interest and research into the factors which influence performance and sporting achievements. Handball is a complex sport whereby performance can be analyzed and presented in a variety of ways. We hypothesized that teams with players with higher anthropometric indices and greater sporting experience had better possibilities in winning a match-play.

Research aim was to assess the interaction between players' height, body mass, body mass index (BMI), age, sports experience and sport performance in the World Women's Handball Championship'2009 (WWHC'2009).

Research methods. The data sets were collected from the IHF website (http//www.ihf.info). We analyzed the height, body mass, body mass index (BMI), sporting experience (international matches played and goals scored) of 390 players as well as their influence on winning points (Pearson's correlation) and final ranking position (Spearman's Correlation) of WWHC'2009.

Research results. Champions from Russia, the first four seat players and European women players were greater in body size (height, body mass), and sports experience.

Discussion and conclusions. Teams composed of players with greater experience had more possibilities to win ($r = 0.719$; $p < 0.001$; $Y = 0.1571x + 4.9104$; $r^2 = 0.5183$), but body mass had negative influence ($r = 0.317$; $Y = 0.5353x – 25.598$; $r^2 = 0.1008$) as well as BMI ($r = –0.3300.$; $Y = –2.0762x + 57.273$; $r^2 = 0.1089$). The height of players had moderate influence ($r = 0.551$; $p < 0.001$) on wining a match-play. It should be noted that the players in the last elite-level competition (European Women's Handball Championship'2010) showed the same tendency and were taller and heavier than the players of WWHC'2009.

Keywords: Women's Handball, body mass, height.

INTRODUCTION

Athletes with specific body structure characteristic of a particular sport have gained significant achievements in sports (Norton, Olds, 2001). However, considering the development of sports and the permanent changes of athletes in the national teams, it is necessary to study the changes in athletes' body composition permanently (Jones et al., 2008).

It has been asserted that handball players' physique (body mass, height) as well as of those in other sports, has a significant impact on athletic outcomes (Bayios et al., 2006; Massuca, 2011; Michalsik et al., 2011). However, the results are sometimes quite controversial, unique to the sample of high skilled or elite athletes. The influence of anthropometric indicators (height, body mass) on sports performance in elite sport might be at different levels: moderate or even insignificant (Bezerra, Simão, 2006). For this reason, it is necessary to establish the trends of interaction between body composition and sport performance permanently.

To date, most of the literature on team handball focuses on elite men's handball players' anthropometric characteristics, competition experience and their interaction with athletic performance. Only a few studies have evaluated peculiarities and tendencies of sport performance in elite women's handball. However, there is no publication related to the last Women's World Handball Championship'2009 (WWHC'2009). It is highly important to find out the influence of body composition (height and body mass, body mass index [BMI]), age, sports experience (international matches played and the goals scored) indicators on sport performance; thus, to carry out discriminant analyses between winners and losers in elite women modern handball.

The hypothesis. The team whose players were higher, had greater body mass and sports experience had better possibilities in winning the match and rank in WWHC'2009.

The aim of the study was to assess the peculiarities of sport performance in WWHC'2009 and the influence of player's body composition, age, sports experience on sport performance.

RESEARCH METHODS

The data sets were collected from the International Handball Federation (IHF) website (http//ww.ihf.info) cover database of the WWHC'2009. We used the data about 24 teams with 390 players, their anthropometric characteristics (height, body mass and body mass index), age, sports experience (international matches played and the goals scored). Body mass index (BMI) was calculated by the formula (Carter, 1984) BMI = body mass (kg)/height^2 (m). The indicators of champions, teams winning of 1–4, 5–12 and 13–24 places, and between teams representing continents were compared. The level of significance was conducted at $p < 0.05$, and the magnitude between values was assessed by using standard effect size (*ES*) analysis procedures (Hopkins, 2006) using previously established scales (Hopkins, 2002): trivial < 0.2, small 0.2–0.6, moderate 0.6–1.2, large 1.2–2.0, very large > 2.0. Pearson's product moment correlation was used to examine the relationships between the analysed indicators and winning points, and Spearman's correlation coefficient was used to evaluate relationships in ranking places. The indicators of champions, teams winning 1–4, 5–12 and 13–24 places, and between have representing different continents were compared using a general linear model analysis of variance (ANOVA), with Tukey Post Hoc test using Excel 2003 and statistical package SPSS 17.0.

