ORIGINAL RESEARCH PAPER

RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND THE OBJECTIVE INDICATORS OF PHYSICAL CAPITAL FOR WOMEN IN FITNESS

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Abstract

As it is mentioned in the action direction Healthy and Workable Individual of the National Development Plan of Latvia 2012 –2020: 30% of all the dead in Latvia have lost their life at the age of being able to work. The main causes of death rate are different diseases (cardio-vascular a.o.), as well as outer death causes (injuries) (Pudule et al, 2012; Štale et al, 2013). Only 8% of the EU and 6% of the Latvian population regularly perform moderate and very difficult physical activity (PA) (Eurobarometer, 2013). Therefore it is necessary to implement purposeful and effective health promoting and risk limiting events to develop the physical capital of one. The understanding of the impact of physical activity on one's physical capital is not well explored in the previous studies (Hutson, 2012; Maguire, 2008; Goldenberg, 2003; Hedblom, 2009). Therefore, the aim of the study is to determine the relationship between PA and the objective indicators of physical capital for women in fitness. In the study voluntarily participated 33 women (30±4.1 years) from 2 fitness clubs in Riga. In order to determine the respondents' objective indicators of physical capital were applied: bioimpedance method (TANITA SC330, Japan, 89/336/EC), heart rate variability analysis data processing software 'Omega', complex load test with expiratory gas analysis (VIASYS Healthcare GMBH, Germany) and Eirofit tests for adults. In order to determine the level of PA the IPAQ (Craig et al, 2003) short version in Latvian (Kaupuzs & Larins, 2010) was used. Descriptive and inferential statistics were made (SPSS ver.18.0). Several moderately close ($0.5<|r_s|<0.69$; $p<0.01$) and close correlations ($0.7<|r_s|<0.99$; $p<0.01$) are determined between the level of PA and indicators of body composition, physical work capacity, physical fitness and functional state of the body. The level of PA has a positive impact on the objective indicators of physical capital. The more physically active the

respondent is, the better physical fitness, higher work capacity, better the indicators of his body composition are and better functional state.

Keywords: *physical activity, physical capital, women in fitness*

Introduction

Nowadays sedentary lifestyle is becoming more and more frequent all over the world, and it causes very big physical and mental health problems (World Health Organization, 2014). Based on 'National Development Plan of Latvia 2012 –2020' 30% of all the dead in Latvia have lost their life at the age of being able to work (National Developmental Plan of Latvia, 2012). The main causes of death rate are different diseases (cardio-vascular, oncologic, mental, loco-motor, a.o.), outer death causes (injuries, accidents, suicides, murders), which often cause the loss of work ability (Pudule et al, 2013; Štāle et al, 2013). As well obesity is one of the most widespread problems. About 25% of children and 40 – 60% of adults in all developed countries suffer from the excess weight which causes physiological and psychological changes of the body and serious health problems (Lobstein, et al., 2004; Brach, et al., 2004; Hills et al., 2013; Ara, et al., 2006). At any age sedentary lifestyle and inappropriate diet increases health problems (Tuyckom et al., 2010). Only 8% of the EU and 6% of the Latvian population regularly perform moderate and very difficult physical activity (PA). 33% in Europe and 25% in Latvia do it with some regularity, 42% in Europe and 39% in Latvia never do physical activities. If we compare genders doing PA, we can see, that 55% of European men and 63% of European women never or seldom do PA. Even worse situation is in Latvia – 66% of men and 71% of women never or seldom do PA (Eurobarometer, 2013).

Therefore it is necessary to implement purposeful and effective health promoting and risk limiting events to strengthen healthy and active lifestyle habit in society by developing health promotion cooperation nets: of healthy diet, active lifestyle and the facilitation of mental health (World Health Organization, 2014). Fitness includes various PA, health improvement programs, innovative technologies, diet programs, whose main principle is health improvement and the development of physical capital.

