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# ESTABLISHING TECHNICAL AND TACTICAL PERFORMANCE GOALS FOR ELITE MALE VOLLEYBALL PLAYERS

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**Abstract** The goal of this study was to establish technical and tactical performance goals for elite male volleyball players (Spanish first division). This paper is the result of scientific collaboration between volleyball coaches and researchers. The process of establishing the goals and the reference values of the performance goals was: 1) conceptual analysis, establishing the criteria for the analysis of players' and teams' performance (researchers and coaches); 2) mathematical analysis, data collection and data analysis of the possible performance goals; and 3) practical analysis, establishing the performance goals according to their usefulness and applicability following the SMART principle. Seven performance goals were established to evaluate the technical-tactical actions of the players in training and in competition. Protocols utilized can be used as references of how to calculate the technical and tactical performance goals in sport.

**Key words** sport, performance, monitoring, statistics

## Introduction

Match analysis is common in most field, bat, and net sports. Skill analysis can have different purposes (Coleman, 2002): to inform the media and the public, for team evaluation, team management or during matches, for match evaluation, for training evaluation, and to obtain reference values and/or patterns of the sport. Federations and competition organizers carry out match analysis to inform the media, the public, and the teams. Coaches carry out match analysis to prepare matches (e.g. to scout) and training sessions, to make decisions during matches, and to analyze their teams or other teams in competition. Researchers carry out match analysis to increase the understanding of the sport (e.g. win-lose) and to establish reference values or patterns. Currently, there is a lack

of connection between researchers and coaches (Williams, Kendall, 2007). There are many reasons for this (e.g. channels of communication, way of communicating, interest in communicating, etc.).

One reason for this gap could be the way in which the skill analysis is done. Researchers usually analyze the data with the goal of establishing general tendencies and trends (i.e. generalization), and coaches usually analyze the data by match to prepare their team for a specific match or opponent. Both perspectives of analysis have the risk of being incomplete. Utilizing a global or general perspective risks having data compensate each other and therefore there is a loss of important details, and specific detailed analysis can result in not seeing the big picture due to certain tendencies. The two types of analysis require different protocols, instruments, etc. To improve sport performance, it is necessary to establish links between researchers and coaches. This symbiotic process can help both groups better achieve their objectives. It allows coaches to increase the power of their analysis as well as the resources involved through collaboration. Researchers are able to get familiar with the real problems found in performance sport, the terms, priorities, and ways of communication, and they get more familiar with aspects that affect performance sport.

Volleyball is not immune to this lack of connection. Reference values to guide and interpret teams' and players' actions in a match are not common (e.g. Coleman, 2002). To be useful, an evaluation requires reference values to know whether the result is adequate or not. These values are common in areas such as physical testing or conditioning. For example, in strength training, if weight and speed execution are not monitored, it is not possible to establish whether athletes are working properly (Samozino, Rejec, Prampero, Belli, Morin, 2012). Ideally, if players' skills are going to be evaluated in training and competition, reference values should be available for all levels of competition for both genders (Coleman, 2002). This lack of objective information has caused coaches to use subjective information combined with their accumulative analysis and experience to analyze players' and teams' actions in practice and in competition with regard to technique and tactics. Establishing reference values involves the generalization of the trends and characteristics of a competition. These values will be used by coaches to analyze their players and teams. In theory, the collaboration of researchers and coaches will allow them to realize a strong conceptual analysis of the performance indicators of the sport, to conduct a mathematical analysis of the performance indicators, and to establish usefulness and applicability of performance goals. This process provides an integrated approach that should provide an evidence-based applicable outcome. This research is the result of scientific support provided to volleyball coaches and this paper describes the steps taken in this collaboration process. The goal of this study was to establish technical and tactical performance goals for elite male volleyball players.

## Method

Three steps in the process of calculation and analysis were done in order to establish the reference values of the goals: 1) establishing the criteria for calculating and analyzing the performance (researchers and coaches); 2) data collection (match observation) and descriptive (mean, standard deviation, baseline of won and lost sets, and percentiles) and inferential analyses (Chi-Square Test and likelihood ratio) of the data comparing won/lost sets; and 3) review of the data by coaches and researchers to establish performance goals following the SMART principle (Bull, Albinson, Shambrook, 1996).

The first stage involved the work sessions between researchers and coaches. The goal was to establish the criteria for calculating and analyzing the performance. Three coaches participated in this stage. They had more than

five years of coaching experience in volleyball, they had the highest volleyball coaching certification Spain, and they had bachelor degrees in Sport Science. Likewise, three researchers participated in this stage. Two had more than seven years of experience in coaching volleyball, and all three were university professors and had their doctorate in Sport Science. A total of three meetings were held. The steps followed to establish performance goals from technical-tactical actions from match analysis were (Palao, López-Martínez, 2012): 1) establish the critical aspects of the sport at this level of competition; 2) establish the performance indicators and reference values for the sport; 3) establish the baseline performance indicators and characteristics of the players and teams; and 4) establish the training and competition goals. In the first meeting, there was an introductory part, a brainstorming session, and an organizing session for the tasks to do for the different parts (prepare a list of actions to analyze, criteria, and aspects that would be interesting to analyze). In the rest of the meetings, the proposed list was reviewed by coaches and researchers. At the end of the process, the actions, criteria, and manner of analysis were established. The criteria followed to establish the reference values was the consensus; at least five out of the six participants had to agree on the criteria.

The second stage involved the data collection (i.e. match observation) and data analysis. Three levels in the competition were established according to their final ranking: level 1, 1st–4th; level 2, 5th–8th, and level 3, 9th–12th. One team from each of the different levels of the competition was selected and included in the sample. All matches that the three teams played in the regular season of Spain's men's first division competition were analyzed (2008–2009 season). A sample of ninety sets from 44 matches was analyzed. The variables studied were the efficacy of the different actions (serve, reception, set, attack, block, and dig), the complex or game phase (side-out or defense), and the result of the set. The efficacy was measured in relation to the action's success and the options that the action gave to the attack of the analyzed team and the opponent (Coleman, Neville, Gordon, 1969). An adaptation of the FIVB statistical system and Data project system was used (Data Project, 2008). Terminal actions (serve, spike, and block) were evaluated on a 5-point scale (i.e. error, all opponent attack options, limited opponent attack options, no opponent attack options, and point). Continuity actions were evaluated on a 4-point scale (i.e. error, no attack options, limited attack options, and all attack options).

Data recording and registration was carried out using video cameras and the Data project software. Three trained observers registered the data. Observers were part of the coaching staff of professional volleyball teams with more than four years of experience in peak performance and with formal training in the use of the software. Observations of the matches were done by the observers as part of their jobs with the teams. One observer did inter- and intra-reliability testing with one of the researchers. The values found were greater than 0.82 and 0.98, respectively, utilizing Cohen's kappa. All observers observed a match for quality control. All matches were reviewed by the referent observer to correct the differences in the criteria observed in the match trial.

Data were exported from the Data Project Software to a spreadsheet (Garcia-de-Alcaraz, Palao, 2013). From the raw data, statistical values proposed in stage one were calculated. With this data matrix, descriptive (mean, standard deviation, baseline of won and lost sets, and percentiles) and inferential (Chi-Square Test and likelihood ratio) analyses of the data to compare won/lost sets were done with the SPSS 21 software. Statistical significance was set at 0.05.

The third stage involved a comparison of the results obtained with data from previous studies in the literature (win/loss studies and team levels studies). A review of the studies (found in Web of Knowledge, Sportdiscus, Sponet, and Google Scholar) that analyze the actions studied and the differences between winning and losing was

done with the data found in stage two. The review and establishment of the reference values was done by the same coaches and researchers as in phase one. Coaches and researchers established performance goals following the SMART principle (Specific, Measurable, Achievable, Realistic, Trackable) (Bull et al., 1996). The criteria followed to establish the reference values was consensus, taking into account the usefulness, importance, and possibilities to implement; at least five of the six participants had to agree on the criteria.

## Results

The result of the first stages of the actions, criteria, and manners of analysis is shown in Table 1. The list was composed of six skills analyzed in two phases (team in side-out and team on defense) and in the six rotations. The efficacy was measured in relation to the action's success and the options that the action gave the analyzed team and the opponent. An adaptation of the FIVB statistical system and Data project system was used to measure the efficacy (Coleman et al., 1969; Data Project, 2008). The manners of analysis that were established were: occurrence, percentage, coefficient, ratio, and efficiency (Ejem, 1980; Palao, 2008; Schleuder, 1998).

**Table 1.** List of actions, criteria, and manners of analysis established after stage one

Serve	Reception	Set	Spike	Block	Dig
Occurrence	Occurrence	Occurrence	Occurrence	Occurrence	Occurrence
Percentage	Percentage	Percentage	Percentage	Percentage	Percentage
Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Point-to-error ratio	Efficiency	Efficiency	Efficiency	Efficiency	Efficiency
Efficiency					
Technique	Serve type	Technique	Technique	Technique	Technique
Zone	Technique	Zone	Zone	Zone	Zone
Tempo	Zone	Tempo	Tempo	Tempo	Tempo
Complex	Tempo	Complex	Complex	Complex	Complex
Player role	Complex	Player role	Player role	Player role	Player role
	Player role	Recep/dig efficacy	Recep/dig efficacy	Recep/dig efficacy	

In the second stage, after the data collection and data analysis, significant differences were found in the variables presented in Table 2. In the third stage, a comparison of the results obtained with data from previous studies in the literature (normal values and win/loss studies) was done (Table 3).

**Table 2.** Differences between the teams' won and lost sets in the previous season (data from match analysis of Spain's professional first division volleyball players)

	Won set		Lost set		Sig.
	M	SD	M	SD	
1	2	3	4	5	6
Serve (Coefficient)	1.44	0.19	1.36	0.25	0.126
Serve (Efficiency)	23.37	6.70	17.24	16.11	0.049*
Serve (Error percentage)	9.92	6.12	13.71	6.78	0.008*



1	2	3	4	5	6
Reception (Coefficient)	2.14	0.16	2.04	0.19	0.006*
Reception (Efficiency)	21.16	14.69	17.30	16.00	0.249
Spike (Coefficient)	2.87	0.35	2.60	0.38	0.001*
Spike (Efficiency)	37.39	21.24	24.54	19.77	0.005*
Block (Coefficient)	1.62	0.39	1.25	0.38	0.001*
Block (Efficiency)	8.21	15.45	0.84	17.10	0.039*
Dig (Coefficient)	1.09	0.34	0.90	0.26	0.006*
Dig (Efficiency)	-34.49	20.95	-44.14	15.55	0.021
Counter-attack (Coefficient)	2.66	0.44	2.42	0.56	0.040*
Counter-attack (Efficiency)	26.12	23.77	13.59	27.49	0.026*

Legend: \* – Student t-test for independent samples. Coefficient: average efficacy score of an action on a scale from 0 to 4 for terminal actions and from 0 to 3 for actions of continuity). Efficiency – Percentage of Perfect/Point actions – Percentage of errors (for the serve, the actions that limit the opponent attack were also included; for the dig, the actions that allow the team attack were also included).

**Table 3.** Differences between winning and losing (data from the review of the literature)

	Won set	Lost set	Sig.
Serve (Coefficient)	1.36 <sup>a</sup> –1.44 <sup>b</sup>	1.15 <sup>b</sup> –1.27 <sup>a</sup>	*a
Serve (Efficiency)	-8.8 <sup>b</sup>	-11.0 <sup>b</sup>	*a
Serve (Error percentage)	12.7 <sup>b</sup>	13.8 <sup>b</sup>	*a
Reception (Coefficient)	2.40 <sup>a</sup> –2.59 <sup>b</sup>	2.29 <sup>a</sup> –2.51 <sup>b</sup>	*a
Reception (Efficiency)	62.9 <sup>b</sup>	56.4 <sup>b</sup>	*a
Spike (Coefficient)	2.64 <sup>a</sup> –2.99 <sup>b</sup>	2.50 <sup>b</sup> –2.66 <sup>a</sup>	*a, b
Spike (Efficiency)	31.3 <sup>b</sup>	25.5 <sup>b</sup>	*a, b
Block (Coefficient)	1.29 <sup>b</sup> –1.84 <sup>a</sup>	1.18 <sup>b</sup> –1.58 <sup>a</sup>	*a, b
Block (Efficiency)	-11.9 <sup>b</sup>	-16.2 <sup>b</sup>	*a, b
Dig (Coefficient)	1.85 <sup>b</sup>	1.77 <sup>b</sup>	
Dig (Efficiency)	-1.4 <sup>b</sup>	0.3 <sup>b</sup>	
Counter-attack (Efficiency)	2.92 <sup>a</sup>	2.57 <sup>a</sup>	*a
Dig (Coefficient)	–	–	*a

Legend: Efficiency – Percentage of perfect/point actions minus percentage of errors actions (for the serve, the actions that limit the opponent attack were also included; for the dig, the actions that allow the team attack were also included).

Note: Only studies that analyzed differences between winning and losing or differences between level of competition by sets or complex phases were included (\*Marelić, Rešetar, Janković, 2004; <sup>a</sup> Palao, Santos, Ureña, 2004).

After the review of the data done by the coaches and researchers, the list of reference values was established (Table 4). The expert panel did not eliminate any skills. The analysis by phase only was considered for two skills. Rotation criteria was not given consideration. Only three manners of analysis were finally selected (occurrence, percentage, and efficacy) to ease understanding for the players. The list was reduced to seven performance goals. Coaches' criteria were that in order for goals to be applicable to evaluate players in practice and in competition, there should be few. The serve was the only action with two analysed criteria. The spike was analysed in two-phase moments (side-out and counter-attack). A simulation of the performance goals using info from previous matches was used to test the performance goals during this stage.

**Table 4.** Technical and tactical performance goals for male performance volleyball players (data from match analysis of Spain's professional first division men's volleyball players).

Technique	Criteria	Goal
Reception	Efficacy (Perfect – Error)	55%
Attack	Efficacy (Points – Error)	40–45%
Counter-attack	Efficacy (Points – Error)	20–25%
Serve	Percentage of error	9%
Serve	Percentage of points and actions that reduce the opponent attack options	35–40%
Block	Number of contacts per set	3 points & 3 contacts that allow team to continue playing
Dig	Number of contacts per set	6 contacts that allow team to continue playing

## Discussion

The goal of this study was to establish technical and tactical performance goals for elite male volleyball players (Spain's first division). In the first stage, the experts suggested many options for possible analysis. Ideas from research and previous practical experiences were discussed and reviewed to establish the data needed and the analysis necessary to obtain these data. Researchers' collaboration previous experience with coaches was useful (e.g. Palao, López-Martínez, 2012). To gather ideas and perspectives and promote discussion between the expert panel, several studies and books were reviewed related to the nature of volleyball, related to game complex or the order of actions and related to types of data analysis (e.g. Eom, Schutz, 1992ab; Ejem, 1980; Diaz, 1992; Palao, 2004, 2008; Palao, Manzanares, 2009; Schleuder, 1998). The criteria used to analyze the viability of brainstorm ideas were if they could be adapted to the statistical system used by coaches with their teams (software, human resources, possibility to integrate information into practices and competitions, etc.). It was difficult to unify criteria for the set action in stage one. Different coaches had different ways of understanding this action of the game.

From the first stage, a protocol to extract the data from the software used by the coaches to collect and analyze their teams (Data Volley) was developed. More information about this protocol can be found in García-de-Alcaraz and Palao (2013). This allowed us to extract the data from match analysis software and use statistical packets for the data analysis regarding the results of the set. From the data analysis, the importance of the side-out actions was found. The researchers reviewed the data from the second stage with the data from the research studies found in the bibliography. A report with all these data was presented by the researcher to the expert panels. The possibilities for comparing the data obtained in the second stage with the data from research studies were limited because not all the studies utilized the same unit of analysis (e.g. match, set or rally) or the same way to present the data (e.g. occurrence, percentage, etc.); further, some studies only presented the inferential values. This affects the possibilities coaches have for using the information from these studies by coaches.

The last stage attempted to establish practical outcomes of the work done in previous stages. In this stage, the coaches emphasized that in order to use these performance goals they must be realistic, adjust to their work system, and few in number. For coaches, at least one goal from each skill must be included to have a general perspective of the game and give every skill the same importance. However, coaches decided not to include any goal for the set because of the high level of efficacy, and they included two performance goals each for the serve and spike. Coaches emphasized the importance of the set in the game, but they thought that these data were not

useful enough or that the way to measure this action was difficult to be introduced into their statistical analysis. More studies are needed to analyze the setter's actions (e.g. number of blockers in front of the spiker, use of the jump set, etc.) and the viability of including this measurement in coaches' statistical analysis of the game. During the process of selecting the performance goals, the criteria used to decide which of the performance goals would be included in the final proposed criteria was to determine whether it could be implemented easily in team protocols and whether it would allow coaches to provide information to their players and teams (i.e. usefulness).

The collaboration of coaches and researchers is a key aspect to use scientific knowledge in real situations. This paper describes the stages carried out to apply protocol used in research to develop a proposal of technical and tactical performance goals. The authors believe that this type of collaboration allows us to improve the type of analysis done, get more applicable and useful results, etc. Performance analysis researchers must collaborate with coaches and athletes if they want their studies to be used by elite coaches. Coaches must also collaborate with researchers when they want to innovate, introduce new perspectives and analyses, and update their knowledge with evidence-based information. This type of collaboration contributes toward reducing the gap between sport professionals and researchers.