RESEARCH RESULTS

Height. The height was typical of teams which took higher places in the ranking scale (Table 1, 2). The champions – Russian players ($p < 0.01$; ES = 0.850 [moderate]), the players of 1–4 teams ($p < 0.01$; ES = 0.450 [small]), and European handball players ($p < 0.001$; ES = 0.349 [small]) were higher than the tournament player on average (Table 1). Players of 13–24 teams ($p < 0.01$; ES = 0.252 [small]), players of Africa ($p < 0.02$; ES = 0.320 [small]), and America ($p < 0.01$; ES = 0.437 [small]) continents were smaller than the tournament player on average. Russian players exceeded the players of the lowest 5–12 teams ($p < 0.01$; ES = 0.746 [moderate]), and of 13–24 teams ($p < 0.001$; ES = 1.085 [moderate]) in the ranking scale. African ($p < 0.001$; ES = 1.218 [large]), American ($p < 0.001$; ES = 1.27 [moderate]), Asian ($p < 0.001$; ES = 1.015 [moderate]), Australian ($p < 0.01$; ES = 0.957 [moderate]) and European handball players ($p < 0.05$; ES = 0.545 [small]) were smaller than Russian players. Players of 1–4 teams were taller than players of 5–12 ($p < 0.05$; ES = 0.309 [small]) and of 13–24 ($p < 0.001$; ES = 0.703 [moderate]) teams, as the players of 5–12 teams ($p < 0.001$; ES = 0.436) compared to the lowest (13–24) ones. European handball players were significantly taller ($p < 0.001$) compared to handball players of the continents of Africa (ES = 0.707 [moderate]), America (ES = 0.804 [moderate]) and Asia (ES = 0.540 [small]), but not significantly higher ($p > 0.05$; ES = 0.416 [small]) than the players of Australian continent.

Body mass. Variation of body mass was opposite to the height (Table 1, 2). Teams including players with the heavier body mass took lower places. Asian handball players had statistically significantly ($p < 0.01$; ES = 0.365 [small]) lower body mass than the tournament player on average. Russian players were heavier in their body mass than the players of 5–12 teams ($p < 0.02$; ES = 0.613 [moderate), Asian ($p < 0.01$; ES = 0.883 [moderate]) and American handball players ($p < 0.05$; ES = 0.333 [small]). The players of 1–4 teams were heavier in their body mass ($p < 0.05$; ES = 0.373 [small]) than players of 5–12 teams. European handball players were heavier ($p < 0.001$; ES = 0.548 [small]) compared to players of the Asian continent, but

not significantly ($p > 0.05$) compared to players of other continents. Asian handball players had less body mass ($p < 0.01$; ES = 0.503 [small]) compared to players of the African continent.

Body mass index. BMI indicator was adequate to body mass (Tables 1, 2). BMI of Asian players ($p < 0.01$; ES = 0.349 [small]) and players of lower 5–12 teams were smaller ($p < 0.01$; ES = 0.286 [small]) than that of the tournament player on average. BMI of African players were higher ($p < 0.001$; ES = 0.489 [small]) than that of the tournament player on average. Players of 5–12 teams had lower ($p < 0.001$; ES = 0.482 [small]) BMI than players of 13–24 teams. African handball players had greater BMI than Russian handball players ($p < 0.05$; ES = 0.773 [moderate]). BMI of African players ($p < 0.01$; ES = 0.642 [moderate]) and American ($p < 0.02$; ES = 0.056 [trivial]) players were less compared to the ones of players of the European continent. BMI of Asian handball players were significantly less ($p < 0.001$) compared to the ones of players of Africa (ES = 0.815 [moderate]) and America (ES = 0.090 [trivial]).