Shilling (1991) defines physical capital as a social formation of bodies through sport, leisure and other activities. According to Bourdieu, Hutson (2012) defines physical capital as the value assigned to particular modes of embodiment, uses of the body, investment in the body, and interpretations of the body that may be appropriated, exchanged, or

reinvested for additional profit or status in the social group. The term physical capital is characterized by human entity, physical ability and appearance as an attitude towards their own health, which shows each person's knowledge and morality (Hutson, 2013, Jutel & Buetow, 2007; Hamermesh, 2011). Physical ability is defined as the ability to satisfactorily perform physical work. Physical ability is attributable to muscle work needs for employees in their daily work and leisure time (Eurofit for adults – Assessment of health related fitness, 1995). Nowadays, as a result of technology development muscle work is very minimal and does not require much effort, which can lead to a critical level of physical ability. In the study attention is paid not only to physical ability as the physical capital characteristics, but to physical fitness in general. Physical fitness can be judged both as solely the body's physical ability, which is necessary for physical activity performance, and as a health-influencing criterion. As a health-influencing criterion physical fitness is the body's morphological and functional property aggregate (Caspersen et al., 1995), which includes cardiorespiratory work capacity, motor readiness as muscle system's manifestations (strength, muscle endurance, speedy strength), movement coordination, reaction time, flexibility and as an additional indicator of body composition. To be well physically fit means to be healthy. Health-influencing physical fitness is the ability to perform daily activities with effort and skill and to participate in leisure activities without excessive fatigue, as well as to be able to overcome increased physical load caused by emergency situations and to show the ability that reduces early development of diseases caused by immobility (Vanhees et al, 2005; Pate, 1988).

Several studies show correlation between PA, physical fitness (Sloan et al., 2009; Kaupuzs & Larins, 2010; Mammen & Faulkner, 2013; Napolitano et al., 2011 u.c.) and functional ability (Vecenāne & Fernāte, 2013; Edward et al., 2006). PA helps to improve not only the physical components, but also the social and spiritual ones (Mammen & Faulkner, 2013). PA may be defined as any body movement, performed with the help of skeletal muscle, which requires energy consumption (Caspersen et.al, 1995). The term health-enhancing physical activity is frequently used in relation to the health benefits gained from physical activity. It should be understood as any form of physical activity that benefits health and functional capacity without undue harm or risk (HEPA Europe, 2005).

Nowadays, women have to invest more in their bodies than men, which is due to competition in both the labour market, and in everyday life, where a woman strives to be equal to a man (Adelman & Knijnik, 2013; Crossley, 2006). The optimum activity of functional systems of the

women's body is between the ages of 15-25 years (Ory et al., 2003; Vanhees et al, 2005). After reaching this age the aging processes begin to activate in the functional systems, homeostasis is lost. By improving physical fitness as an indicator of physical capital, including cardiorespiratory system's work capacity and body composition, it is possible to increase functional ability and to extend the life of their social activity.

Therefore, the aim of the study is to determine the relationship between PA and the objective indicators of physical capital for women in fitness.

Materials and Methods

In the study voluntarily participated 33 women (in the average age of 29.31 ±1.3 years) from 2 fitness clubs in Riga. In order to solve the study's goal the following methods were applied: bioimpedance method, testing (Eirofit tests and complex load test), heart rate variability method (HRV), International Physical Activity Questionnaire (IPAQ) short version in Latvian, descriptive and inferential statistics methods.

In order to determine the objective indicators of physical capital for women in fitness the following methods were used: testing (Eirofit tests and complex load test), bioimpedance method, and heart rate variability method (HRV).

Motor readiness ability was determined with testing method, with standardized Eirofit tests for adults (Eurofit for adults – Assessment of health related fitness, 1995), which consist of 9 sections, such as: body balance determination test – the flamingo balance test; hand movement speed determination test – the plate tapping test; flexibility determination test – sit-and-reach test; shoulder joint flexibility determination test – shoulder abduction; hip joint flexibility determination test – hip abduction; explosive strength determination test – vertical jump; static strength determination test – the handgrip test; the body strength determination test – sit-ups test and functional strength determination test – the bent arm hang.

Cardiorespiratory system's work capacity was determined with testing method with complex load test with expiratory gas analysis on cardiopulmonary diagnostic device 'Master Screen CPX' (VIASYS Healthcare GMBH, Germany). During this functional diagnostic test complexly established and measured was cardio-vascular and respiratory system's activity during rest, load and recovery time after the load. In addition, during the test the work capacity presented by women was recorder. The load tests were conducted on the spot in the laboratory (physical health, sports medicine and rehabilitation centre), in a specially

equipped room in order to provide emergency aid rendering. The load test was performed under the supervision of a sports doctor and it consists of several phases, the duration of which is determined by the sports doctor, taking into account the person's state of health and physical fitness level. The test contained 4 phases: 1. rest phase; 2. warm-up phase; 3. load phase – gradually increasing physical load; 4. recovery phase. During the load phase each woman performed a gradually increasing load on a veloergometer until exhaustion or the moment of another troublesome reason's emergence. The load intensity starting from the load phase was determined individually as well, which was later increased every one minute by 10 W. The duration of the load phase was dependent on women's physical fitness level.