## Conclusions

Seven performance goals were established to evaluate the technical-tactical actions of the players in training and in competition for Spain's first division men's volleyball teams or a similar level. Protocols utilized and data found can be used as references and as an example of how to calculate technical and tactical performance goals in sports. This paper shows a collaboration between researchers and coaches as an element that generates new applicable knowledge using scientific methods for the professional that uses the knowledge provided by scientific studies in performance analysis. The collaboration between researchers and coaches allowed for the integration of a conceptual analysis of the performance indicators (review of literature and expert analysis), a mathematical analysis of the performance indicators, and an application analysis (usefulness and integration in training). The combination of these approaches provided an applicable realistic outcome that is evidence-based. More studies and collaborations need to be done by researchers and coaches so their work can benefit from each other.

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## CARDIAC REHABILITATION IN HEART FAILURE. PART I, MECHANISM

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**Abstract** Diagnosis and treatment issues among heart failure (HF) patients are becoming one of the most important points in public health of developed countries, largely due to the aging of population and the fact that HF affects mainly the elderly. In this review we would like to focus on pathophysiology of exercise intolerance in patients with heart failure and potential benefits of cardiac rehabilitation (CR).

Analysis of articles in the EBSCO database using keywords: heart failure, cardiac rehabilitation, exercise training, pathophysiology. HF can be described as a composite syndrome which results from structural or functional impairment of ventricular filling or blood ejection. Patients have variety of symptoms which usually are nonspecific. The most frequently occurring symptoms of HF are dyspnea and fatigue, which may restrict exercise capacity, and fluid retention. There are many possible pathophysiological factors involved in the development of exercise intolerance. Based on the available literature pathological changes in central hemodynamic function, pulmonary system, skeletal muscles, endothelial function and neurohumoral system can be distinguished. They play a crucial role in the pathogenesis of HF symptoms and represent a potential curative object.

HF patients are characterized by diminished functional performance. Exercise training has many potential profits in patients with heart failure, including an increase in peak oxygen uptake, improvement in central hemodynamics, peripheral vascular and skeletal muscle function and has become part of evidence-based clinical therapy in these patients.

**Key words** heart failure, cardiac rehabilitation, exercise training, pathophysiology

## Introduction

Diagnosis and treatment issues among heart failure (HF) patients are becoming one of the most important points in public health of developed countries, largely due to the aging of population and the fact that HF affects mainly the elderly. The rate of the heart failure (HF) occurrence is steadily increasing. Despite the progression in

the care of patients with heart failure, it did not improve outcomes among recently hospitalized patients, so it is important to modify strategies to minimize remissions of patients with heart failure (Chaudhry et al., 2010).

HF can be described as a composite syndrome which results from structural or functional impairment of ventricular filling or blood ejection. Patients have variety of symptoms which usually are nonspecific. The most frequently occurring symptoms of HF are dyspnea and fatigue, which may restrict exercise capacity, and fluid retention, which can cause pulmonary/splanchnic congestion and/or peripheral edema. A large number of possible symptoms, with even presentation of no signs of volume overload, makes diagnosis of HF difficult, especially that there is no single diagnostic test for heart failure (Yancy et al., 2013). The disease in question is major cause of morbidity, mortality, hospitalizations, impaired quality of life and disability (Taylor et al., 2014). HF patients experience a reduction in their overall physical activity. HF has poor prognosis: 50% of patients with diagnosed HF die within 5 years (Go et al., 2014).

The HF syndrome may result mostly from impaired left ventricular (LV) myocardial function, but every disorder of pericardium, myocardium, endocardium, heart valves, great vessels or metabolic abnormalities can cause described illness. According to large number of patients, HF may be associated with LV functional abnormalities, ranged from normal LV size and preserved ejection fraction (EF) to severe dilatation and/or reduced EF, which is used in general classification of HF patients. HF patients are divided into following subgroups: HF with reduced ejection fraction (HFrEF) and HF with preserved ejection fraction (HFpEF) depending on EF values. This classification is important because of differing demographics, comorbid conditions, prognosis and responses to therapies (Yancy et al., 2013).

Other classifications of HF, which provide complementary information about severity of HF, are the American College of Cardiology Foundation/American Heart Association (ACCF/AHA) stages and New York Heart Association (NYHA) classification. The ACCF/AHA stages emphasize the development and progression of disease, so it can be used on individuals and populations. On the other hand, the New York Heart Association (NYHA) classes focus on exercise capacity and symptoms of the disease (Yancy et al., 2013).

## Material and methods

Articles in the EBSCO database have been analyzed using keywords: heart failure, cardiac rehabilitation, exercise training, pathophysiology. The available literature was subjectively selected due to its usefulness in showing the pathophysiology of heart failure and the effect of cardiac rehabilitation. Moreover, literature which reveals inconsistency in the results was shown as well.

## Results

### Cardiac rehabilitation

In patients with heart failure, exercise training in form of the cardiac rehabilitation (CR) has many potential profits, including increasing in peak oxygen uptake, improvement in central hemodynamics, peripheral vascular and skeletal muscle function (Lavie, Berra, Arena, 2013). Decrease in cardiac output were primarily hypothesized as being the only restricting factor to physical performance in HF. Furthermore, different changes in vascular function, skeletal muscle and pulmonary function also play significant roles in the pathogenesis of HF symptoms and represent a potential curative objects which author of the training protocol could aim at (Lavie et al., 2013).

## Pathophysiological mechanisms of Exercise Intolerance in Heart Failure

There are many possible pathophysiologic factors involved in the development of exercise intolerance. Recent studies supply information about understanding of oxidative metabolism, molecular changes in skeletal and cardiac muscle, mechanisms of endothelial dysfunction, the role of sympathetic nervous system and inflammatory cytokines (Downing, Balady, 2011).

The low frequency component of heart rate variability could be an indicator of the sympathetic influence on heart functioning (Malliani, Lombardi, Pagani, 1994). The mean low frequency powers in RR interval and resting muscle sympathetic nerve activity were lower in the 21 heart failure patients than in the 12 control subjects (Van De Borne, Montano, Pagani, Oren, Somers, 1997). Moreover, low-frequency power of heart rate variability was a significant predictor of a sudden, presumably arrhythmic death in a multivariate model testing in chronic HF patients (La Rovere et al., 2003).

## Central Hemodynamic Function

Cardiac diseases belong to the main group of reasons impairment of exercise capacity. Unsatisfactory LV shortening with increases in end-systolic and end-diastolic volumes is the clue of response of the central circulation to exercise in the patient with systolic HF (Downing, Balady, 2011). Chronic elevated ventricular filling pressures can provide to secondary pulmonary hypertension and succeeding right ventricular dysfunction (Downing, Balady, 2011). Exorbitant increase in pulmonary capillary wedge pressure is the one of the main causes of exertional dyspnea (Kitzman, Higginbotham, Cobb, Sheikh, Sullivan, 1991).

Authors (Patwala, Woods, Sharp, Goldspink, Tan, Wright, 2009) demonstrated that cardiac resynchronization therapy increases the exercise capacity which might be caused by the improvement in systolic function during the treatment. However, several studies showed a poor correlation between left ventricular ejection fraction and exercise capacity (Franciosa, Park, Levine, 1981; Fleg et al., 1995).

HF with preserved ejection fraction concerns diastolic left ventricular (LV) dysfunction may be caused by for example hypertrophied hearts and with LV remodelling after small myocardial infarctions (Hanrath, Mathey, Siegert, Bleifeld, 1980). Increased resistance to ventricular filling describes diastolic dysfunction. Increased diastolic filling rate needed during physical activity is realized in the normal LV by an increase in chamber expansibility, which provides in an increase in LV diastolic volume without a pressure increase (Downing, Balady, 2011). This mechanism is impaired in patients with diastolic dysfunction which leads to a quick elevation in LV diastolic pressure and pulmonary capillary wedge pressure and can manifest as a dyspnea (Downing, Balady, 2011).

## Pulmonary Function

The deteriorating LV is maintained by increased filling pressures, which next may result in pulmonary abnormalities (Clark, Poole-Wilson, Coats, 1996). The chronic pulmonary venous hypertension causes the pathologic changes in the lung, for example pulmonary vascular damage, fibrosis, pulmonary congestion or oedema (Clark et al., 1996; Ponikowski et al., 2001; Mancini, 1995). Patients with chronic heart failure demonstrate an increased ventilatory response during progressive exercise (Buller, Poole-Wilson, 1990). Studies (Buller, Poole-Wilson, 1990; Sullivan, Higginbotham, Cobb, 1988) showed that there is a linear correlation between minute ventilation and the rate of carbon dioxide production in HF patients during physical exercise.

## **Skeletal Muscle**

Some evidences suggest that exercise capacity have potential peripheral determinants and muscle abnormalities are a part of the chronic HF and induce some symptoms of patients (Harrington et al., 1997). Changes in muscle function may be important contributors to exercise intolerance (Harrington et al., 1997). Study (Sullivan et al., 1990) based on muscle biopsy demonstrated histological abnormalities for example reduction in type I fibers and a shift toward type IIb fibers. Interestingly, researches showed evidence that biochemistry and histology of skeletal muscle can effect on the pathophysiology of exertional fatigue in patients with long-term heart failure (Sullivan et al., 1990). Biochemistry changes depend mainly on reducing mitochondrial-based enzymes, mitochondrial size and in the activity of oxidative enzymes (Clark et al., 1996; Sullivan et al., 1990). Moreover the abnormalities of lower limbs observed in HF can be caused by diminished muscle mass, which lead to increase in fatigue and a decrease in exercise tolerance (Clark et al., 1996). In consequence it leads to the reduction in leg blood flow and increased vascular resistance (Clark et al., 1996).

## **Endothelial function and neurohumoral system**

Several researches showed evidences for abnormal endothelial function in patients with HF (Downing, Balady, 2011). Potential mechanisms of endothelial dysfunction are reduced nitric oxide, increased reactive oxygen species and reduced vasodilatory response to shear stress.

It is worth mentioning, that endothelium plays a crucial role in monitoring vascular tone as well as in preventing platelets and inflammatory cells from adhering to the vascular area (Dimmeler, Zeiher, 2003). It demonstrated disturbed balance between nitric oxide and oxidative stress which provide to local vasoconstriction. Nitric oxide restrains apoptosis of endothelial cell, inflammatory activation, and increases the function of free oxygen radical-scavenging enzymes (Dimmeler, Zeiher, 2003).

Numerous studies showed the role of inflammatory factors in the mechanism of skeletal muscle wasting and fatigue in patients with HF (Anke, Rauchhaus, 1999). Cachectic patients demonstrated elevated plasma levels of cortisol, catecholamines, and aldosterone. Moreover, cardiac cachexia is associated with increased plasma levels of tumor necrosis factor  $\alpha$  (Anker, Rauchhaus, 1999; Vescovo et al., 2000). Inflammatory mediators can provide to muscle catabolism, loss of muscle protein, and apoptosis, which leads to a reduction in exercise capacity (Vescovo et al., 2000).

## **Effects of the physical exercise on HF patients**

Physical exercises have beneficial effects on cardiovascular system. Study with animal models (Rinaldi et al., 2006; Kwak, Son, Lawler, 2006) showed that regular physical exercise provided to antioxidative protection in the myocardium and prevent to cardiomyocyte apoptosis. Moreover, cardiac changes associated with ageing process: decreased elasticity of wall, impaired early LV diastolic relaxation, increased end-systolic LV volume and reduced contractile reserve are inhibited by regular physical training (Arbab-Zadeh et al., 2004; Pugh, Wei, 2001). Studies demonstrated that aerobic training causes neurohormonal balance which concerns with reduction of norepinephrine secretion (Coats et al., 1992). Furthermore, 4-months training based on walking was related with reduction of angiotensin II, aldosterone, arginine vasopeptide, and atrial natriuretic peptide levels (Braith, Welsch, Feigenbaum, Kluess, Pepine, 1999).

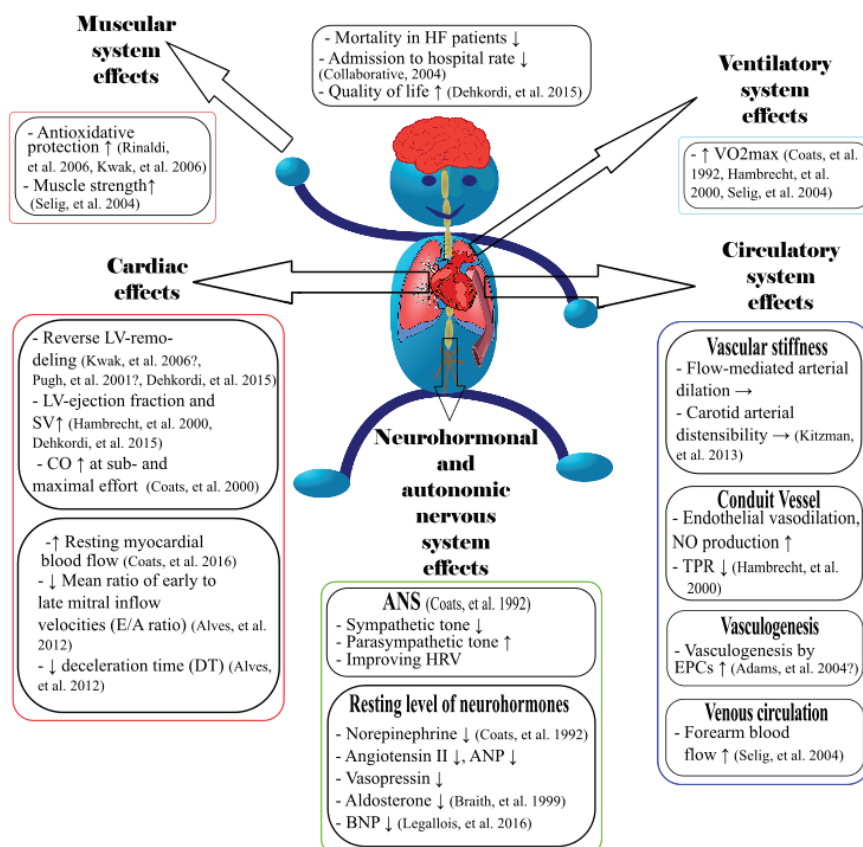


Mobilization of endothelial progenitor cells causes vascular regeneration, for example physical exercise was related with increasing VEGF, which is a main factor of endothelial proliferation (Adams et al., 2004). Moreover, studies which used left common carotid artery recorded using an ultrasound instrument (Kitzman et al., 2013) showed no changes in arterial stiffness after CR implementation.

A positron emission tomography-based study (Legallois et al., 2016) have revealed that rest myocardial blood flow, endothelium-related change in myocardial blood flow from rest to cold pressor test as well as the percentage of myocardial blood flow increase during the cold pressor test, left ventricular ejection fraction, plasma levels of brain natriuretic peptide, VO<sub>2</sub>max were significantly improved in HF patients due to dilated cardiomyopathy after the 12 weeks of the CR (Legallois et al., 2016).

Meta-analysis which included 801 patients (Collaborative, 2004) revealed positive effects of systematic, long-term (circa 700 days) CR. 88 deaths was noted in the exercise group, which constituted 22% of patients and 105 in the control group which stated for 26% of patients. A significant effect of exercise training in mortality and hospital admissions reduction was noted (Collaborative, 2004). Randomized-controlled trial (RCT) (Hambrecht et al., 2000) showed that after 6 months of CR, patients in the intervention group had statistically significant improvements in NYHA functional class, maximal ventilation, exercise time, and exercise capacity as well as diminished resting HR, LV end diastolic diameter and total peripheral resistance (TPR) during peak exercise and improved resting SV and LV ejection fraction.

3-months resistance exercise programme increased high-frequency and lowered low-frequency of heart rate variability in chronic HF patients (Selig et al., 2004). Moreover, such intervention significantly improved muscle endurance and strength (Selig et al., 2004). Moreover, another RCT study (Kitzman et al., 2013) showed that the 16-weeks systematic training protocol did not significantly improved the arterial stiffness, however increased the VO<sub>2</sub>max and quality of life in HF patients. In contrary, brachial artery endothelial-dependent flow-mediated arterial dilation and carotid arterial distensibility, resting left ventricular systolic and diastolic function remained unchanged after the intervention (Kitzman et al., 2013). Additionally, a significant difference in left ventricular diameter and ejection fraction after 24 weeks exercise programme implementation was observed (Dehkordi, Far, 2015). In another RCT (Alves et al., 2012) subjects with moderate to severe systolic dysfunction and advanced diastolic dysfunction CR diminished the mean ratio of early to late mitral inflow velocities (E/A ratio) and improved the deceleration time (DT) compared to the control group (Alves et al., 2012).



**Figure 1.** Selected effects of cardiac rehabilitation on physiological systems

The figure shows effects of CR on the main systems of the organism. “↑” denotes an improvement, “↓” refers to decline, “→” describes lack of effects and “?” denotes insufficient evidence on effects. List of abbreviations: HF – heart failure, VO<sub>2</sub>max – maximal oxygen consumption, LV – left ventricle, NO – nitric oxide, CO – cardiac output, SV – systolic volume, ANP – atrial natriuretic peptide, BNP – brain natriuretic peptide, HRV – heart rate variability, ANS – autonomic nervous system, EPCs – endothelial progenitor cells, TPR – total peripheral resistance.

## Discussion

In the above article we showed studies which demonstrated many potential benefits of CR including improvements in peak oxygen uptake (Kitzman et al., 2013), central hemodynamics (Arbab-Zadeh et al., 2004; Pugh, Wei, 2008; Hambrecht et al., 2000; Dehkordi, Far, 2015), peripheral vascular and skeletal muscle function (Selig et al., 2004), autonomic nervous system function and overall functional capacity. As it was mentioned earlier, exercise and functional capacity are clearly diminished in HF and provide to exertional fatigue and dyspnea and

in consequence reduce quality of life and increase depression (Downing, Balady, 2011). Many studies clarify physiological and biochemical mechanisms of exercise-induced cardiovascular therapeutic effects (Gielen, Schuler, Adams, 2010). It is worth to examine cardiac as well as pulmonary musculoskeletal and nervous system due to the variety of potential sites of CR effects. Moreover, combining few methods of evaluation altogether should be considered. Developing new techniques allows on examination of effects of CR on several levels simultaneously: examinations on molecular level (biochemical parameters) should be assisted by imaging studies (using PET and/or fMRI) and functional examination of cardiopulmonary, musculoskeletal and nervous systems. Studies on CR mechanism can translate to clinical benefit: revealing the most beneficial training protocol in terms of intensity and type of exercise adjusted by the initial health state of the patients would be a challenge for further researches.