Age. African handball players were older ($p < 0.01$; ES = 0.350 [small]), Asian handball players were younger ($p < 0.02$; ES = 0.318 [small]) than the tournament player on average. The players of 1–4 teams were older than players of 5–12 teams ($p < 0.05$; ES = 0.301 [small]). European handball players were significantly older than the Asians ($p < 0.001$; ES = 0.495 [small]), Americans ($p < 0.05$; ES = 0.380 [small]) and Australians ($p < 0.05$; ES = 0.504 [small]), but not significantly older ($p > 0.05$) than the Africans. African handball players were older than Asian ($p < 0.001$; ES = 0.659 [moderate]), Australian ($p < 0.02$; ES = 0.649 [moderate]) and American ($p < 0.01$; ES = 0.567 [small]) handball players, but insignificantly older than European players ($p > 0.05$).

Sports experience (international matches played). The players of 1–4 teams ($p < 0.02$; ES = 0.312 [small]) and European ($p < 0.05$; ES = 0.205 [small]) handball players had played more international matches than the tournament player on average (Tables 1, 2). Players of lowest 13–24 teams ($p < 0.01$; ES = 0.284 [small]) and Australian ($p < 0.01$; ES = 1.051 [moderate]) handball players had played fewer international matches than the tournament player on average. Russian players had played more international matches than Australian players ($p < 0.01$; ES = 1.307 [large]). Players of the lowest 13–24 teams had played significantly fewer

Table 1. **Body size, sports experience of players of different continents and ranking scale at WWHC'2009 ($\bar{x} \pm s$)**

Players	Height, cm	Body mass, kg	BMI	Age, years	International matches played	Goals scored
Mean, n = 390	174.6 ± 7.1	68.4 ± 7.9	22.1 ± 1.1	24 ± 3.7	46 ± 47	111 ± 146
Champions, n = 16	180.5 ± 6.7 ***	72.3 ± 7.5	22.4 ± 1.9	24 ± 3.7	53 ± 44	136 ± 155
1–4th places, n = 67	177 ± 6.3 ***	70.6 ± 7.5	22.3 ± 1.8	25 ± 3.8	62 ± 54 **	149 ± 149
5–12th places, n = 133	175.7 ± 6 &&&	67.8 ± 7	21.9 ± 1.6 ***	24 ± 3.8	51 ± 48	121 ± 153
13–24th places n = 190	172.7 ± 7.5 ***&&&&	68.2 ± 8.4 &&	22.8 ± 2	24 ± 4.2	34 ± 40 ***	84 ± 128
European continent players, n = 179	177 ± 6.3 ****&	69.6 ± 6.9	22.2 ± 1.5	25 ± 3.7	56 ± 50 *	133 ± 148
Asian continent players, n = 83	173.2 ± 7.7 &&&& @@@@	65.5 ± 7.9 ***&&& @@@@	21.8 ± 1.7 ***	23 ± 4 ***@@@@	35 ± 43 @@@	81 ± 128 @
American continent players, n = 48	171.4 ± 7.5 ***&&&& @@@@	69.8 ± 7.4 &	23.4±2.3 @@	23±3.2 @	47 ± 33	193 ± 67
African continent players, n = 66	172.4 ± 6.5 **&&&& @@@@	69.8 ± 9.2	22.9±1.7 **** &&&&@@@	25±4.2 **	34 ± 49 @@@	101 ± 193
Australian continent players, n = 14	174.4 ± 6 &&&	68.7 ± 8.8	22.5 ± 2.2	22 ± 5 @	10 ± 20 ***&&& @@@@	16 ± 26 *&& @@@@

Note. * – $p < 0.05$; ** – $p < 0.02$; *** – $p < 0.01$; **** – $p < 0.001$ compared with the average value; & – $p < 0.05$; &&& – $p < 0.01$; &&&& – $p < 0.001$ compared with champion's value; @ – $p < 0.05$; @@ – $p < 0.02$; @@@ – $p < 0.01$; @@@@ – $p < 0.001$ compared with European value.