## Conclusions

1. There are several pathophysiological factors in HF patients which are considered to be responsible for the exercise intolerance. These multi-systemic factors are, inter alia: hemodynamic, ventilatory, and skeletal myopathic processes.
2. Exercise training has become part of evidence-based clinical therapy in patients with HF.
3. CR has positive effect on organism functioning and improvements in, inter alia, NYHA functional class, maximal ventilation and exercise capacity, due to improvement of systems functioning involving, inter alia, cardiopulmonary, musculoskeletal and nervous.

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## LEVEL OF PHYSICAL ACTIVITY OF THE STUDENTS AT THE UNIVERSITY OF TUZLA ACCORDING TO IPAQ

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**Abstract** The study was conducted using the long version of the International Physical Activity Questionnaire (IPAQ) and the aim of this research is to determine the level of physical activity and differences among students, of the University of Tuzla, in relation to gender. The study was conducted on a sample of 813 students (321 male and 492 female) 1st cycle of studies at the University of Tuzla. The results of present study showed that average level of total physical activity for male students was 6,013.493 MET-minutes/week, while female students showed average level of total physical activity was 4,619.381 MET-minutes/week. We conclude that the total data indicates that in this group of students the physical activity level is sufficient and that there is a lower physical activity among females than males. Also there is a need to continuously take measures for promoting the sports at Universities with the aim of raising the health status of students to a higher level.

**Key words** IPAQ-long, physical activity, male and female students

## Introduction

The level of physical activity (PA) in the adolescent age is declining, and excessive body mass and obesity are growing and are one of the biggest global problems around the world. Low levels of PA and overweight annually take 2.8 million lives (World Health Organization, 2013). Therefore, it is no surprise that physical activity and obesity has lately been one of the most common research subjects and challenges of many international scientists (Wang, Lobstein, 2006). The need of human for physical activity today is certainly one of the main conditions for his survival.

Physical activity is defined as any body movement derived by activating skeletal muscles and resulting in energy consumption (Caspersen, Powell, Christenson, 1985). Defined by the World Health Organization (WHO, 2017), PA includes activities undertaken while working, playing, carrying out household chores, travelling, and

engaging in recreational pursuits and is categorized by intensity levels from low to moderate to high intensity. Previous research consistently shows that inadequate PA is a risk factor for the development of several chronic diseases (Reiner, Niermann, Jekauc, Woll, 2013). Despite the efforts of public health, the level of physical activity of the population of Croatia and other European countries is still low (Jurakić, Pedišić, Andrijašević, 2009; Sjostrom, Oja, Hagstromer, Smith, Bauman, 2006; Van Tuyckom, Van De Velde, Bracke, 2013), which points to the need for a more focused approach to this problem. Some international studies show a high rate of physical inactivity represented in leisure time, in the European countries, which move in the range of 35% to 89% (Haase, Steptoe, Sallis, Wardle, 2004). Additionally, the worrying fact is that physical behavior of students in Europe is not improving because recent studies show similar high rates of inactivity (Bergier, Kapka-Skrzypczak, Bilinski, Paprzycki, Wojtyła, 2012; Romaguera et al., 2011; Sigmundova, Chmellk, Sigmund, Feltlova, Fromel, 2013; Varela-Mato, Cancela, Ayan, Martin, Molina, 2012). Also, previous studies have shown that transition from secondary school education to college may be associated with a significant fall in PA (Bray, Born, 2004).

Sexual differences are interesting because many of the research done so far suggests a different relationship between male and female towards PA and that females are far less willing to participate in different programs of regular PA than males. Namely, the rate of female participation in more active programs, which should be initiated and accepted in early childhood as much as possible, is far below the average (Markuš, Andrijašević, Prskalo, 2008).

Freshman year in this new life chapter faced with numerous university challenges, such as the orientation of the studying system, exams and partial exams, the presence of lectures, change of residence during the study, independent financial budget, interest activities, and all these are just some of the potential new topics in their life they encounter. Thus, such research can be helpful in solving similar problems (Mir, Lichtenberger, Pichler, Wegscheider, 2015). Students sit in the amphitheater, classrooms, libraries, listen to lectures, read and work in groups or on a computer. Continuous, uninterrupted sitting is a sign of today, the way of life and work that is learned very early, no later than we go to elementary school. This structured attitude towards life continues to largely go on through the life profession (Dreger, Huber, 2013). Uniform attitudes towards PA not only bring negative consequences to health but also affect learning ability and learning capacity at all stages of life. Responsible relationships of physical activity are with the development of synapses, the distribution of alertness, the stimulation of neurotransmitter and the oxygen supply to the brain (Gligoroska, Manchevska, 2012; Graf, Koch, Dordel, 2003; Hollmann, Struder, 2003).

International Physical Activity Questionnaire (IPAQ) has been developed to help solve the problems of physical activity or inactivity by experts in 1998 in order to facilitate monitoring of PA based on the global standard (Craig et al., 2003). Since then, this questionnaire has become one of the most used for PA (Van Poppel, Chinapaw, Mokkink, van Mechelen, Terwee, 2010). IPAQ is particularly preferred due to its strictly uniform terms and concepts, which are translated into multiple languages for use on a global scale (Bednarek, Pomykała, Bigosińska, Szygula, 2016). Croatian version of the long IPAQ self-evaluation questionnaire is reliable for measuring the level of specific activity for different areas and intensity of physical activity (Pedišić, Jurakić, Rakovac, Hodak, Dizdar, 2011).

In accordance with the stated, the aim of this research is to determine the level of physical activity and differences among students, of the University of Tuzla, in relation to gender.

## Material and methods

### Participants

The study was conducted on a sample of 813 students 1<sup>st</sup> cycle of studies at the University of Tuzla. All students were healthy with no previous medical condition to prevent them from being physically active and to complete the surveys. Out of the total number of students 321 were male (mean age  $20.07 \pm 1.027$ ) and 492 female (mean age  $19.91 \pm 0.637$ ) of the first year of study. At the beginning of the academic year, students through the subject physical education are offered a range of sports which could be recreationally engaged in, by free choice, with the aim of maintaining health and preventing injury and illness, as well as a happier life span. Student's freshmen at the Faculty of Physical Education and Sports, are not included in this study due to the fact that their faculty program is focused on physical education and sports and they have an advantage over hours spent in PA, at least 4 times a week. The survey protocol was approved by the Scientific Committee of Faculty of Physical Education and Sports, University of Tuzla. The study was voluntary and no incentives were paid to the students.

### Instrument

In order to determine the level of physical activity among adolescents at this age, the International Physical Activity Questionnaire long form (IPAQ) was used. IPAQ describes physical activity in energy expenditure units – minutes per week (MET). Metabolic equivalent of task (MET) is used to estimate the metabolic cost (energy expenditure as reflected by oxygen consumption) of PA – resting metabolic rate. According to scientific reports, one MET is equal to approx.  $3.5 \text{ ml oxygen kg}^{-1} \text{ body weight per min}^{-1}$ . It was determined that the cost of an intensive physical effort is 8 MET per minute, a moderate effort – 4 MET, walking (march, quick walking) – 3.3 MET. The energy cost of the PA is calculated as the MET level multiplied by the standard resting metabolic rate ( $1.0 \text{ kcal/kg/h}$ ). Only the PA lasting longer than 10 minutes was estimated, without rest breaks, and within the last 7 days prior to survey.

The specific types of activity that are assessed in the study are walking (W), moderate-intensity activities (M) and vigorous-intensity activities (V) (assuming that an vigorous-intensity PA is a hard physical effort which forces strongly intensified respiration and considerably accelerated heart rate, a moderate-intensity PA means physical effort with slightly accelerated and make you breathe somewhat harder than normal and slightly accelerated heart rate. Weekly PA was calculated by summing-up the MET obtained during vigorous-intensity PA, moderate-intensity PA and while walking during the entire week. In the methodology of the assessment of the category score of weekly PA of the IPAQ, the following 3 categories were selected:

1. LOW PA - when the total energy expenditure does not reach 600 MET in/week.
2. MODERATE PA - assuming that this expenditure is the effect of 3 or more days of vigorous-intensity PA for a minimum of 20 minutes daily; 5 or more days of moderate-intensity PA and/or walking for at least 30 minutes per day; 5 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum total PA of at least 600 MET-minutes/week.
3. HIGH PA – assuming that this expenditure is the effect of vigorous-intensity activity on at least 3 days achieving a minimum total PA of at least 1500 MET-minutes/week; 7 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum total PA of at least 3000 MET-minutes/week.



## Procedure

The measurement protocol was the same for all faculties. When arriving at the sports hall participants took the survey questionnaires and after explanation and detailed information about the research, objectives and mode of implementation, and that at any moment can turn to for help with possible ambiguities they started to answer the questions. The participants faculty, age and sex were also recorded. Since the survey was anonymous, prior to the start of the survey, respondents were asked to complete the questionnaire as accurately and honestly as possible.

### Data analysis

Analysis of the data was processed using a software system for data. Descriptive statistics (Mean – arithmetic mean, SD – standard deviation, Median and Frequencies in percent (%)) were calculated for each university's participants. Data sets were checked for normality using KS-Kolmogorov-Smirnov test (KS). Significance (p) for all statistical tests was set at  $p \leq 0.01$ . Significant differences between groups were assessed using Mann-Whitney U tests.

## Results

The results (Figure 1, Table 1) of the indicators for category score of PA per gender indicate that of the total number of male students 58.9% of them shows a high level of PA, 32.1% of them shows a moderate level of PA and 9% of them shows a low level of PA. Unlike male students, the results of the female students indicate that of the total number of female students 53.7% of them shows a high level of PA, 33.3% of them shows a moderate level of PA and 13% of them shows a low level of PA.

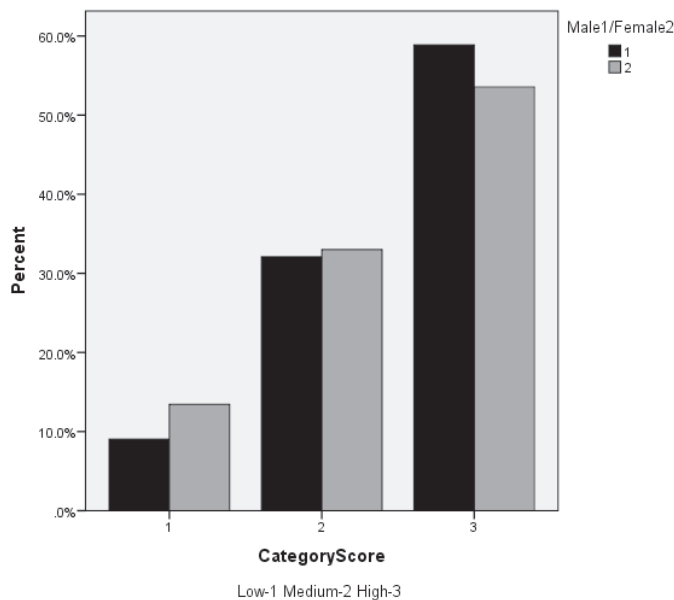


Figure 1. The distribution of physical activity based on IPAQ survey data for category score

**Table 1.** Frequency results of physical activity based on IPAQ survey data for category score (%)

Category score	Male	Female	Total sample
1	9.0	13.0	11.7
2	32.1	33.3	32.6
3	58.9	53.7	55.7
Total	100.0	100.0	100.0

Kolmogorov-Smirnov test (KS) was used to assess the normality of distribution of results for PA of male and female students. The results of the KS test (Table 2), given the significance level, show that the distribution of all the applied variables for assessment of PA for male and female students is statistically significantly different from the normal distribution ( $p = 0.000$ ). It is important to check the normality of the obtained distributions in all the tests performed since the results of the KS test allow the selection of a suitable analysis to determine the difference between the results obtained in all the applied variables in the participants of different groups. As noted above, when computing statistically significant differences between groups of classified by gender, the non-parametric Mann-Whitney U test was used.

**Table 2.** The level of PA of male and female students expressed in MET-minutes/week and statistically significant level of KS test

Physical activity	Walking		Moderate-intensity		Vigorous-intensity		Total	
	male	female	male	female	male	female	male	female
Mean	2,530.540	2,265.221	2,501.290	1,942.488	981.680	411.540	6,013.493	4,619.381
Median	1,815.00	1,724.25	1,260.00	1,080.00	80.00	0.00	4,252.50	3,502.50
Std. Deviation	2,401.991	1,973.874	3,446.701	2,521.064	1,511.525	970.494	5,585.680	3,837.973
KS-test	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

**Table 3.** Results of Mann-Whitney U test between male and female students for PA

Physical Activity	Male1/ Female2	N	Mean Rank	p-level
Walking	1	321	414.48	0.433
	2	491	401.28	
Moderate-intensity	1	321	416.85	0.308
	2	491	399.73	
Vigorous-intensity	1	321	465.30	0.000
	2	491	368.06	
Total	1	321	433.66	0.008
	2	491	388.74	

Considering the results of Mann-Whitney U test (Table 3) for variables for assessment of PA we see that there were statistically significant differences between male and female students in two of the four variables. A statistically significant difference was obtained in the variable for assessment of vigorous-intensity PA at the

level of significance  $p = 0.000$  and in variable for assessing total PA at the level of significance  $p = 0.008$ . When we analyze the results of the Mean Rank we find that in these statistically significant variables, the value of the results is in favor of the male students, respectively, in the aforementioned variables male students have achieved greater levels of PA at a statistically significant level.

## Discussion

The present study was conducted using the long version of the International Physical Activity Questionnaire (IPAQ). The main aim of the presented research was to determine the level of PA and differences among students, of the University of Tuzla, in relation to gender. The results of present study showed that average level of total PA for male students was 6,013.493 MET-minutes/week, while female students showed average level of total PA was 4,619.381 MET-minutes/week. Total data indicates that in this group of students the PA level is sufficient. Also, we found statistically significant differences between genders in our study in favor of male students, while other studies (Kaupužs, 2013) show no significant differences between genders.

Research of Pedišić, Rakovac, Bennie, Jurakić, Bauman (2014) showed a high prevalence of insufficient PA among Croatian university students, 25.1% of females and 24.6% of males, with average level of total PA for male students of 3,241.8 MET-minutes/week and with average level of total PA for female students of 2,979 MET-minutes/week. Students in our study in comparison with Croatian university students have higher levels of PA. However, we must note that students from our study have compulsory course of physical education in the duration of two school classes per week during the academic year. Also students from our study don't live in campus so they need to walk to classrooms, libraries, sport facilities, supermarkets etc., which are located separately, or use various means of transportation, which can affect the level of PA (Zhao, Sigmund, Sigmundová, Lu, 2007).

Similar results as in our study and above mentioned were obtained in study of authors Bednarek et al. (2016) where students from the University of Physical Education in Krakow, Poland get 6,308 MET-minutes/week for male students and 5,599 MET-minutes/week for female students while students from Adnan Menderes University in Aydin, Turkey get 4,527 MET-minutes/week for male students and 2,539 MET-minutes/week for female students, where sample size of students was taken from university programs focused on physical education and recreation.

Here we see a lot of variations between different university programs, and the reason for this may be sport cultural differences (Zhao et al., 2007) or may be driven by a complex suite of interwoven socioeconomic development, technology and urbanization factors (Bednarek et al., 2016).

Since PA can improve health, in order to increase PA WHO (2017) recommends for adults aged 18–64 years to involve in the realization at least 150 minutes of moderate-intensity PA throughout the week, or do at least 75 minutes of vigorous-intensity PA throughout the week, or an equivalent combination of moderate and vigorous-intensity PA, and also for additional health benefits, adults should increase their moderate-intensity PA to 300 minutes per week, or equivalent, and in order to be beneficial for cardiorespiratory health, all activity should be performed in bouts of at least 10 minutes duration. Based on the above mentioned and considering the category score scale we can say that category 2-moderate PA and 3-high PA meeting the above criteria. Accordingly, based on the results obtained in this research we can see that of the total number of male students 91% of them shows sufficient level of PA as well as of the total number of female students 87% of them shows sufficient level of PA, and we can also say that males are more active than females. Study from authors Bergier et al. (2012) and

Bergier (2015) confirm our findings that women engage in less physical activity than men, which may be driven by perception of overarching exercise (Bednarek et al., 2016).

The organization of physical education tailored to the interests of students in higher education helps students to maintain an active lifestyle. Results of this study show that through such activities students can have a higher level of PA which can positively affect their health.

## Conclusion

The obtained results of the presented study indicate a lower physical activity among females than males, but we can conclude that PA level of majority of students from University of Tuzla could be considered as adequate. The results presented in this study show that it is necessary to continuously take measures for promoting the sports at Universities with the aim of raising the health status of students to a higher level. We recommend that in the future other universities should incorporate PA programs among their students in order to raise the overall level of PA.

Potential limitations of this study may be that the sample was limited to first year students who had compulsory course of physical education, while students from other years of study did not have compulsory course of physical education and they also did not participate in the study.

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## EVALUATION OF THE CURVATURE OF THE LONGITUDINAL FOOT ARCH IN CHILDREN AGED 7 AND 8 — A PILOT STUDY

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<sup>A</sup> Study Design; <sup>B</sup> Data Collection; <sup>C</sup> Statistical Analysis; <sup>D</sup> Manuscript Preparation; <sup>E</sup> Funds Collection

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**Abstract** The foot is an essential part of the human body, and a key factor enabling mobility. The proper functioning of the foot depends on its morphological structure and on the proper shape of its arches – transversal and longitudinal. Having in mind that flat feet develop as a succession of different stages, it is important to systematically monitor the development of feet at various phases of a child's growth. Therefore, this study aims to evaluate longitudinal foot arch curvature in children aged 7 and 8. The study involved 122 children (77 girls and 45 boys) aged 7 and 8 – students of a primary school in Bezrzecze near the city of Szczecin. Body height and weight, and the length and width of the feet were measured. A podoscope was used to determine the curvature of the longitudinal foot arch, which was then expressed on a scale compatible with the Szriter-Gudanow “KY” foot arch curvature index. This non-invasive method enables preventive measures to be taken at critical stages of a child's life. The results for the tested groups of children revealed statistically significant relationships for body height and weight, and the length of the feet between the 7 and 8 year olds. Furthermore, it was observed that the vast majority of the tested children has normal curvature of the longitudinal arch of both the right and left foot.

**Key words** longitudinal foot arch curvature, child, podoscope

### Introduction

The foot is an essential part of the human body, and a key factor enabling mobility. We need feet to walk, run, and maintain a vertical posture. We also use them in a variety of essential daily activities.

The proper functioning of the foot depends on its morphological structure and on the proper shape of its arches – transversal and longitudinal. When walking, the foot arch with a proper curvature acts as a shock absorber which eliminates the negative impact of the applied loads and protects the internal organs and the central nervous system from micro-injuries. The proper structure and functioning of the foot may affect the development of other constituents of the motor system (knees, hips, spine). Improper curvature may lead to dysfunctions of ankle and

foot joints, tendon strain, knee misplacement, which may ultimately and consequently lead to the deformation of the hip and spine.

Therefore, attention should be paid to the proper development of the feet of young children. Preschool and elementary school periods are stages of rapid growth of the body. A child between 3 and 7 gains weight slowly, but grows quite fast (5–7 cm a year). This rapid growth also includes the feet. When a child starts to walk and exercise various forms of physical activity, the shape of its feet is affected. At this stage, the bones are sensitive and susceptible, the muscles are weak, and the feet joints are characterised by high flexibility. At the age of 5 to 6, the entire bone structure strengthens considerably, and the physiological curves of the spine take shape. The foot is characterised by a pronounced curvature of the longitudinal arch (Demczuk-Włodarczyk, 2003). Proper development of the foot is mostly affected by physical activity of the child, as well as its weight, and proper footwear (Kasperczyk, 1994). The outer structure of the foot consists of an arrangement of transversal and longitudinal arches, which extend under a load and, return to their initial state when the load is no longer applied. The development of flat feet can be divided into three main stages: muscular insufficiency, muscular insufficiency with severe changes, and the stage of structural changes in which the arches are permanently altered (Rykała, Snela, Drzał-Grabiec, Podgórski, Nowicka, Kosiba, 2013). The evaluation of the curvature of the longitudinal foot arch is a key element in preventive treatment of children at early school age.

The main purpose of this study was to evaluate longitudinal foot arch curvature in children aged 7 and 8.

## Material and Methods

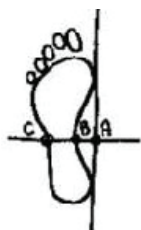
In 2016 tests were carried out in the primary school in Bezrzecze near Szczecin in Poland. The tests involved the measurement of the curvature of longitudinal foot arch in children aged 7 and 8. The study involved 122 children (77 girls and 45 boys) aged 7 and 8.

Body height and weight, and the length and width of the feet were measured. A podoscope, i.e. a device for photographing the sole part of the foot, was used to measure the curvature of the longitudinal arch of the right and left foot. A podoscope can be used to examine the feet of children, adolescents, and adults. It provides a variety of essential information required to diagnose and treat a number of medical conditions. It can also be used to properly evaluate the shape of the foot, or the presence of skin swelling or corns. Operation of a podoscope is easy ([www.podoskop.pl](http://www.podoskop.pl)).

### Description of the test

The patient wearing no shoes nor socks (i.e. barefoot) stands on the podoscope, and a full HD camera integrated with the device takes a picture. Then the podoscope sends the picture to a PC, which analyses the image to determine the relevant parameters of the feet.

The Szriter-Gudanow “KY” index, and the “Ky” index scale were used to evaluate the longitudinal curvature of the feet. As this scale does not include parameters for 7 year olds, the “Ky” index parameters for 8 year olds were used for children aged both 7 and 8.



The level of statistical significance  $p < 0.05$  was used. The statistically significant results presented in the tables are marked with an asterisk (\*). Average, median and standard deviation values were also measured for the measurements of the curvature of the longitudinal arch under load and with no load. The Student test (t) and Man-Whitney (U) test were used to analyse the differences in the results for both groups (Petrie, Sabin, 2006).

## Test results

On the basis of the obtained test results we characterised the group in terms of the selected anthropometric features. The Shapiro-Wilk test was used to check the distribution of the variable with a normal distribution.

**Table 1.** Characteristics of the tested group of boys

Distribution characteristics	Body weight (kg)	Body height (cm)	L foot length (cm)	R foot length (cm)	L foot width (cm)	R foot width (cm)
Boys aged 7 n = 20						
Min-max	18–33	110–131	16.8–26.7	16.6–26.6	6.6–10.3	6.3–10.3
Q <sub>1</sub> –Q <sub>3</sub>	21–25.5	119–125.5	22.2–24.5	22.2–24.1	8.3–9.6	8.6–9.6
Median	23	121.3	22.75	22.9	9.15	9.1
X	23.5	121.2	23.1	22.9	8.9	9.00
SD	3.8	5.3	20.8	20.6	8.9	9.6
Shapiro-Wilk test (p)	(+) 0.32	(+) 0.76	(–) 0.02	(–) 0.02	(+) 0.35	(+) 0.10
Boys aged 8 n = 25						
Min-max	20–44	120–143	17.4–29.8	17.2–30.3	6.7–11.1	6.6–11.7
Q <sub>1</sub> –Q <sub>3</sub>	27–34	129–135	24.9–26.6	24.8–26.8	8.9–10.2	9.0–10.2
Median	30	134	25.9	25.6	9.5	9.5
X	30.1	132.1	25.0	24.9	9.3	9.4
SD	5.8	6.1	30.3	30.7	9.3	9.4
Shapiro-Wilk test (p)	(+) 0.51	(+) 0.57	(–) 0.0007	(–) 0.002	(+) 0.14	(–) 0.03

Table 1 characterises the parameters of the tested groups of boys. In the group of 7 year olds, the lowest measured height was 110 cm, and the highest was 131 cm. In the group of 8 year olds, the lowest height was 120 cm, and the highest was 143 cm. The difference in the averages was high and amounted to 10.9 cm. The lowest body weight observed was respectively 18 kg and 20 kg. The highest weight was observed in the group of 8 year olds (44 kg). The difference in average body weight amounted to 6.6 kg in favour of 8 year olds. The average width of the feet was also greater in case of 8 year olds – 0.04 cm.



The length of the feet for 7 year olds was in the range of 16.8–26.7 cm for the left foot, and 16.6–26.6 cm for the right foot. In the group of 8 year olds, the minimum and maximum values for foot length were 17.4–29.8 cm and 17.2–30.3 cm respectively. The difference between both tested groups was 1.91 cm for the left foot and 2.0 cm for the right foot.

**Table 2.** Longitudinal foot arch curvature characteristics for the tested group of boys

Distribution characteristics	Ky L <sub>0</sub> foot (no load)	Ky R <sub>0</sub> foot (no load)	Ky L foot (load)	Ky R foot (load)
Boys aged 7 n = 20				
Min–max	0.23–0.57	0.22–0.59	0.29–0.61	0.27–0.85
Q <sub>1</sub> –Q <sub>3</sub>	0.27–0.42	0.30–0.38	0.40–0.49	0.43–0.53
Median	0.33	0.32	0.46	0.46
X	0.34	0.35	0.44	0.48
SD	0.10	0.09	0.08	0.12
Shapiro-Wilk test (p)	(+) 0.13	(–) 0.01	(+) 0.98	(–) 0.02
Boys aged 8 n = 25				
Min–max	0.20–0.70	0.23–0.60	0.24–0.77	0.30–0.80
Q <sub>1</sub> –Q <sub>3</sub>	0.31–0.43	0.30–0.42	0.31–0.51	0.36–0.45
Median	0.36	0.36	0.41	0.39
X	0.37	0.37	0.43	0.43
SD	0.11	0.09	0.14	0.13
Shapiro-Wilk test (p)	(+) 0.11	(+) 0.37	(+) 0.17	(–) 0.0001

Table 2 shows the results for the curvature of the right and left foot arch under own-weight and with no load for the tested groups of 7 and 8 year old boys – based on the Szriter-Gudanow (Ky) index. The difference between the curvature under load and with no load points to a dynamic load-carrying purpose of the arch. The average longitudinal arch curvature of the right and left foot under own-weight load was 0.44 and 0.48 respectively for 7-year old boys, and 0.43 for the left and right in case of 8 year olds. Based on the “Ky” index, these parameters correspond to the proper development of the longitudinal arch of the foot.

**Table 3.** Ky index value for tested groups of boys, with load applied

Ky index	Ky L		Ky R	
	N	%	N	%
Boys aged 7 n = 20				
Above norm – lowered arch > 0.54	4	20	4	20
Norm 0.44–0.54	13	65	13	65
Below norm – hollow arch < 0.44	3	15	3	15
Boys aged 8 n = 25				
Above norm – lowered arch > 0.54	6	24	6	24
Norm 0.44–0.54	14	56	14	56
Below norm – hollow arch < 0.44	5	20	5	20

As presented in Table 3, among both 7 year olds and 8 year olds the vast majority of boys has normal curvature of the longitudinal arch of the left and right foot. The proportion of children with lowered longitudinal arch in both groups is the same, and amounts to 20% for both feet.

**Table 4.** Characteristics of the tested group of girls

Distribution characteristics	Body weight (kg)	Body height (cm)	L foot length (cm)	R foot length (cm)	L foot width (cm)	R foot width (cm)
Girls aged 7 n = 33						
Min–max	15–35	108–134	16.9–28.3	16.2–28.4	6.6–11.1	6.9–12.1
Q <sub>1</sub> –Q <sub>3</sub>	20–25	115–125	21.9–24.1	22.0–23.8	8.2–9.2	8.3–9.0
Median	23	120	23.1	23.0	8.8	8.7
X	23	120.2	23.0	22.9	8.7	8.8
SD	4.4	6.1	22.8	22.8	9.6	10.5
Shapiro-Wilk test (p)	(+) 0.26	(+) 0.82	(–) 0.02	(–) 0.009	(+) 0.22	(–) 0.01
Girls aged 8 n = 44						
Min–max	20–37	118–144	19.5–33.0	19.0–33.2	7.0–12.1	6.8–11.9
Q <sub>1</sub> –Q <sub>3</sub>	23–29.5	124–132	23.0–25.4	22.8–25.5	8.6–9.7	8.5–9.5
Median	26	127	24.2	24.0	9.0	8.9
X	26.9	127.8	24.6	24.4	9.2	9.1
SD	4.9	5.4	27.1	27.8	1.0	1.0
Shapiro-Wilk test (p)	(–) 0.003	(+) 0.22	(–) 0.0008	(–) 0.003	(+) 0.07	(–) 0.04

Table 4 characterises the parameters of the tested groups of girls. The average body height for 7-year old girls amounted to 120.2 cm, and was lower by 7.6 cm less than the average for the group of 8 year olds. The difference in body weight amounted to 3.9 kg in favour of 8 year olds. The same holds for the length of the feet. 8-year old girls had the left foot longer by 1.6 cm and the right foot longer by 1.5 cm. For foot width, the difference in the average values is also in favour of 8-year old girls (0.5 cm for the left foot and 0.3 cm for the right foot).

**Table 5.** Longitudinal foot arch curvature characteristics for the tested group of girls

Distribution characteristics	Ky L <sub>0</sub> foot (no load)	Ky R <sub>0</sub> foot (no load)	Ky L foot	Ky R foot
Girls aged 7 n = 33				
Min–max	0.20–0.73	0.20–0.68	0.26–0.77	0.27–0.68
Q <sub>1</sub> –Q <sub>3</sub>	0.29–0.40	0.31–0.47	0.34–0.50	0.36–0.52
Median	0.33	0.36	0.44	0.44
X	0.38	0.38	0.44	0.45
SD	0.13	0.12	0.11	0.45
Shapiro-Wilk test (p)	(–) 0.13	(+) 0.38	(+) 0.19	(+) 0.64
Girls aged 8 n = 44				
Min–max	0.20–0.61	0.21–0.64	0.22–0.80	0.26–0.82
Q <sub>1</sub> –Q <sub>3</sub>	0.31–0.40	0.32–0.44	0.34–0.48	0.38–0.50
Median	0.33	0.37	0.42	0.45
X	0.35	0.38	0.42	0.45
SD	0.08	0.09	0.11	0.12
Shapiro-Wilk test (p)	(–) 0.03	(+) 0.07	(–) 0.03	(–) 0.03

Table 5 Characterises the tested groups of girls in terms of the curvature of the longitudinal foot arch both under load and with no load. The arithmetic average for both feet for the tested groups is within the range of proper arch curvature for this age.

**Table 6.** Ky index value for tested groups of girls, with load applied

Ky index	Ky L		Ky R	
	N	%	N	%
Girls aged 7 n = 33				
Above norm – lowered arch > 0.54	6	18	6	18
Norm 0.44–0.54	21	64	21	64
Below norm – hollow arch < 0.44	6	18	6	18
Girls aged 8 n = 44				
Above norm – lowered arch > 0.54	4	9	4	9
Norm 0.44–0.54	30	71	30	71
Below norm – hollow arch < 0.44	10	20	10	20

The curvature of the feet for girls is adequate. The vast majority of the tested girls (64% of 7-year olds, and 71% of 8-year olds) has normal curvature (Table 6).

**Table 7.** Significance of the differences of the selected parameters between the tested groups of girls

Parameters	Samples (+; –)	Student's test (t)	Sample (+; –)	Man-Whitney test (U)
Body weight	+ –	0.0006	+	<b>0.0005*</b>
Body height	++	<b>0.0001*</b>	+	0.0001
L foot length	--	0.0080	+	<b>0.0040*</b>
R foot length	--	0.0150	+	<b>0.0100*</b>
L foot width	++	0.0600	+	0.3300
R foot width	--	0.2400	+	0.1400
KyL <sub>0</sub>	--	0.3900	+	0.9200
KyR <sub>0</sub>	++	0.9800	+	0.9300
KyL	+ –	0.5300	+	0.4700
KyR	+ –	0.8200	+	0.8800

\* Significant with  $p < 0.05$ .

A comparison between the tested groups of girls (Table 7) revealed statistically significant correlation between body weight and height, and the length of the feet, attributable to the physical development of the children of this age (Table 7). No statistically significant differences were observed in the longitudinal curvature of the feet in the girl group. It can be presumed that the arch at this stage does not yet undergo dynamic growth. This may raise concerns so as to the proper formation of the arch, as there exists a statistically significant correlation for the length of both the left and the right foot. This proves that the foot grows lengthwise, thus the bones expand.

**Table 8.** Significance of the differences of the selected parameters between the tested groups of boys

Parameters	Samples (+; -)	Student's test (t)	Sample (+; -)	Man-Whitney test (U)
Body weight	++	<b>0.0001*</b>	+	0.0002
Body height	++	<b>0.0001*</b>	+	0.0001
L foot length	--	0.0150	+	<b>0.0009*</b>
R foot length	--	0.0170	+	<b>0.0009*</b>
L foot width	++	0.1900	+	0.1400
R foot width	+-	0.2100	+	0.0900
KyL <sub>0</sub>	++	0.3100	+	0.2700
KyR <sub>0</sub>	-+	0.4600	+	0.3000
KyL	++	0.6100	-	0.4400
KyR	--	0.2700	+	0.0600

\* Significant with  $p < 0.05$ .

The results obtained for the groups of tested boys were similar to those for the girl groups. Statistically significant differences were observed in the weight and height of the body, and in the length of the feet. At this stage, the longitudinal arch of the foot does not yet undergo rapid development, and the differences are not yet significant (Table 8).

**Table 9.** Significance of the differences of the selected parameters between the groups of 7-year old girls and boys

Parameters	Samples (+; -)	Student's test	Sample (+; -)	Man-Whitney test
Body weight	++	0.71	+	0.67
Body height	++	0.54	+	0.48
L foot length	--	0.95	+	0.58
R foot length	--	0.95	+	0.90
L foot width	++	0.55	+	0.30
R foot width	+-	0.57	+	0.19
KyL <sub>0</sub>	+-	0.35	+	0.47
KyR <sub>0</sub>	-+	0.22	+	0.19
KyL	++	0.92	+	0.67
KyR	-+	0.33	+	0.36

As shown in Table 9, no statistically significant difference in the test parameters between the 7-year old girls and boys were observed.

**Table 10.** Significance of the differences of the selected parameters between the groups of 8-year old girls and boys

Parameters	Samples (+; -)	Student's test (t)	Sample (+; -)	Man-Whitney test (U)
Body weight	+ -	0.016	+	<b>0.020*</b>
Body height	+ +	<b>0.004*</b>	+	0.004
L foot length	- -	0.530	+	<b>0.020*</b>
R foot length	- -	0.510	+	<b>0.040*</b>
L foot width	+ +	0.580	+	0.230
R foot width	- -	0.280	+	<b>0.046*</b>
KyL <sub>0</sub>	+ -	0.340	+	0.380
KyR <sub>0</sub>	+ +	0.460	+	0.460
KyL	+ -	0.930	+	0.940
KyR	- -	0.560	+	0.170

\* Significant with  $p < 0.05$ .