Table 2. **Body size, sports experience of players of different teams at WWHC'2009 ($\bar{x} \pm s$)**

Country	Height, cm	Body mass, kg	BMI	Age, years	Sports experience	
					International matches played	Goals scored
Russia	180.5 ± 6.7***	72.3 ± 7.5	22.1 ± 1.1	24 ± 3.7	53 ± 44	136 ± 155
France	177 ± 5.9	69.2 ± 7.5	21.9 ± 1.9	24 ± 3.8	51 ± 44****	110 ± 93**
Norway	178.1 ± 4.9*			26.6 ± 3*	87 ± 70	204 ± 198
Spain	175.1 ± 7.1	70.4 ± 7.6	22.9 ± 2.2	26 ± 4.6	57 ± 49	144 ± 175
Denmark	175.5 ± 6.1	70.6 ± 7.1	22.8 ± 1.3	25 ± 3.9	54 ± 40	98 ± 46
Korea	172.4 ± 5.4	62.3 ± 6.4***	20.9 ± 1.4***	24 ± 4.4	67 ± 51**	182 ± 179
Germany	176.2 ± 7.5	69.6 ± 6.8	22.4 ± 1.4	25 ± 2.4	76 ± 59	126 ± 118
Romania	177.3 ± 4.6	69.7 ± 6.2	22.1 ± 1.6	26 ± 3.2*	65 ± 47	201 ± 207*
Hungary	176.8 ± 5.7	67.6 ± 6.3	21.5 ± 1.3	23 ± 3	34 ± 38	85 ± 126
Austria	174.5 ± 5.8	66 ± 6.4	21.6 ± 1.4	21 ± 3.9***	52 ± 52	139 ± 199
Angola	174 ± 6.9	69 ± 9.7	22.7 ± 2.3	24 ± 3.3	15 ± 28***	10 ± 28**
China	178.8 ± 4.7**	68.1 ± 4.7	21.3 ± 1	22 ± 3.5*	47 ± 40	
Sweden	177 ± 5.8	71.7 ± 6.1	22.8 ± 1	25 ± 3	55 ± 49	120 ± 116
Tunisia	172 ± 6	65.3 ± 6.5	22 ± 1.6	23 ± 4	69 ± 69	245 ± 287***
Brazil	176.6 ± 7	70 ± 6.8	22.3 ± 1	25 ± 2.8	46 ± 38	88 ± 72
Japan	167.6 ± 5.8****	63.1 ± 4.8***	22.4 ± 1.5	25 ± 3	24 ± 28	63 ± 75
Ukraine	178.8 ± 8*	68.8 ± 7.1	21.4 ± 0.8	26 ± 4.1	28 ± 20	75 ± 71
Ivory Coast	175.3 ± 5.4	74.7 ± 9.9***	24.2 ± 2.3****	27 ± 4.1****		
Argentina	172.1 ± 5.7	67.6 ± 6.8	22.8 ± 1.3	23 ± 3.5	47 ± 28	98 ± 65
Congo	168 ± 5.8****	69.7 ± 8.5	24.6 ± 2.1****	26 ± 4.6	18 ± 9*	47 ± 26***
Thailand	166.6 ± 4.8****	61.1 ± 6.5****	21.9 ± 1.9	20 ± 2.6****	1 ± 1****	10 ± 8
Kazakhstan	179.8 ± 6.8***	72.8 ± 10.7*	22.4 ± 2.3	22 ± 4.4		
Chile	165.5 ± 5.2****	64.5 ± 8	23.5 ± 2.5**	22 ± 2.9		
Australia	174.4 ± 6	68.7 ± 8.8	22.5 ± 2.2	22.8 ± 5	10 ± 20***	16 ± 26**

Note. * – $p < 0.05$; ** – $p < 0.02$; *** – $p < 0.01$; **** – $p < 0{,}001$ compared with the average value.

($p < 0.001$) international matches compared to the players of 1–4 teams (ES = 0.600 [moderate]) and of 5–12 teams (ES = 0.401 [small]). European players had played significantly more international matches compared to the ones of other continents ($p < 0.01$–0.001; ES = small) except Australian continent (ES = 1.304 [large]) and insignificantly compared to American handball players. Australian handball players had played less international matches than the players from America ($p < 0.001$; ES = 1.360 [large]) and Asia ($p < 0.05$; ES = 0.779 [moderate]).

Sports experience (goals scored). The players of 1–4 teams had scored more goals than the players of the lowest 13–24 teams ($p < 0.01$; ES = 0.462 [small]) (Tables 1, 2). European handball players had scored more goals compared to players of the Asian continent ($p < 0.05$; ES = 0.373 [small]). Australian handball players had scored fewer goals than the player of the tournament on average ($p < 0.05$; ES = 1.097 [moderate]), the champions – Russian players ($p < 0.02$; ES = 1.317 [large]), European players ($p < 0.02$; ES = 1.329 [large]), and the players of America ($p < 0.001$; ES = 3.748 [very large]).

DISCUSSION

The results of our research are in line with other researchers who have claimed that the successful outcome of the game is mainly due to handball players' physique (height, body mass) (Bayios et al., 2006; Hasan et al., 2007; Massuca, 2011; Michalsik et al., 2011) body fat and muscle ratio (Vila et al., 2011). Handball players with greater experience have a greater chance of winning a match-play (Schneider et al. 2007; Skarbalius, 2009). Such trend was established in the WWHC'2009. The players of the European continent and players representing the teams winning 1–4 places were more experienced, taller, older and heavier than the players of the WWHC'2009 on average. The same tendency was established in the last European Women's Handball Championship'2010 (Joergensen, 2010). It should be noted that the players of the European Women's Handball Championship'2010 were taller and heavier than WWHC'2009 participants. Handball players were getting taller over time (Taborsky, 2007) such as athletes in many sports have been getting taller and more massive. It could be affirmed that the handball female players were getting bigger at a faster rate than that predicted by the secular trend alone and it is in the line to athletes' development in general (Norton, Olds, 2001).

The question is how players' height and body mass, and BMI influenced sports results. The height of players was a significant indicator to win a match–play ($r = 0.551$; $p < 0.001$; $Y = 0.7627\,x - 121.93$; $r^2 = 0.3043$) (Figure 1). As the competition system of the WWHC'2009 was divided into stages (preliminary, main round, and final) with different mastership level of participating teams, it did not allow teams to take the highest places ($r = -0.278$; $p < 0.01$) in the ranking scale adequate to their mastership level. It can be concluded that the final result of match-play may be influenced by other factors (Hughes, Frank, 2006).

Contrary to the height the body mass indices had a negative impact on winning a match-play ($r = 0.317$; $p < 0.01$; $Y = 0.05353\,x - 25.598$; $r^2 = 0.1008$), winning the tournament score and even to predict the championship places for the teams ($r = -0.067$) (Figure 2). In consequence, greater body mass of players was the limiting factor to win a match-play. This is controversial compared to elite men's handball (Skarbalius, 2009). Negative influence of body mass on sports results in WWHC'2009 could be explained by the phenomenon of the ratio of muscle and fat mass in females (Hatzimanouil et al., 2005). BMI had a negative impact on winning a match-play ($r = -0.33005$; $Y = -2.0762\,x + 57.273$; $r^2 = 0.1089$) and winning the tournament score ($r = -0.230$; $p < 0.01$) (Figure 3).

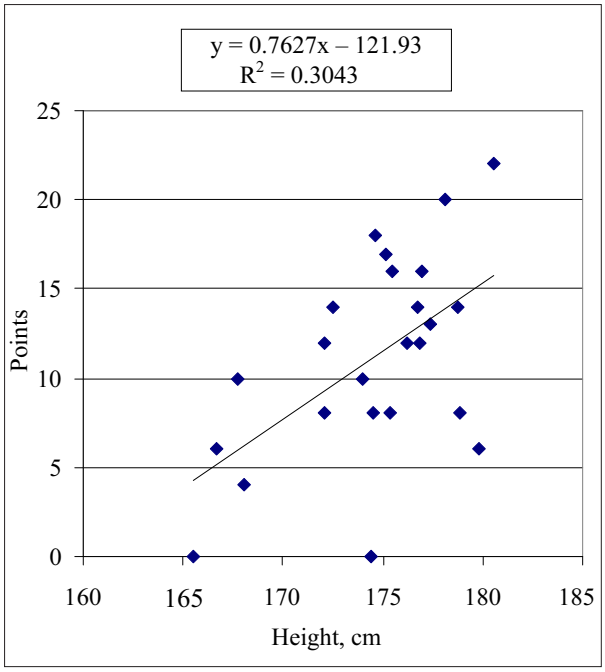

Figure 1. **Relationship between players' height and winning points in WWHC'2009**