Statistically significant differences in body height, the length of the left and right foot and in the width of the right foot were observed between the groups 8-year old boys and girls (Table 10). The boys were taller and had longer feet, which points to their faster physical development in this age. No statistically significant differences were observed in the feet curvature.

The proportion of children with hollow foot arch was also determined for the tested groups. The largest percentage of such children, which amounted to 20%, was noted in case of both boys and girls aged 8 (Tables 3 and 6). There were no differences between the right and left foot.

This may be attributable to many factors. It may be e.g. due to the fact that the tested children participated in recreational dance classes and karate classes at school. Increased physical activity, even recreational, fosters the development of the ligament-muscular system of the feet.

## Discussion

A number of researchers explore the issue of the development of arch curvature in children at early school age. Studies show that from the time of birth, the foot grows at a regular pace, and the curvature of its arch becomes noticeable at about the age of 3 (Lizis, 2000). Gołąb, Lizis, and Ignasiak note that the age between 5–9 is the critical period of the most rapid development of the feet (Gołąb, 1980; Ignasiak, 1993; Lizis, 2000). Kurniewicz-Witczakowa points to the occurrence of dynamic changes in the feet curvature at the age between 3–7 (Kurniewicz-Witczakowa, 1996). As maintained by Lizis, the foot reaches maturity much earlier compared to other parameters of the body, such as the height, length, or width of the hand (Lizis, 1992). Considering the dynamic nature of the development of the foot in this period, particular attention should be paid to preventive care.

It is widely known that physical activity and normal body weight are the key factors that determine proper development of the feet (Lizis, 1992). Basing on an evaluation of the longitudinal foot arch curvature in preschool children, Mickle et al. maintain that the risk of flat feet increases together with body weight (Mickle, Steele, Munro 2006).

The authors' own studies revealed that the parameters of the longitudinal arch curvature are appropriate. The obtained test results show that for both 7 and 8 year olds the curvature of the feet is normal for more than

a half of the tested boys and girls. The percentage of boys with lowered longitudinal arch is greater (20 and 24%) than girls (18 and 9%) (Tables 3 and 6). These relationships are, however, statistically insignificant in terms of the sex (Table 9). No statistically significant differences in the curvature of the longitudinal arch were also observed between 7 and 8 year olds. In the tested group, the curvature of the longitudinal arch develops in the same manner for both boys and girls. Significant differences were observed, however, for 8 year old boys and girls between the length of the feet, and the weight and height of the body (Table 10). The boys grow faster and their feet are longer. This does not significantly affect the formation of the longitudinal arch of the foot.

Due to similar lifestyles and school duties of the 7 and 8 year olds, no statistically significant differences between the tested groups were found. The curvature of the longitudinal arch of the 7 year olds was similar to that of the 8 year olds. There were no obese children in the tested group. The participation in extracurricular activities (i.e. dance and karate lessons) and normal body weight positively affected the development of the feet structure of the tested children. This outcome is in line with the results quoted by Lizis and Mickle (Lizis, 1992; Mickle, 2006).

Dynamic growth of the feet and the applied loads affect the development of this part of the body. Feet develop as a succession of different stages (Rykała, Snela, Drzał-Grabiec, Podgórski, Nowicka, Kosiba, 2013). To enable appropriate correction it is essential to diagnose the early changes related to ligament-muscular insufficiency. The non-invasive nature of this method of evaluation of the longitudinal foot arch curvature enables regular monitoring of the development of the feet, to take preventive steps at appropriate stage.

## Conclusions

1. The study has revealed statistically significant differences for 7 and 8 year old girls and boys between the weight and height of the body and the length of the feet.
2. No statistically significant relationships were found between in the curvature of the right and left foot between 7 and 8 year olds of either sex.
3. In the test groups of 7 year olds and 8 year olds, the vast majority of boys and girls had normal curvature of the longitudinal arch of the right and left foot.
4. Among 7 year olds, no statistically significant relationships were found for any parameter between girls and boys.
5. Among 8 year olds, there are statistically significant differences in the arithmetic average values between the girls' and boys' body height and weight, and the length and width of the right foot.

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# UNDERSTANDING EXERCISE INTENTIONS AMONG WOMEN EXERCISING IN FITNESS CLASSES: AN APPLICATION OF THE THEORY OF PLANNED BEHAVIOUR

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**Abstract** The study was aimed at examining the usefulness of the Theory of Planned Behaviour (TPB) in predicting exercise intentions and exercise of women in fitness classes. On the theoretical plane it broadens state of knowledge on the TPB, but the findings are also important for the development of more effective interventions to promote and maintain exercise engagement of women in fitness centers. The study was carried out in the second quarter of 2016 in two fitness centers in Katowice, Poland. The participants were 95 women aged 17–66 ( $M = 37.40 \pm 12.15$ ). The obtained data were analyzed with the use of structural equation modelling (path analysis). Significant predictors of intention to exercise were perceived behavioural control and attitude, with the strongest effect observed in the former. The findings of the study suggest that interventions should focus on increasing the level of control over women's exercise behaviours and shaping attitudes toward them.

**Key words** theory of planned behaviour, exercise, women

## Introduction

It is well established that regular participation in physical activity, especially in the form of exercise, leads to manifold benefits, physical (physiological, morphological) and psychological as well (Dishman, Washburn, Heath, 2004). Awareness of the fact, despite being increasingly common among people, does not necessary leads to greater participation in exercise. It is because exercise – especially with recommended frequency of daily or in most days a week of at least moderate intensity (Randsell, Dinger, Huberty, Miller, 2009) – is a complex behavior, dependent on many factors, some of which are set in our personality (cognitive, emotional, motivational domain) and others in our environment, both physical and social (Anshel, 2014). Fitness professionals and scientists need to well understand them in order to help people stay active for a lifetime, especially that as research suggests even up



to 50% of people who start exercise programs drop them out within the first 6 months (Anshel, 2014). Recognizing factors that determine exercise behaviors could increase effectiveness of the process of establishing habits of regular undertaking them.

Among various theoretical models that try to explain how behaviour change occur, one the most commonly used is Ajzen's Theory of Planned Behaviour (TPB) (Biddle, Mutrie, 2001). According to the TPB immediate predictor of volitional behavior, such as physical activity, is behavioural intention defined as the degree to which a person formulates volitional plans of action and as such should not be confused with the notion of expectations, which are rather some form of wishful thinking and assessing behavior in terms of probability of undertaking it. Intention is determined by three factors. The first is attitude, defined as "the individual's positive or negative evaluation of performing the particular behaviour of interest" (Ajzen, 1988, p. 117). The second determinant of intention is subjective norm, defined as the perceived social pressure that individuals may feel to perform or not perform physical activity. Finally, the intention is controlled by a perceived behavioral control, which is the perceived ease or difficulty of performing the behavior, reflecting both past experiences with the behavior and anticipated impediments and obstacles of undertaking it (Ajzen, 1988, p. 132). Perceived behavioural control is the only determinant of intention that is supposed to exert also direct effect on the behavior, because the latter depends not only on motivation to do so but also on adequate control over it. In some cases, even very strong intentions to exercise ("I really want to make my exercise program in the gym") means nothing if a person come down with an illness or sustain an injury that forces her/him to stay in home ("but I am ill"). As Ajzen stated "perceived behavioural control can help predict goal attainment independent of behavioral intention to the extent that it reflects actual control with some degree of accuracy" (Ajzen, 1988, p. 134). The concept of PBC to some degree refers to Bandura's perceived self-efficacy, although the question whether both these notions could be identified is contentious, as while some authors treat both notions as synonyms, others argue that their complete identification is unfounded (Armitage, Conner, 2001; Hausenblas, Carron, Mack, 1997). Supporters of the latter approach point out that self-efficacy, as Bandura defines it, reflects only a degree to which a person perceives his or her control over the behavior, whereas the notion of PBC relates also to external aspects of such control, e.g. barriers of exercise.

In summary, the TPB posits that physical activity will be the more probable and the more intensified, the stronger is the intention to perform it. Next, the latter will be more likely to occur if people believe that exercise will produce positive – emotional as well instrumental – outcomes, experience other's support for their behaviours and believe that they possess personal resources enabling them exercising. Despite some reservations expressed toward the said theory (see for example: Armitage, Conner, 2001; Latimer, Ginis, 2005; Courneya, Plotnikoff, Hotz, Birkett, 2000), it is considered as a model of proven value in explaining volitional physical activity (Hagger, Chatzismantis, Biddle, 2002). In fact, it has been successfully used to explain such behaviours in various populations, like adults (Dodd, Forshaw, Ward, 2012), children and adolescents (Plotnikoff, Lubans, Costigan, McCargar, 2013, Mummery, Spence, Hudec, 2000; Martin, Oliver, McCaughy, 2007), diabetics (Plotnikoff, Lippke, Courneya, Birkett, Sigal, 2010), breast cancer survivors (Vallance, Lavalley, Culos-Reed, Trudeau, 2012), college students and academic teachers (Kirk, Rhodes, 2012, Blanchard et al., 2008). One population that seem "understudied" are people with different training status, including those attending fitness classes. Therefore the purpose of the study was to determine the capability of the TPB constructs to predict exercise participation among women attending fitness classes.

## Material and methods

The study was carried out in the second quarter of 2016 in two fitness centers in Katowice, Poland. The participants were 95 women aged between 17 and 66 ( $M = 37.40$ ,  $SD = 12.15$ ). A diagnostic poll method of research was adopted and the participants voluntarily filled in an anonymous questionnaire designed by the author for the needs of the study and based on Ajzen's suggestions on how to develop a TPB questionnaire published by (Ajzen, 1988, 2002).

The respondents' behaviour was assessed by a question regarding frequency of their attendance to fitness centre with the range of responses from "once a week" to "everyday". The TPB constructs – intention, attitude, subjective norms and PBC – as suggested by Ajzen were measured by 7-point bipolar adjective scales anchored to statements concerning: in the case of intention- the strength of plans and intentions to continuing regular participation in the fitness class for at least next six month; in the case of attitude – evaluation of emotional and instrumental outcomes of exercises, in the case of subjective norms – the strength of perceptions of other's will and acceptance of exercise behaviors of the respondents and in the case of perceived behavioural control – the strength of beliefs that exercise behaviors are under volitional control of the respondents.

The reliability of the scales measuring TPB variables was assessed by Cronbach's coefficient  $\alpha$ . According to Sokolowski and Sagan (1999), an instrument is reliable if  $\alpha > 0.6$ . All scales fulfilled this criterion, obtaining  $\alpha$  values from 0.72 to 0.88.

For determining relationships between the TPB variables, the structural equation modelling technique was adopted. The theoretical model was tested using the GLS > ML (generalized least squares > maximum likelihood) method. The underlying assumption of this method is that variables are normally distributed. Because our data were non-normally distributed and despite growing evidence that this method performs well also under non-normal distribution of variables, we used power Box-Cox transformation of dependent variables for purposes of normalization of data.

The evaluation of goodness-of-fit of the model to the data was performed with the use of:  $\chi^2/df$  (which should be less than 2), goodness-of-fit index (GFI) and adjusted goodness-of-fit index (AGFI) (in both cases a model is considered as good-fitted to the data if values of both indexes are  $>0.95$ ), root mean square error of approximation (RMSEA) (when  $<0.05$ , the model is considered as good-fitted, when  $<0.01$  – as excellent-fitted), and Akaike Information Criterion (the more this index is close to 0, the better the model fits the data). All calculations were carried out in Statistica 10.0 (Statsoft, PL).

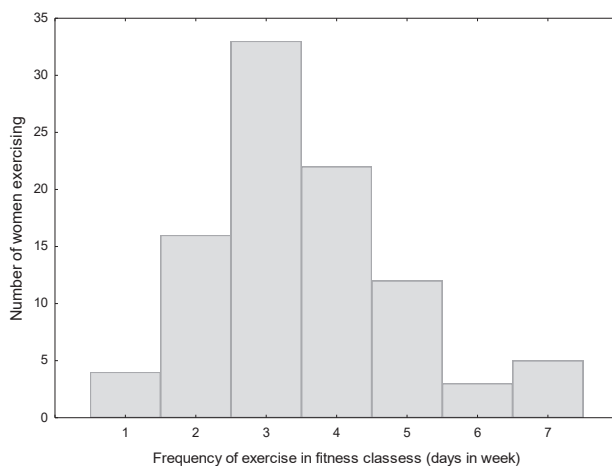
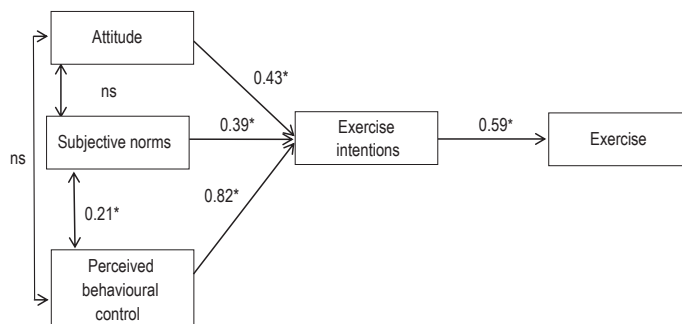
## Results

Descriptive statistics and correlations between variables are presented in the Table1. Significant correlations were observed between intentions and exercise frequency, intentions and attitude and between perceived behavioral control and subjective norms. The highest means in the predictor variables were observed in the case of attitudes ( $6.80 \pm 0.33$ ) and intentions ( $6.61 \pm 0.85$ ) suggesting both strong, positive evaluations of usefulness of exercising and strong intentions to continuing participations in it. Over half of the respondents declared exercising three to four times a week, although the range of participation extended from once a week ( $n = 4$ ) to everyday ( $n = 5$ ) (see Figure 1).

**Table 1.** Descriptive statistics and correlation matrix of the study variables

Variable	M	SD	Exercise	Intention	Attitude	Subjective norm	PBC
Exercise	3.54	1.39					
Intention	6.61	0.85	0.20*				
Attitude	6.80	0.33	0.18	0.20*			
Subjective norm	4.99	1.52	0.12	0.13	0.14		
PBC	4.99	0.80	-0.17	-0.12	-0.07	0.21*	

PBC – perceived behavioural control; Correlations marked with \*superscript are significant at  $p < 0.05$ .

**Figure 1.** Frequency of exercise in fitness classes per week in the study group

\* path coefficients significant at  $p < 0.05$ . By convention, values greater than .50 are considered as indicating "large" effect, while values around .30 "medium" effect.

**Figure 2.** Path diagram showing causal relationships between the TPB variables and values of the standardized path coefficients found in the study

The assessment of causal relationships between variables was performed with path analysis. As the priori model showed not satisfactory fit to the data one modification was introduced: dropping the non-significant relationship between perceived behavioral control and exercise. This modification resulted in improvement of the model fit indices that were as follows:  $\chi^2/df = 1.14$ ; GFI = 0.97; AGFI = 0.92; RMSEA = 0.05, Akaike Information Criterion = 0.29. Causal relationships between the variables and obtained values of structural path coefficients are shown on the path diagram in Figure 2.

As it can be seen, the intention toward performing exercises in fitness classes had a significant and strong influence on frequency of attending to them ( $\beta = 0.59$ ,  $p < 0.05$ ). Among the cognitive variables, perceived behavioral control had the strongest effect on intentions with standardized path coefficient of  $\beta = 0.82$  ( $p < 0.05$ ). As the value of the coefficient is closer to one the stronger the relationship between two variables, the obtained results could be verbalized as the large effect ("strong influence") of PBC to intentions. The effects of attitude on intentions were significant and of moderate strength, while the effect of subjective norms showed only tendency toward significance ( $\beta = 0.39$ ,  $p = 0.06$ ).

## Discussion

The present study set out to investigate the usefulness the Theory of Planned Behaviours to understand participation of women in fitness classes. The obtained results suggest that the TPB may be a useful theoretical framework for explaining exercise behaviours of women attending fitness classes. From the three socio-cognitive predictors of behavioral intentions assumed by the TPB perceived behavioural control emerged as the strongest determinant of it and subjective norms as the weakest- with only tendency toward significance of the effect. The last observation is consistent with the conclusions of other studies and meta-analyses which suggest that social environment of people has little or even no impact on their intentions to exercise (Hausenblas et al., 1997; Hagger et al., 2002), including in the context of fitness and sports centers (Chang-Ik, HeeSun, 2015). However, such conclusion could be premature, as there are many studies outside the TPB context in which social factors are important determinants of people's physical activity (Vrazel, Sounders, Wilcox, 2008). According to Latimer and Ginis weak predictive value of subjective norms may arise do to its dependence on other – usually uncontrolled – variables, like the extent to which people are concerned with others' approval of them. As the said researchers have demonstrated in their study, among people highly concerned with receiving disapproval from others (i.e. with high fear of negative evaluation) the influence of subjective norms on intentions to exercise was stronger than for people with weaker worries about how they will be evaluated by others. However, voices also rose that the true problem with the construct of subjective norm is inaccuracy of its operationalization which should rather reflect social support, than perceived social pressure or others will (Courneya et al., 2000; Rhodes, Jones, Courneya, 2002).

Somewhat to our surprise attitude toward exercising in fitness classes was only marginally stronger predictor of intentions than the abovementioned subjective norms. It is also important to stress strong influence of perceived behavioral control on intentions, reflected in high value of path coefficient. At the same time, however, this variable has not shown to be direct predictor of exercise. The question of such an influence, although assumed in the theory, is not conclusive amongst investigators; while some of them have found significant and strong influence of it on behaviors, others have not and therefore claim to ignore the path between the both kinds of variables (Hausenblas et al., 1997; Smith, Biddle, 1999). Our study supports the premise of significant influence of perceived behavioral control on behavioral intention, but not for the behavior itself.