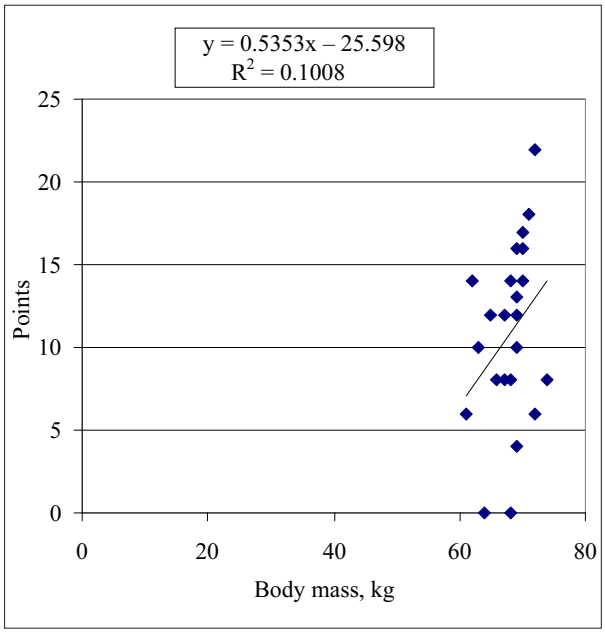

Figure 2. **Relationship between players' body mass and winning points in WWHC'2009**

High-performing athletes are characterized by sporting experience which is highly related to the age of athletes as well (Skarbalius, 2009). F. Taborsky (2011) asserts that the handball players

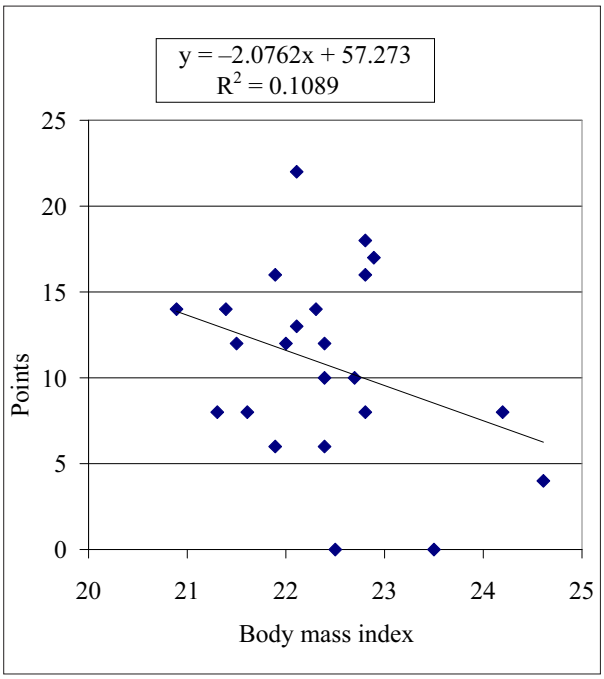

Figure 3. **Relationship between players' BMI and winning points in WWHC'2009**

who participated more in high-level competitions are superior and more mentally fit. Teams, the players of which had more sports experience (international matches played), had more chances of winning a match-play ($r = 0.719$; $p < 0.001$; $Y = 0.1571 x + 4.9104$; $r^2 = 0.5183$) and possibilities to take higher places ($r = 0.356$; $p < 0.01$) (Figure 4). The players of the teams of higher positions (1–12) in the ranking scale had played more than 40 matches. Another indicator of sports experience (goals scored) had a significant impact on winning a match-play in the WWHC'2009 ($r = 0.655$; $p < 0.001$; $Y = 0.052 x + 6.5346$; $r^2 = 0.4296$) (Figure 5). One more significant indicator was the age of players for winning a match-play ($r = 0.504$; $p < 0.001$; $Y = 1.5641x + 26.372$; $r^2 = 0.2547$) (Figure 6). However, a weak relationship was found between the age and the final places in the ranking scale ($r = –0.154$, $p < 0.01$). Such contraversial findings might be explained by not valid enough competition system for the mastership of participating teams (while the teams were divided into groups based on subjective criteria) in WWHC'2009.

On the other hand, such controversial findings might be explained on the variation of interaction during athletes' mastership development. Researchers suggest (Mujika, 2007; Pyke, 2009) that athletes' fitness might be highly correlated with sports results in the group of people varying greatly in fitness, but the correlation may be much lower if similar studies are conducted on a group consisting entirely of elite athletes. The results of WWHC'2009 might be considered to be in line to G. Laffaye and T. Debanne (2011) who stated that within elite handball population height or body mass did not guarantee throwing the ball quickly.

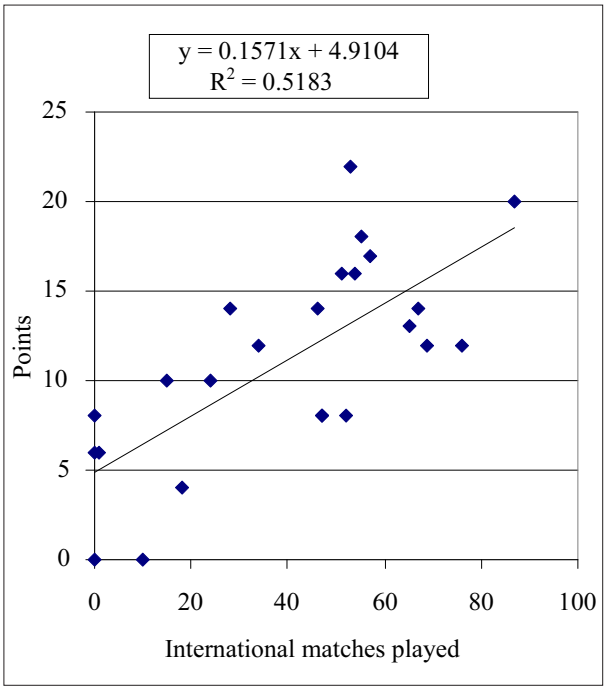

Figure 4. **Relationship between players' sports experience (international matches played) and winning points in WWHC'2009**

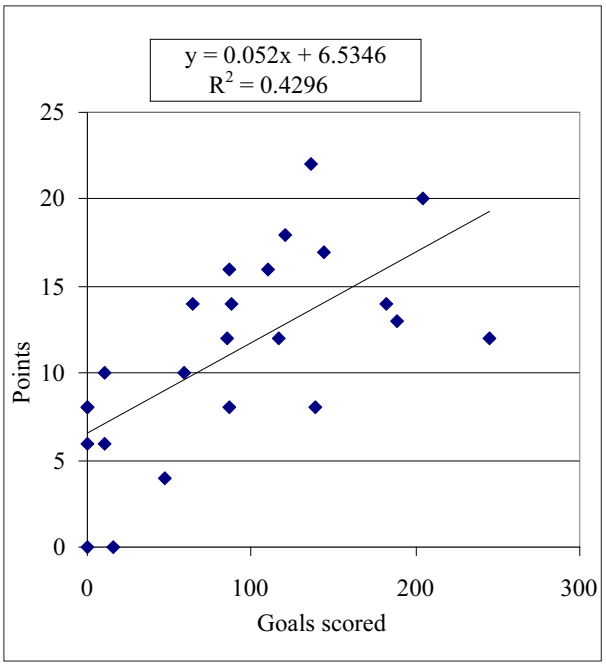

Figure 5. **Relationship between players' sports experience (goals scored) and winning points in WWHC'2009**