## Conclusions

To our knowledge this study was the first one that utilize the TPB to understand women exercising in fitness classes. We believe our findings have considerable theoretical and practical values. From the theoretical point of view our study broadens the state of knowledge on the TPB, going out to meet the demand of Hausenblas et al. (1997) that researchers should examine the TPB in different contexts of exercise behaviors and different categories of people. As it was described earlier, attitude and perceived behavioral control were found to predict intentions of women to continue participating in fitness classes and that the intentions, on the other hand, predicts frequency of this kind of behaviors. These results are important from the practical point of view, i.e. for the development of interventions aimed at reinforcing and/or increasing engagement of women in exercising in fitness classes. First of all, it means convincing women that they possess appropriate resources (such as skills, willpower etc.) to perform the behaviour of interest, and secondly, persuading women about the benefits of exercising (instrumental attitude) and fostering their positive emotional experiences with this kind of behavior (affective attitude).

Despite our belief that our study has considerable values, some limitations of it should also be acknowledged. First, subjects for the study were selected with the use of convenience sampling technique and therefore the wider applicability of the findings is limited. Secondly, the number of participants was relatively small considering path analysis, as sample sizes between 100 and 200 are more desirable. However, there is no universal rule regarding the required number of respondents, and according to some recommendations minimal sample size should be eight times the number of variables in the model plus 50 more or at least 15 cases per measured variable or indicator. Considering such recommendations our sample size fulfilled the criterion. Thirdly, as the study was based on self-report measures, the findings are sensible to social desirability biases. Finally, as a measure of exercise engagement the frequency of participation in fitness classes was adopted. Meanwhile, exercise frequency may reflect other factors (time constraints, financial issues etc.) and not only the "strength" of exercise habit. Notwithstanding these limitations, we are convinced that our study brings about valuable data on women's exercise behaviors.

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# THE INFLUENCE OF DANCING ACTIVITIES ON WOMEN'S SELF-IMAGE

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**Abstract** Dancing not only improves our development, but also changes us. It changes our attitude to many issues. It influences our temperament thus transforming the perception of our body.

The chief aim of this research was to prove that dancing classes are a form of work on reaching self-awareness and that they have therapeutic properties. The subjects were female participants of all kinds of dancing classes, conducted in various schools by different instructors. 51 females, aged 20–60 years old voluntarily participated in a diagnostic survey.

Dancing class participants, often unknowingly, undergo a certain metamorphosis. Indisputably, dancing has therapeutic influence; it allows to create and discover hitherto unknown recesses of ourselves.

Dancing classes considerably diminish our low self-esteem and distorted perception of our body. The analysis of research shows that behavior of women who participated in dancing class change so that they can more effectively fulfill their life aims.

**Key words** dancing classes, self-acceptance, self-image, self-awareness

## Introduction

The issue of perception of one's self was first dealt with in 1930s. One of the precursors was Alfred Adler, who claimed that "the person's conduct is a result of their beliefs or outlook that they have about themselves and the world" (Adler, 1939, p. 11). Many psychologists and pedagogues agree that our behavior considerably influences the recognition of our self-esteem. Human corporeality is inextricably linked to personal development and functioning in the environment (Hurlock, 1960; Wylie, 1961; Konorski, 1969). Murphy suggested a very apt definition: "My sense of self is how I perceive myself" (Murphy, 1947, p. 487). Snygg and Combs also stated simply that the perception of one's self is a group of features and properties that we define as ours (Snygg, Combs, 1959). Raimy maintained that the picture of ourselves is a result of observing ourselves in the past as well as in the present. It is a sort of a map that we use in the most difficult moments of our lives (Raimy, 1975). Similarly, others authors stated that deciding factors determining the formation of our self's perception are experiences through which we recognize our possibilities and secure a certain position and image in a society (Reykowski, 1970, Reel, Petrie,

SooHoo, Anderson, 2013; Thompson, Sherman, 2011; Krane, Stiles-Shipley, Waldron, Michalenok, 2001; Loland, 1999; De Bruin, Oudejans, Bakker, Woertman, 2011). This development depends on the degree of self-awareness, formed in interpersonal contacts (Reykowski, 1970).

Contrary to appearances this is a complex issue, including knowledge not only about one's own traits, but also values that govern our conduct (Brzezińska, 1973; Baley, 1947; Zaborowski, 1967; Przetacznikowa, 1971; Koziński, 1986). J. Reykowski differentiated between two kinds of one's self-esteem: too low and too high. The former is ascribing to ourselves lower possibilities than possessed in reality. As a consequence, our activity and expansiveness are diminished. We are often depressed (nothing can give us real satisfaction), worried about everything, feeling guilt, dislike, and sometimes even loathing towards ourselves. We also underestimate our own attractiveness, which is destructive especially for females (Fredrickson, Roberts, 1997; Szymanski, Moffitt, Carr, 2011; Grogan, 2017). All of the above lead to underachievement. Too high self-esteem, on the other hand, is uncritical perception of ourselves and attributing greater possibilities than we really possess (Reykowski, 1970).

The picture of our self is created on the basis of data from two sources. The former is life experience, which place us in a society. It makes us aware of what we can really achieve. The latter is other people's opinions (Siek, 1993).

The level of self-acceptance is determined by a general judgment of ourselves, based on comparing our own achievements with the goals we set (Rogers, 1959; Kantanista et al., 2018). Fair judgment requires recognition of all properties and factors that condition the development of the individual's picture of their sense of self. This is the first step to form a positive, accepting self-image. Only then we are able to act properly, be satisfied with our life and reconciled with ourselves (Gough, Heilbrun, 1983).

The chief aim of this research was to prove that dancing classes are a form of work on reaching self-awareness and that they have therapeutic properties.

## Material and methodology

The subjects were female participants of all kinds of dancing classes, conducted in various schools by different instructors. 51 females, aged 20–60 years old voluntarily participated in a diagnostic survey. The survey contained open-ended and closed-ended questions. Only those women who answered all of the questions were taken into consideration, *i.e.* 40. This fact shows that even anonymous evaluation of one's physical appearance posed a problem for some of them.

Results On the basis of the obtained data concerning the height and body mass, the body mass index (BMI) was calculated. This indicator, also called Quetelet's II, is a ratio of the body mass (in kilograms) and quadratic height (in meters). The average height (rounded) is 1.67 m, and the body mass – 66 kg. It follows that the average BMI is 23.7. This result is within a norm, but is not highly satisfactory. 25 is the upper limit of the norm, whereas 18.5 is the lower. The average BMI of dancing classes participants is close to danger of diseases connected with overweight and obesity. Barely over a half of subjects (55%) have an ideal body mass, as much as 35% are overweight and 5% struggle with severe obesity. Underweight occurs much more rarely (5%) than the tendency to overweight. Underweight more frequently concerns professional dancers than amateurs. Nevertheless, the following must be taken into consideration: for those who regularly do sports, BMI is not a perfectly accurate indicator of the fat content in their organisms.



The numeric data shows that 52.5% of the surveyed consider their body mass as normal, and 47.5% as too high. This is the reason why most of women make attempts at losing weight regardless of the actual need. It is often the case that those who should do so, do otherwise, and the other way round. Out of all the respondents merely 15% never made this attempt. The rest attended fitness/aerobics classes (82%), went on various types of diets (77%), exercised at the gym (27%), practiced various sports (26%) or did jogging (9%). The desperate ones even used weight loss products (15%), as well as underwent beauty treatments, allegedly aiding weight loss.

80% of the respondents claim they like their body, but as much as 45% of them would gladly change some parts of it, even if plastic surgery were involved (35%). Lack of cohesion may result not as much from the lack of inner harmony, but rather from outside pressure. Nowadays slim females are glorified in all the media, which makes over a half of women (52.5%) feel pressurized. Only 5% of the respondents pay absolutely no attention. "What will others think of me?" is a typical question that blocks women. It is advisable to strive for emotional freedom and to feel as one wants to feel, regardless of other people's opinions. Thanks to the dancing classes, women realized that they had trusted other people instead of themselves. An opinion may influence people only if they themselves believe it. Dancing gives emotional freedom, where everybody consciously decides how they want to think and act.

Representatives of fair sex, regardless of their appearance, occasionally feel awkward. Common changing rooms in dance schools make most women a bit self-conscious. As much as 20% feel awkward in the presence of other women, especially younger ones. Self-consciousness in the presence of men concerns only 7.5%. Unfortunately, psychological barrier that discourages women from any contacts with others, occurs in 5% of women. It is however advisable to follow an example of those who are not ashamed of their body, but are proud that despite of their imperfections they want and are able to fight them or simply accept them (22.5%).

Dancing not only improves our development, but also changes us. It changes our attitude to many issues. It influences our temperament thus transforming the perception of our body. Dancing class participants, often unknowingly, undergo a certain metamorphosis. Indisputably, dancing has therapeutic influence; it allows to create and discover hitherto unknown recesses of ourselves. Even if some women (especially the youngest ones) attend dancing classes only because of trends, it still leaves a permanent trace on their inner, as well as outer, self. As much as 95% of the surveyed perceive, through the participation in dancing classes, an attractive woman not only as the one with an ideal body, but also the one who accepts her body regardless of its shape.

80% think that a woman may be perceived as beautiful at every age, as femininity is much more than Aphrodite's looks. It can have a face of a young girl, mature woman, or elderly lady. Each of them has her unique assets. A question about characteristics that best portray femininity was answered in as many different ways, as there were respondents. This is perfectly obvious, as every girl, since a very young age, is subject to upbringing – she is continually told what is good or bad manners, what is and what is not the right thing to do. Girl's clothes are pink, dolls are for playing, it is not becoming of a young lady to be angry, however, crying is appropriate. As the time passes, depending on a peer group that a young woman identifies with, her behavior starts to be shaped, and boundaries of femininity and masculinity are determined. Therefore in such a case it is not reasonable to make generalizations. Similarly, the ideal of beauty will be different for everyone; even the most beautiful Caucasian woman will not fulfill the criteria of beauty of other human races. Miss World has never been fancied by everyone. The most important thing, however, is to feel good in one's own body and be able to use it in different ways, depending on the purpose. Research indicates that thanks to dancing classes women look in the mirror more often (75%), and 62.5% like their bodies more, no matter if it changed or became more attractive. Their attractiveness

manifests itself in the desire to be fancied by others and themselves. Some of the women (45%), since they began attending dancing classes, started to pay more attention to their make-up, hairdo and clothing. They want to look fashionable, introducing new and braver elements into their style. Caring about their looks, women spend less on beauty treatments (83 PLN), cosmetics (96 PLN) and more for doing sport (181 PLN). It is because they can see better and long-lasting effects of their physical activity. They feel not only more attractive, but also healthier. 90% of respondents noticed a considerable improvement of their physical condition and 17.5% defines it as "very good" and 80% as "good". 2.5% of participants considers their condition to be on a low level as a result of considerable overweight (nevertheless they recognize improvement).

It is uplifting that the average self-evaluation of appearance of the women participating in dancing classes is 7.2 (in 10-point scale). This may be due to high level of self-acceptance and considerable influence on the level of self-esteem.

## Summary and conclusions

1. Dancing classes considerably diminish our low self-esteem and distorted perception of our body.
2. The conducted research suggests that women participating in dancing classes have greater consciousness of their own body. They appreciate not only esthetic values, but above all the harmony between the body and the spirit. Dancing classes satisfy their physical as well as emotional needs.
3. The results confirm that experiencing one's self in dancing gives positive effect within the Self structure.
4. The results shows that dancing classes diminish awkwardness of our own body, allow women to dismiss complexes and give strength to fight them or simply accept them.
5. The research confirm that as a result of gaining social experience in dancing classes, women's behavior change so that they can more effectively fulfill their life aims.

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# THE IMPORTANCE OF PHYSICAL ACTIVITY IN THE PROCESS OF SUCCESSFUL AGEING — AN OVERVIEW

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**Abstract** Rising life expectancy of the populations living in highly developed countries has been observed over recent decades. The number of people worldwide above the age of 60 is increasing at an unprecedented pace. The purpose of the study was to determine the significance of physical activity of older people in the process of successful ageing. Research methods. This article is a review of Polish and foreign studies considering the relationship between physical activity and successful ageing. The elaboration refers to the results of surveys published in the reviewed scientific journals including empirical studies mainly based on diagnostic survey. Study results. A thorough analysis identified three parts: the concept of successful ageing, the relationship between physical activity and health, and physical activity of older persons in Poland compared to their counterparts abroad. A review of the literature and documents has revealed that one of the main factors affecting successful ageing is physical activity. Conclusions. Physical activity and successful ageing are different in the assessed communities. Thus, it is necessary to monitor physical activity of older people in the context of successful ageing – in order to provide conducive circumstances to activating this social group and thus reducing social security cost.

**Key words** older people, physical activity, health, successful ageing

## Introduction

Rising life expectancy of the populations living in highly developed countries has been observed over recent decades. This is mostly due to the civilizational development including technology and medical progress, improved sanitary and hygienic conditions, and easier access to medical care facilities. An influence on the decreasing number of premature deaths and so extended longevity is also exercised by various social campaigns encouraging to preventive medical examinations.

At the end of 2015, the total number of population in Poland was 38.5 million including 22.6% of persons above 60 years of age (Demographic Yearbook, Central Statistical Office GUS, 2016). This age is considered by the World

Health Organization to be the onset of old age. It is estimated that by the end of 2050 the percentage of persons above the age of 60 in Poland will have increased by 19%, that is, to 13.7 million people (the forecast population in Poland in 2014–2050, 2014). It is expected in the EU states that in 2060 the population rate between the ages 0 to 14 and at the age of 65 and above in relation to people aged 15–64 years will be respectively 53.5 to 25.0%. A decade ago (in 2008) this rate ranged from 25.4 to 23.3% (Giannakouri, 2008). These unfavourable proportions of persons in pre-productive age and post-productive age in comparison to people in productive age are referred to as “inverted population pyramid” by demographers.

A similar phenomenon can be observed on a global scale. In 1980, there were 378 million of people aged 60 and over in the world. Currently this number has doubled and amounts to 759 million. It is estimated that 2 milliards of persons of 60 years and more will live worldwide in 2050 (Current Status of the Social Situation, Wellbeing, Participation in Development and Rights of Older Persons Worldwide, Department of Economic and Social Affairs Office of the High Commissioner for Human Rights, 2011). The ageing society issue must result in the changes of the state policy on economy and culture as well as the health care system. These dynamic demographic and social transformations over the recent decades, considering inefficient societies, give reasons to searching for solutions conducive to successful, active ageing.

This paper is an attempt to define the significance of physical activity of older persons in the process of successful ageing.

## Research methods

This article is a review of Polish and foreign studies considering the relationship between physical activity and successful ageing. The elaboration refers to the results of surveys published in the reviewed scientific journals including empirical studies mainly based on diagnostic survey. A search of relevant literature was performed in the databases of PubMed and Web of Science. Consequently, 65 articles were found and 30 of them met the adopted criteria. The overview also includes scientific monographs based on empirical studies of large groups of older persons who take up various forms of physical recreation. Materials gathered are completed with the analysis of documents (Central Statistical Office GUS, Reports, Forecasts, NPZ).

## Study results

### The concept of successful ageing

Gerontology is a scientific discipline which deals with the issues of broadly understood old age and ageing (from Greek *geron* – old man and *logos* – science). Gerontology literature regards old age as a static process while ageing – as the dynamic process (Brzezińska, 2011). Old age is referred to as third age, fourth age, advanced age, declining years or longevity. P. Szukalski (2013) claims that such a division of old age is justified by the fact that older persons (declining years or longevity) depend on constant care as they find it difficult to perform daily tasks on their own. As far as the persons who have just surpassed old age (early old age, advanced age, third age) are concerned, they have a couple or a dozen or so years ahead of fully efficient and independent life. P. Baltes and J. Smith (2003) consider third age to be the period between the age of 60 and 80 years. According to them, fourth age begins after 80 years of age. W. Pędich (1995) defines early old age (60–75 years) also as third age whereas late old age (over 75 years of age) as fourth age. S. Klonowicz (1979) distinguishes other age categories for men and still other for

women. Old age concerns men at the age between 65 and 79 years and women aged 60 to 79. Above this threshold (over 80 years of age), the ageing of males and females is captured jointly and referred to as a very advanced age.

Significant differences can be observed in defining the beginning of old age. Some scientists regard the age of 55 years as the onset of old age. Yet others claim that elders are people who are 65 years old and more or they propose to extend this age threshold even to 80 years. A modern 60-year old person is at least twice more likely to live to 80 years compared to his counterpart living in the early 1950s (Szukalski, 2013).

In Poland, the age of 60 is often considered to be the old age threshold and disease factors are thought to be the most important ones by gerontologists as they affect mental state and good social condition (Orzechowska, 1999).

Even psychology literature does not provide only one definition of the beginning of old age at all. The authors of these papers most frequently focus on several major aspects of old age like memory, personality, lifestyle, the meaning of life and life value (Steuden, 2011; Szatur-Jaworska, Błędowski, Dzięgielewska, 2006).

According to the World Health Organisation (WHO), old age begins at 60 and can be classified into three main periods, namely, early old age (60–74) which includes people who are physically, mentally efficient and independent in most cases; late old age (75–89 years) – connected with significant limitation of psychophysical efficiency, increased demand for medical care and support of others in daily activities; advanced age, longevity (above 90 years of age) – characterized by decreased psychophysical aptitude in comparison with the preceding group (refers to those who were efficient during the previous period). WHO experts also determine a period in human life referred to as pre-old age including people aged 45–59 (Zych, 2001). The above mentioned old age classification is often applied in scientific studies. Besides, some additional terms are also used. W.W. Spirduso (1995) provides the criteria of identification of old people according to the calendar age, that is, *young-old* – 65–74 years; *old* – 75–84 years; *old-old* – 85–99 years; *oldest-old* – 100 years and more or another classification including sixty-year old persons – 60–69 years; seventy-year old people – 70–79 years; eighty-year old persons – 80–89 years; ninety-year old people – 90–99 years; one hundred- year old persons –  $\geq 100$  years.