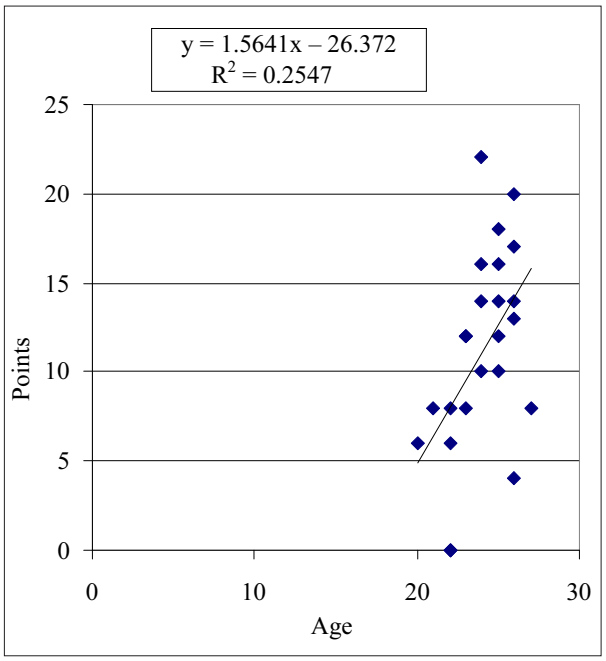

Figure 6. **Relationship between players' age and winning points in WWHC'2009**

CONCLUSIONS AND PERSPECTIVES

Older handball female players, which meant greater sports experience (international matches played and the goals scored), had more possibilities to win in the WWHC'2009.

Sports experience had higher influence than body size (height and body mass) in winning the matches played.

The indices of body mass and BMI had negative influence on winning of match-play.

Future research is needed to reveal the key discriminated indicators for sport performance between winners and losers.

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PASAULIO MOTERŲ RANKINIO ČEMPIONATO'2009 ŽAIDĖJŲ ANTROPOMETRINIŲ RODIKLIŲ, VARŽYBINĖS PATIRTIES RYŠYS SU SPORTINIAIS REZULTATAIS

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SANTRAUKA

Tyrimo pagrindimas ir hipotezė. Sportininkų parengtumas lemia sportinius rezultatus. Rankinio varžybinė veikla kompleksiška, dėl to žaidimo ypatumai gali būti analizuojami įvairiais būdais. Elito rankininkių kūno sudėjimo ir sportinės patirties ryšys su sportiniais rezultatais leistų atskleisti ypatumus, būdingus ne tik konkrečioms aukščiausio rango varžyboms, bet ir sudarytų prielaidas spręsti apie elito rankinio tendencijas. Keliama hipotezė, kad komandos, kurių žaidėjos yra aukštesnės, didesnės kūno masės ir sportinės patirties, turi daugiau galimybių laimėti rungtynes.

Tikslas – nustatyti ir įvertinti 2009 metų pasaulio moterų rankinio čempionato komandų ūgio, kūno masės, kūno masės indekso (KMI), amžiaus, varžybinės patirties ryšį su sportiniais rezultatais.

Metodai. Iš viešai prieinamo Pasaulio rankinio federacijos puslapio duomenų bazės (http//www.ihf.info) atlikta paskutinio 2009 m. XIX moterų rankinio pasaulio čempionato (24 komandų) 390 žaidėjų antropometrinių rodiklių (ūgio ir kūno masės), amžiaus, varžybinės patirties (šalies rinktinei atstovautų rungtynių ir įmestų įvarčių skaičiaus) lyginamoji analizė (skirtumų patikimumas nustatytas Stjudento *t* kriterijumi taikant 95% reikšmingumo lygmenį – $p < 0,05$). Minėtų rodiklių ryšiui su sportiniais rezultatais (pelnytais taškais ir užimtomis vietomis) nustatyti buvo taikyti Pirsono ir Spirmeno koreliacijos koeficientai.

Rezultatai. Čempionės Rusijos žaidėjos, pirmųjų keturių vietų rankininkės ir europietės buvo aukščiausios ir didžiausios sportinės patirties.

Aptarimas ir išvados. Čempionato rungtynių sėkmę lėmė varžybinės patirties rodikliai. Didesnės patirties žaidėjos (pagal žaistų tarptautinių rungtynių rodiklį) turėjo daugiau galimybių laimėti rungtynes ($r = 0,719$; $p < 0,001$; $Y = 0,1571x + 4,9104$; $r^2 = 0,5183$) ir užimti aukštesnes vietas ($r = –0,356$; $p < 0,01$), tačiau neigiamą poveikį turėjo kūno masė ($r = 0,317$; $Y = 0,5353x – 25,598$; $r^2 = 0,1008$) ir KMI ($r = –0,3300$; $Y = –2,0762x + 57,273$; $r^2 = 0,1089$). Paskutinio 2010 metų Europos moterų rankinio čempionato rankininkės (www.eurohandball.com) buvo aukštesnės ir didesnės kūno masės negu PC'2009 dalyvės.

Raktažodžiai: moterų rankinis, kūno masė, ūgis.

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