The process of ageing occurs on numerous levels. Physiological ageing can be revealed by lower physical activity and reduced adaptive possibilities of human body. This process is connected with decreased efficiency of particular body functions and organs. As a result of ageing processes, physical endurance is decreasing and muscle tension of a 65-year old person accounts only for 75–85% of value achieved between the age of 20 and 30. The best results of maintaining physical endurance until old age can be achieved by continuing physical training commenced in (Górski, 2011).

It is decreased physical performance that comprises an indispensable element of old age and ageing and it is mainly affected by biological factors, deteriorating health (Steuden, 2011) as well as lower physical activity. Ageing optimization is determined by lifestyle, environmental and genetic factors and medical care opportunities.

During social ageing, elders change their interests and possibilities of taking up various forms of activity. Gerontologists determine a number of activities including domestic and family, cultural, professional and social activity (Orzechowska, 1999), leisure-time and hobby-related, receptive, publicly oriented and integrational activity (Halicka, Halicki, 2002). Depending on the role, there are different lifestyles of the elderly. Leisure-time and hobby-related activity comes down to walking, sports activities, gardening, spending time in allotments. Receptive activity means watching TV and reading books usually at home. The type of activity which covers social and political involvement is publicly oriented activity. Integrational activity is based on meetings, trainings, educational activities,

social and charity engagement. The above specified types of activity comprise numerous patterns of individual and group behaviours, illustrating the abundance of lifestyles of old persons. Physical activity is reported to be of crucial importance in various types of activity and also in typologies of health styles (Nowak, 2008).

Regular exercise belongs to the most important successful ageing factors (Kaczmarczyk, Trafialek, 2007; Kostka, 2001). This term was used for the first time by R.J. Havighurst and R. Albrecht in 1953 (1953). According to M. P. McCann, L. Ward and H. Winefield (2008), successful ageing is a process of optimizing health capacities (physical, social and psychical health), which enables elders to actively participate in social life and so enjoy a good quality of life. The basic conditions of successful ageing are defined by the authors as maintaining a successful condition of health, keeping family and social relationships, education and self-realization opportunities, independent living and financial independence. Successful ageing is associated with a low risk of developing chronic diseases, infirmity and with a high level of mental and physical performance as well as life activities (Laskowska-Szcześniak, Kozak-Szkopek, 2013). On the basis of own study, J. Halicki (2008) identified the following conditions of successful ageing: health and physical performance, good relations and family bonds, social contacts and activeness, adaptation to old age, life satisfaction, objectives and dreams for the future, financial security, good disposition, independence, mental health and hobby.

The term of successful ageing is closely connected with active ageing. The concept of active ageing according to the WHO is a process which enables individuals and social groups to preserve mental and physical wellbeing, professional and social activity, independence and individuality (Active Ageing: A Policy Framework, 2002. Retrieved from [http://www.who.int/ageing/active\\_ageing/en](http://www.who.int/ageing/active_ageing/en)). In 2013, the European Union introduced the Active Ageing Index (AAI). It is a ranking which considers the most important aspects of seniors' lives in particular EU countries. The index allows for assessment of conveniences proposed by the state including but not limited to the employment rate of elders, independence, security, participation in social life, conditions conducive to active ageing. The relevant literature also mentions the term of positive ageing. According to the concept developed by R.D. Hill (2009), positive ageing connotes to using the resources available to an individual in order to optimize the experience of growing old. The resources which can be utilized for positive ageing include inborn psychical predispositions, environmental circumstances (medical procedures, access to medical and care services, housing conditions, working conditions, etc.) as well as individual features.

### **The relationship between physical activity of older people and their health**

Physical activity means each work performed by skeletal muscles, characterized by non-resting energy expenditure. The concept of physical activity also refers to active relaxation and performing a job which together with other factors increase total daily energy expenditure. Some scientific papers differentiate habitual activity connected with everyday life, physical activity during leisure time and occupational physical activity (Bouchard, Shephard, 1994).

So far, no definition of physical activity has been developed which would be recognized worldwide (Van Der Wilk, Jansen, 2005). Human physical activity occurs during work (especially physical work), moving (walking, cycling also when commuting), performing domestic duties (cleaning, cooking, chopping wood, etc.) and during leisure time (participation in sports or recreational activities) (Report on health condition in the world, 2002, 2003). The definitions of physical activity emphasize the fact that the level of this activity depends on the standards of material, civilizational and cultural life of the society. Some of these definitions, especially the ones which highlight



recreational aspects of physical activity, refer this activity to the lifestyle and regard it as a significant element of a healthy lifestyle (Drabik, 1997; Łobożewicz, 2001; Nowak, 2008; Osiński, 2011).

Moderate physical activity of older adults implies better health. This concept, applied in medicine, psychology, sociology, physiology and physical culture, is recognized in a characteristic way for a given field of science. The most commonly used definition of health is the one developed by the World Health Organization (WHO, 1946). In its original wording, according to the World Health Organisation Constitution, health “a state of complete physical, mental and social well-being, rather than solely as an absence of disease” (Ewles, Simnett, 1985, p. 5). A peculiar attempt to combine the common and professional way of defining health is the holistic concept of health which identifies health in several dimensions. Physical health means the right functioning of the body, all its systems and organs. Psychical health includes mental health (the ability to think logically and clearly) and emotional health (the ability to recognize feeling, express them in the proper way, the ability to cope with stress). Social health – means the ability to maintain the appropriate relations with others. Spiritual health is connected with religious practices and beliefs. As a whole, health consists of a few interlinked dimensions the limits of which are not always explicit. The notion of holism in the context of health refers to an individual as a whole and in whole, in the environment, in the aspect of lifestyle and living conditions (Ewles, Simnett, 1985).

A number of studies indicate that the level of physical activity is strictly connected with health, specifically health of older persons (Grzanka-Tykwińska, Kędziora-Kornatowska, 2010). Health should be supported by exercise for health, defined as a lifelong, usually self-controlled process (Kuński, 2003). Numerous researchers have elaborated on physical activity as the best prophylactic measures (Drabik, 1997; Charzewski, 1997; Gębska-Kuczerowska, Miller, 2006; Kostka, 2001; Lipowski, 2006; Nowak, 2008, 2010; Sygit, 2015; Szeklicki, 2007; Jopkiewicz, 1996).

Scientific studies have revealed the beneficial impact of properly dosed physical effort on the cardiovascular system, respiratory system, locomotor apparatus and improvement in cognitive functions (Drabik, 1997; Gębska, Kędziora-Kornatowska, 2012; Kuński, 2003; Szeklicki, 2007). Regular physical activity adjusted to individual needs and capabilities is the natural ageing slowing agent (Łobożewicz, 1991; Nowak, 2010), having a favourable influence on the efficiency of the body and self-assessment of health.

In the foreign literature, the issues of pro-health physical activity also comprise the object of numerous studies (Alves et al., 2016; Blair, Kohl, Gordan, Paffenbarger, 1992; Both, 2000; Hupin et al., 2016; Parsons et al., 2016; Vasconcelos, Cardozo, Lucchetti, Lucchetti, 2016; Hart, 2016). Regular physical activity is recommended to individuals of all ages including those above 80–85 years of age. Physical activity of seniors is supposed to enhance oxygen efficiency (aerobic), promote muscle strength, improve flexibility, balance and coordination of movement. The coexistence of the aforementioned elements maintains good health and wellbeing of older persons (Lacour, Kostka, Bonnefoy, 2002). On the other hand, the Australian studies, conducted among 9 thousand adults over the age of 65 using the diagnostic survey, have revealed that health problems are the most common barrier when taking up physical activity (Lim, Taylor, 2005). The same results were obtained by German scientists (Moschny, Plyta, Klaassen-Mielke, Trampisch, Hinrichs, 2011). Valid tests concerning the pro-health impact of physical activity do not explicitly state whether physical activity is pursued by individuals who are generally healthier and whether indeed some people do not get involved in exercise due to health condition. This question could be answered if the health state of the people involved in physical activities was assessed before starting recreational exercise.



## The physical activity of older people in the light of selected Polish and foreign studies

Research on physical activity of elders involves a wide range of problems within particular fields of science. This activity becomes particularly significant in the demographic situation of the Polish society. For over 30 years, studies have been conducted on physical activity of older men. Three research projects mainly regarding the risk of falls have been accomplished (Osiński, Szeklicki, 2012). On the basis of the Senior Fitness Test (Rikli, Jones, 1999) adapted to Polish circumstances, the level of motor performance was evaluated in 2494 individuals aged 65–103. The results were referred to American standards (Zieliński, Wieleński, 2012). R. Szeklicki (2007) assessed the correlation between habitual physical activity and morphological and metabolic components of physical activity connected with the health of males after 60. The author used an interview questionnaire to examine the social standard of the oldest residents of Poznań. M. Nowak (2008) undertook the issue of a healthy lifestyle of women where a crucial role was played by regular physical activity next to many other pro-health behaviours. This paper is a typology of healthy lifestyles confronting the recognized and realized life values. Kozdroń (2006) and Lipowski (2006) wrote about women's physical recreation and the reasons for pursuing such activity as well.

The "Third Age University" (TAU) program plays a significant role in the social, cultural and physical inclusion of older people. The research conducted in the TAU revealed that the students are active individuals also in terms of physical activity (70% take part in physical activities proposed by the TAU) and it is women who pursue this type of activity more often (Ziębińska, 2007).

The issue of old age and ageing is discussed in numerous Polish magazines, however not on a regular basis, for example, "Central European Journal of Sport Sciences and Medicine", "Human Movement", "Journal of Education, Health and Sport", "Journal of Human Kinetics", "Medical and Biological Sciences", "Polish Journal of Sport and Tourism" and others. Likewise, a number of foreign journals specialized in the problems of gerontology, namely, "Aging and Mental Health", "European Review of Aging and Physical Activity", "Journal of Aging and Health", "Journal of Aging and Physical Activity", "Journal of the American Geriatrics Society", "The International Journal of Aging and Human Development".

Scientific publications presented in foreign reviewed journals, only during the last two years, published numerous papers concerning physical activity of seniors (de Souto Barreto, Delrieu, Andrieu, Vellas, Rolland, 2016; Hart, 2016; Van Holle, De Bourdeaudhuij, Deforche, Van Cauwenberg, Van Dyck, 2015; Marques, Sarmento, Martins, Saboga Nunes, 2016; Musich, Wang, Hawkins, Greame, 2016). Particular attention should be paid to the study by de Souto Barreto (2016). This elaboration examined the impact of physical activity on cognitive processes of 104,909 individuals of middle age or older. The mean time of observation of the subjects was 32 months. It has been revealed that pursuing physical activity, even infrequently (several times a month), positively influences the cognitive functions in the period of ageing.

Taking into consideration the latest scientific reports, physical activity of women in terms of its advantages has been the subject of studies in numerous countries. The Australian research involved 555 female participants born in the period 1921–1926, who reported the symptoms of depression (Heesch, Van Gellecum, Burton, Van Uffelen, Brown, 2016). Pursuing physical activity by these women could significantly improve their quality of life (HRQL test). Elderly women's physical activity issues were also discussed by A.P. Vasconcelos et al. (2016). The purpose of their studies was to assess the influence of different forms of exercises (e.g. pilates, functional gymnastics), on the physical performance of 148 women aged 60 or more. All groups involved in the research were reported to reveal significant changes before and after the exercises. M. Kim et al. (2016) examined the impact of physical activity

(PA) and physical condition (PF) on fear of falling (FOF) in 94 Korean females aged 65–79. The studies showed that agility and dynamic balance in older women, as examined by means of UNG (test 8-foot up-and-go), was the main factor affecting FOF; individuals with low UNG were clearly characterized by high FOF rate.

The impact of physical activity on the improvement of skeletal muscles of male individuals aged above 65 years has been also evaluated (Saint-Jean-Pelletier et al., 2016). It has been concluded that physical activity protects skeletal muscles partially against ageing effects and significantly affects the content and accumulation of lipids. Cross-sectional studies have been also conducted on 1216 men from the British Regional Heart Study (Parsons et al., 2016). The research has revealed that irrespective of the intensity and duration of exercises – they are beneficial to vascular centres.

A number of studies refer successful ageing to pursuing physical activity. A. Beenackers et al. (2012), using search methods, identified the studies of physical activity conducted from January 2000 to December 2010, published in such journals as: PubMed, Embase, Web of Science, Psychinfo, SportDiscus and in the service Social Abstracts. The following five areas of physical activity were identified: TPA (Total Physical Activity), OPA (Occupational Physical Activity, TLTPA (Total Leisure-time Physical Activity), VLTPA (Vigorous Leisure-time Physical Activity) and AT (Active Transport). Among 131 studies, there were 72 elaborations involving persons over the age of 60. When analysing the above paper, it is worth pointing out that studies on population's physical activity are conducted regularly in Scandinavian countries (Denmark, Finland, Sweden) as well as in Germany, France, Switzerland and Great Britain. Table 1 reveals selected Polish studies which have examined the biggest number of individuals undertaking leisure-time physical activity.

**Table 1.** Physical activity as the determinant of successful ageing – selected results of Polish studies

Author and year of publication	Name of study	Number of subjects	Age of subjects	Type of physical activity
Stelmach et al (2004)	CINDI (Countrywide Integrated Noncommunicable Diseases Intervention Programme)	1,837	18–64	TLTPA
Kaleta, Jegier (2005)	Physical activity in Poland	508	42+	TLTPA
Lipowski (2006)	Physical recreation of women in Poland	1,580	16–80	VLTPA
Kaleta, Jegier (2007)	Physical activity in Poland	954	20–64	TLTPA
Szeklicki (2007)	Men's habitual physical activity	137	>60	VLTPA
Drygas et al. (2009)	Health studies in Poland (WOBASZ project)	12,552	20–74	TLTPA
Kwaśniewska (2010)	Multi-aspect health studies (WOBASZ project)	7,280	20–74	AT
Nowak (2010)	Active lifestyle in Poland	3,662	20–75	VLTPA
Mogila-Lisowska (2010)	Leisure-time physical activity of adult Poles – conditions and style of participation	1,447	16–60	VLTPA
Jopkiewicz, Gawron (2013)	Physical performance in the context of health	1,032	20–59	–
Ministry of Sport and Tourism (2016)	Poles' level of physical activity	1,000	>15	AT, VLTPA

Note. TLTPA (Total Leisure-time Physical Activity), VLTPA (Vigorous Leisure-time Physical Activity), AT (Active Transport).

Another elaboration, significant to this study is “Physical activity in older people: a systematic review” by F. Sun, Norman, While (2013). The data for the purpose of this article was gathered from January 2000 to April 2011 in online databases such as: The Cochrane Library, PubMed, Medline, Embase, Scopus and in several Chinese databases. In this case, the authors focused on the elaborations which considered the current guidelines

concerning physical activity. The biggest number of such studies were conducted in the United States and Australia. Sadly enough, no Polish articles were noticed by the authors during the reported period.

## Summary

One of the factors influencing successful ageing is pursuing physical activity. Regular exercise delays the ageing process, for example, by hampering numerous civilisation diseases including the ones which develop as people get older. Demographic ageing of the society has paradoxically led to increased interest in the way individuals over the age of 60 function. Many government and non-government institutions and associations have been established both in Poland and abroad in order to enhance the quality of seniors' lives. Third Age Universities may serve as an illustration of such foundations. A considerable part of organizations and associations acting for the sake of seniors have physical activities included in their offer. This appears to be highly promising and hopefully may contribute not only to extended lifespan, but also to a healthy life due to active – successful ageing.

A lot of studies referred to in this paper emphasise the fact that the level of physical activity is closely connected to health. Therefore, health problems are the most common barrier when taking up physical activity, especially among older people. In the Polish and foreign literature, the issues of pro-health physical activity also comprise the object of numerous elaborations. Studies on physical activity of seniors involve a wide range of aspects within different fields of knowledge.

As a result of the conducted study it is clear that: Physical activity and successful ageing are different in the assessed communities. Thus, it is necessary to monitor physical activity of older people in the context of successful ageing – in order to provide conducive circumstances to activating this social group and thus reducing social security cost.

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# PERCEPTION OF SUCCESS AMONG PEOPLE PRACTISING MARTIAL ARTS AND COMBAT SPORTS

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**Abstract** A scientific framework for this study is the Humanistic Theory of Martial Arts, and the psychology of sport using the concepts of goal, task and success.

The problem and aim of this study was an explanation of “perception of success” in groups of adults practising martial arts. Is perception of success influenced by the respondents' social background or the type of martial art practised? Would there be any differences in results depending on their country of origin and residence, and if so, what results?

The research was done within the framework of the IMACSSS.1A/2011: “Social determinants of participation in martial arts schools and clubs”. The tool was Perception of Success Questionnaire, which was used to survey a number of respondents from the United States, the Czech Republic and Poland, who were selected randomly and participated voluntarily. The statements and calculations have been ranked by more or less contact forms of martial arts.

The results obtained in this study indicate a poor relationship between perception of success and the type of fighting style practised and a measurable relationship between the perception of success and social origin. There is a weak relationship in perception of success by respondents from American or European cultures.

**Key words** ego orientation, task orientation, martial arts, combat sports, Perceptions of Success in Sport Questionnaire

## Introduction

The first part of the scientific framework for this study concerns the holistic Anthropology of Martial Arts and the Humanistic Theory of Martial Arts (Cynarski, 2012; Zeng, Cynarski, Xie, 2013). In this perspective, we analyse the Martial Arts and Combat Sports (MA&CS) holistically, with physical and technical components, and also values



and motivations of people practising it. It is important what type of MA&CS is practised, and who is the teacher and the student (Obodynski, Cynarski, 2005; Vertonghen, Theeboom, 2012; Cynarski, 2013).

The second part of the background is the psychology of education (Elliot, 2006), and its application for the psychology and sociology of sport, using concepts of goal, task and success; e.g. by Nicholls (1984) and his achievement goal theory. There are two types of goal orientation: learning orientation and performance orientation. Both are parts or manifestations of the motivational processes affecting learning.

Perception of success and task orientation are important issues in the psychology of sport and modern coaching, pedagogy and physical education, as well (Nicholls, 1984; Ames, 1992). Goal orientation is an important part of a personal motivational profile in sport (Moreno Murcia, Cervelló Gimeno, Cutre Coll, 2007; Holgado Tello, Navas Martínez, López Núñez, García Calvo, 2010).

Some authors focus on the philosophy of martial arts for explanation of their impact onto perception of success and aspirations (Back, Kim, 1979; Kim, Back, 2000; Cynarski, 2013; Cynarski, Lee-Barron, 2014). Socio-cultural conditions of the martial arts perception and internalization of the special ethos are indicated quite often (Dykhuizen, 2000; Cynarski, Sieber, Litwiniuk, 2005; Obodynski, Cynarski, 2005; Zeng, Xie, Cynarski, 2013).

Social stratification refers to a multi-level system of layers. It is measured by the availability of five basic social resources: power, money, prestige, knowledge, education and health. The "layer" refers to the community "separate due to the similar lifestyles, customs, income levels and awareness of the barriers separating it from others, especially the lower communities" (Szczepanski, 1970).

We assume here the stratification proposed by William L. Warner, who in his research, in order to assess the stratification, has adopted the following criteria: education, occupation, wealth, titles, membership in clubs, and neighbourhood of residence. He took into account indicators including economic and social prestige, and stated that through the layers he understood two or more groups of people who believed themselves to be occupying in society higher or lower positions. He distinguished three layers (higher, middle and lower), which were divided into sub-layers. Hence, the model was created in the shape of a pyramid with the following characteristics of layers: 1) A1 – higher higher – old families that inherited their wealth from their fathers and grandfathers (on the top of the pyramid); 2) A2 – higher lower – new families, factory owners, businesspeople who made a fortune by themselves (*nouveau riche*); 3) B1 – average higher – doctors, lawyers, professors, directors and managers of companies; 4) B2 – average lower – small traders, artisans, clerks, highly-qualified workers, people with their own houses in the suburbs; 5) C1 – lower higher – semi- and unskilled workers with a permanent job, the residents of tenement houses, people with incomes spent entirely on current expenditure; 6) C2 – lower lower – people with bad reputation, slum dwellers, the homeless, beggars (Szczepanski, 1970). For this study it was assumed that people practising martial arts, sports and combat systems belong to the layers C1, B2, B1, A2.

Another differentiating factor was the attitude of the respondents to the two types of objectives: "physical health, mental well-being, improvement of the fitness level and independence – achieving personal challenges and acquiring a definite position – which all resemble task orientation. In turn, the motives of participation in sports activity resemble ego orientation" (Beck, Monastyrska, Wojciechowska, Szrajda, 2013).

The problem and aim of this study was the explanation of "perception of success" in groups of children and young people practising combat sports and martial arts. Based on this, it was examined how the use of these forms of physical activity and belonging to different social groups and gender influence the beliefs of these people regarding



the possibility of success not only in sports and martial arts. The added value of this study is its internationalization, as the groups of practitioners belong to different culture.

Two research problems were posed. The first problem of the research was an attempt to determine the importance of the social dimension of perception of success in groups of adults practising martial arts, comparatively, in Poland, the Czech Republic and the USA. The questions posed by the research included: Is there a relationship between the perception of success by the respondents, and their social background? The second research problem concerned the determination of the possible emergence of differences in the perception of success in groups of adults martial arts practitioners (and comparatively, in Poland, the Czech Republic and the USA). Therefore, the research question was: Are there any differences in the results according to the country of origin and residence and what they might signify?

In connection with the above issues and research questions the following hypotheses were adopted: 1) There is no statistically significant relationship between the perception of success in martial arts and social origin; 2) Differences in the statements of the respondents from different countries are mainly due to cultural differences.

## Material and Method

The research was done within the framework of the IMACSSS.1A/2011: "Social determinants of participation in schools and clubs of martial arts". It is a Project, under auspices of the Division of Sociology and Anthropology and the Division of Pedagogy the International Martial Arts and Combat Sports Scientific Society (IMACSSS). This project involved research, in which various methods and techniques were used. The study was approved by the Ethical Committee of Idokan Poland Association (Scientific society which cooperates with IMACSSS).

The Perception of Success Questionnaire (POSQ) was used in this study. The authors of this tool (Glyn C. Roberts, Darren C. Treasure, Gloria Balague) identified two indicators with reference to motivation – "task" (T) and "ego" (E) orientations. The task orientation (T) defines success as achieving mastery – concentration on improving one's own skills, striving for perfection, overcoming difficulties and reaching a goal; thus, the demonstration of ability is self-referenced and success is realised when mastery is demonstrated. The ego-involving goal orientation (E), in turn, defines it as outperforming others, rivalry orientation, comparing with opponents and a positive assessment of own actions. The ego goal orientation, then, is the predisposition to evaluate success in terms of demonstrating a better ability than others, especially if little effort is expended (Roberts, Treasure, Balague, 1998). This tool (standardized psychological test) contains a scale of answers to choose from.

The study was conducted between October 2015 to January 2016 in the United States (New York), the Czech Republic (Brno) and in Poland (Rzeszów, Skarżysko-Kamienna, Strzyżów, Warsaw). The number of respondents, randomly selected, and with their voluntary participation was N = 182 (respectively 32, 34 and 116) people. The percentage of men and women by country is presented in Table 1.

**Table 1.** Demographic characteristics of respondents based on gender

Gender	USA		Czech Republic		Poland		Summary	
	N	%	N	%	N	%	N	%
Women	7	3.85	6	3.32	27	14.80	40	21.90
Men	30	16.48	28	15.30	84	46.10	142	78.10

Due to a significant difference in the number of respondents between the Czech Republic (34 persons), the United States (32 persons) and Poland (116 persons) an overwhelming dominance of Poles (46.17%) was observed in comparison to the number of men from the Czech Republic (15.38%), Polish women (14.8%) and American men (16.48%). In contrast, a small minority were the Czech men (3.32%) and American women (3.85%).

The data on age diversity found among survey respondents is shown in Table 2.

**Table 2.** The mean of age of respondents

Gender	USA x	Czech Republic x	Poland x	Summary x
Women	20.34	28.30	22.90	23.64
Men	25.38	27.10	23.34	25.16

The mean of age of the respondents (men and women) from three countries was varied. The highest mean was recorded in the case of people practising martial arts in the Czech Republic (women 28.3 years, men 27.1 years). Then there were the Americans (25.38 years), Poles (23.3 years) and Polish women (22.29 years). On average, the youngest people among the respondents were from the United States (20.34 years).

This questionnaire contained twelve affirmative sentences (in the form of answers) and the scale of their potential acceptance or rejection. These sentences expressed the following attitudes: 1) "I beat other people"; 2) "I am clearly superior"; 3) "I am the best"; 4) "I work hard"; 5) "I show clear personal improvement"; 6) "I outperform my opponents"; 7) "I reach a goal"; 8) "I overcome difficulties"; 9) "I reach personal goals"; 10) "I win"; 11) "I show other people I am the best"; and 12) "I perform to the best of my ability" (Roberts et al., 1998).

The subjects rated their relationship to the above sentences based on the scale from A (Strongly agree) through C (Neutral) to E (Strongly disagree). Individual responses were assigned a corresponding rank (1–5). It should be noted that the questions 4, 5, 7–9 and 12 were classified as *Task orientation*, and 1–3, 6, 10 and 11 – *Ego orientation* (Roberts et al., 1998). The results were used in the analysis measuring the acceptance of these attitudes and possibly occurring correlations. It is assumed that the Poles and the Czechs would be portrayed as persons from the European cultural area, and residents of the United States – the American.

## Results

The first hypothesis presupposed a lack of statistically significant dependence between the perception of success in the martial art practised and social origin. Both *Task orientation* and *Ego orientation* were taken into account. In addition, in order to examine thoroughly the problem of the presence or absence of a statistically significant relationship, the statements and calculations have been ranked by more or less contact forms of martial arts (arithmetic mean, standard deviation, coefficient of variation and the strength of relationships between variables based on Spearman correlation). The level of significance is  $p < 0.05$ . The results obtained (using Statistica software and LibreOffice Calc) are shown in Table 3.

They assumed that martial arts, combat sports and combat systems were divided according to their contact intensity. The category "Combat sports and combat systems" included MMA, kickboxing, judo, taekwondo, and

Krav Maga. "Martial arts (non-contact)" included modern *jujitsu*, *goshin-ryu jujitsu*, *jujitsu* styleless, *idokan jujitsu*, karate *idokan*, karate *isshin-ryu*, *iaido*, *goshinjutsu*, *jujitsu*, *chow gar*, *aikibudo*, kung fu, and aikido.

**Table 3.** The perception of success and the kind of cultivated martial arts

Orientation	Combat sports and combat systems			Martial arts (non-contact)		
	$\bar{x}$	SD	V (%)	$\bar{x}$	SD	V (%)
Task	1.81	0.82	45.3	1.72	0.83	48.25
Ego	2.55	1.03	40.4	2.92	1.14	39.05

The data contained in Table 3 indicate a variation in the responses of people practising sports, combat systems and martial arts in the subject line success (in the form of purpose and self-development).

Coefficient of variation (given in percentage), "ego orientation", and "task orientation" is between 20 and 40% (39.05%) and between 40 and 60% (40.4; 45.3; 48.25), so the diversity of statistical data can be placed between the mid and high range.

The results of Spearman correlation was 0.36. This means that there is a weak correlation between the type of practised fighting styles and perception of success.

Verification of the first hypothesis takes into account the perception of success by the respondents characterised by social origin. The results are shown in Table 4.

**Table 4.** The perception of success and social origin

Orientation	Layer lower higher			Layer average lower			Layer average higher			Layer higher lower		
	$\bar{x}$	SD	V	$\bar{x}$	SD	V	$\bar{x}$	SD	V	$\bar{x}$	SD	V
Task	2.73	1.34	49.10	2.12	0.92	43.40	1.92	0.94	48.90	2.12	0.89	41.99
Ego	2.41	1.13	46.80	2.31	1.01	43.70	2.51	1.15	45.80	3.30	1.47	44.55

The data contained in Table 4 shows a variation in the response of representatives of sports and combat systems and martial arts belong to a distinguished social strata (which are of social origin) in the subject achieve the objective and self-development.

The values of the coefficient of variation (in percentages) "ego orientation" and "task orientation" are between 40 and 60 percent (41.99; 43.4; 43.7; 44.55; 45.8; 46.8; 48.9; 49.1), so that there is a large variation in statistical data.

The Spearman's rank correlation coefficient between social origin and perception of success is  $r_s = 0.42$ . This means that there is a moderate correlation. Moreover, the significance of calculated ratio is 6.17. Because this value is higher than 0.05, it means that we must confirm the hypothesis concerning the lack of a statistically significant dependence between the perception of success in martial arts and social origin.

The second hypothesis was on the differences in the statements of the respondents from countries belonging to the American (United States) and European (Czech Republic and Poland) cultural area, and on the perception of success. Also in this case *Task orientation* and *Ego orientation* were taken into account as well as statements and calculations ranks related to cultural area. The results are shown in Table 5.

**Table 5.** The perception of success and cultural area

Orientation	American			European		
	$\bar{x}$	SD	V (%)	$\bar{x}$	SD	V (%)
Task	2.02	1.04	51.48	2.04	1.02	50.00
Ego	2.34	1.12	47.87	2.21	1.22	55.20

Coefficient of variation (given in percentage) “ego orientation” and “task orientation” is between 40 and 60% (47.87; 50; 51.48; 55.2), so that there is a large variation in statistical data.

The result of Spearman's rank correlation coefficient is  $r_s = 0.39$ , which means that there is a weak relationship between the representation of the American or European cultural area and the perception of success. Moreover, the significance of calculated ratio is 5.77. Because this value is higher than 0.05, it means that we must accept the hypothesis concerning a lack of a statistically significant dependence between the perception of success in martial arts and the origin of the cultural area.

The result of the analysis of the perception of success is also interesting because of the gender of the respondents. The obtained data is presented in the Table 6.

**Table 6.** The perception of success according to men and women

Orientation	Women			Men		
	$\bar{x}$	SD	V (%)	$\bar{x}$	SD	V (%)
Task	1.77	0.66	37.29	1.85	0.93	50.27
Ego	1.91	0.82	42.93	2.20	1.08	49.10

The data contained in Table 6 indicates a lack of diversity in the responses of women and men on the subject of achieving the objectives and self-development.

Coefficient of variation (given in percent) “ego orientation” and “task orientation” is between 20 and 40 percent (37.29) and between 40 and 60 percent (42.93; 49.1; 50.27), so the diversity of statistical data can be placed between the mid and high range.

The result of Spearman's rank correlation coefficient is  $r_s = 0.34$ . This means that there is a weak relationship between gender and perception of success.

## Discussion

Respondents practising combat sports and combat systems agreed that success depended on achieving specific objectives, the outcome was similar to the response “other” than “definitely”. While they were neutral towards the claims that it was equally important orientation for self-development (percentage of replies situated them between consent and neutrality). In the case of martial arts' practitioners these results were presented in analogy, the responses to “ego orientation” were closer towards “disagree.” While the standard deviation in individual cases indicated a lack of diversity in the responses given.

Social background of a person is determined by 1) personal level of education; 2) parental level of education; and 3) profession. It was assumed that these indicators are associated with membership to a particular social class, expressed *inter alia* by socio-professional categories (Gillbert, 2017). In this case, the social layer is divided into middle, higher and lower classes. However, due to the lack of responses concerning acquired and performed parental professions and the previously analysed level of practitioner's education, the survey was limited merely to the description of the parental level of education as a factor for determining the social background of the respondents.

Respondents representing a lower higher, average lower and higher lower neutral layer responded to the opinion that success depends on achieving the specific objectives, but "rather" coincides the claims of persons from an average higher layer.

In the case of "ego orientation" neutral posture was kept by the representatives of the lower higher layer, average lower and average higher, attitudes "disagree" – the higher lower layer. Besides, the standard deviation values indicated no significant differences in the responses given.

The data contained in Table 5 indicate a lack of diversity in the responses of representatives of sports and combat systems and martial arts belong to the appropriate social class. Respondents from the American cultural area expressed a neutral position towards the opinion that success depends on achieving specific objectives and that equally important is oriented self-development. In the case of persons belonging to the European cultural area, these results were similar. In contrast, the standard deviation indicated no significant differences in the answers provided.

The data contained in Table 6 indicate a lack of diversity in the responses of women and men on the subject of achieving the objectives and self-development. Women agreed that success depends on achieving specific objectives and that orientation for self-development is equally important. Men also agreed with the statement that success depends on achieving the goal, but expressed a neutral attitude towards the opinion that success is related to self-development. Standard deviations indicated no significant differences in the responses given.

This popular tool (POSQ) was used in some similar research connected with young people who practise and play sports (Escartí, Roberts, Cervelló, Guzmán, 1999; Beck et al., 2013; Gómez-López, Granero-Gallegos, Abrales, Rodríguez-Suárez, 2013; Guelmami, Jbabli, Barhoumi, Hamrouni, Agrebi, 2014). According to Salinero Martín, Ruiz Tendero and Sánchez Bañuelos (2006), "*Task orientation correlated with motivation-effort in order to achieve success, with sports practice enjoyment, anxiety over stressful situations and with a lower learning commitment and dedication.*" However, martial arts have their own specifics.

The results (shown above) are generally compatible with some similar research on what affects people practising martial arts (King, Williams, 1997; Boyd, Weinmann, Yin, 2002; Vertonghen, Theeboom, 2012; Zeng, Cynarski, 2016). However, authors' own research presented above brings new knowledge on the perception of success among martial artists. Poor dependence on the indications of that perception with varying social origin, gender and cultural area indicate that in the era of globalization a significant unification of cultural patterns takes place in Western countries. There were no significant differences between trainees of martial arts and combat sports in some earlier studies (Vertonghen, Theeboom, 2012; Witkowski, Cynarski, Blazejewski, 2013). In studies by Vertonghen, Theeboom and Pieter (2014) social diversity in relation to the cultivated varieties of martial arts and combat sports was observed, but a tool POSQ studied only young people aged between 11 and 18 (N = 33). Quite often, the statement is a correlation between the level of aggressiveness and orientation on the target, and

practising harder, more contact varieties of combat sports. Significantly, “more immigrants were found among kick-/Thai boxers” (Vertonghen et al., 2014; King, Williams, 1997; Vertonghen, Theeboom, 2012; Witkowski et al., 2013).

## Conclusions

Undoubtedly, this issue requires further research and on a larger scale, in training environments, different varieties of martial arts, combat sports and related systems. The novelty of this study is multidimensionality (culture, kind of martial art or sport practised, and aim/perception of success).

The results obtained in this study indicate a weak relationship between the perception of success and the kind of cultivated fighting styles, and moderate relationship between the perception of success and social origin. In addition, there is a weak relationship in the case of the perception of success and representation of the American or European cultural area.

Poor dependence on the indications of perception the success with the cultural area and gender may indicate that in the era of globalization there is a substantial unification of cultural patterns. However, the limited scope of the study and a small number of groups does not allow for unambiguous generalizations.

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## Guide for Authors

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