Indicators of body composition such as muscle mass, the total amount of water, the total amount of water %, bone mass, metabolic age, amount of visceral fat, body mass index, ideal body weight, the degree of obesity, desired amount of body fat and physical activity level were determined with bioimpedance method, body composition analyzer TANITA SC330 (Japan, 89/336/EC).

Functional state was determined with heart rate variability (HRV) analysis data processing software 'Omega'. HRV analysis is based on electrocardiogram RR time interval analysis and feature dynamics, which are visually marked in the cardio interval gram or rhythmogram (see fig.1).

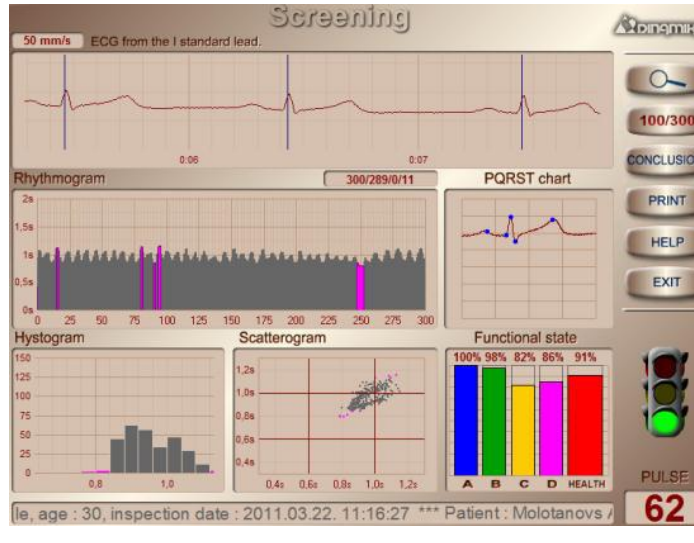

Figure 1. HRV analysis – screening diagnostics
(Научно-исследовательская лаборатория „Динамика", 2002)

Any changes in the body are reflected in heart rate, where in response to the central nervous system impulse reflects the whole body's rhythm. Consequently, on the basis of heart rate dynamics protocol it is possible to determine the functional state of the whole body (Баевский, Иванов & Рыбыкина, 1999; Чуян, Бирюкова & Раваева, 2008). For this study we selected the main indicators of functional state that the data processing software 'Omega' analyzes automatically: 1) (A) parameter (blue) – cardiovascular system's adaptation to the load; 2) (B) parameter (green) – heart training indicator (autonomous regulation of the vegetative system); 3) (C) parameter (yellow) – power supply level of physical loads; 4) (D) parameter (pink) – psycho-emotional state; 5) (C) parameter (red) – physical health indicator, functional state index (see fig.1).

For physical activity amount determination the International Physical Activity Questionnaire's (IPAQ) short version (Craig et.al., 2003) in Latvian (Kaupuzs & Larins, 2010) was used. Respondents marked how much of very difficult or moderately intensive physical activity they have performed over the last 7 days, how much time they spent sitting or walking.

For data analysis SPSS ver.18.0 data processing programme was used. Where descriptive statistics was carried out (frequencies, mode, mean), Kolmogorov-Smirnov criterion and Spearman's rank correlation coefficient was determined.

Results

By summarizing the data, it can be concluded that all respondent's IPAQ questionnaires were valid for data processing. By evaluating the obtained Spearman's rank correlation coefficients (one-tailed), it can be concluded that for each objective indicator of physical capital there are significant relationships with PA.

Several moderately close ($0.4<r_s<0.7$) (Dravnieks, 2012) relationships between PA and motor readiness ability have been determined:

1. Between very difficult PA and motor readiness ability: the more often the respondent performs very difficult PA, the better the balance is (r_s= -.445, $p<0.01$), the better the hip joint flexibility (r_s = .474, $p<0.01$). The longer the respondent performs very difficult PA, the better the hand agility (r_s = -.17, $p<0.01$), flexibility sitting, with arms extending to the feet (r_s = .503, $p<0.01$) and the better the static strength (r_s = .437, $p<0.01$) (fig.2).

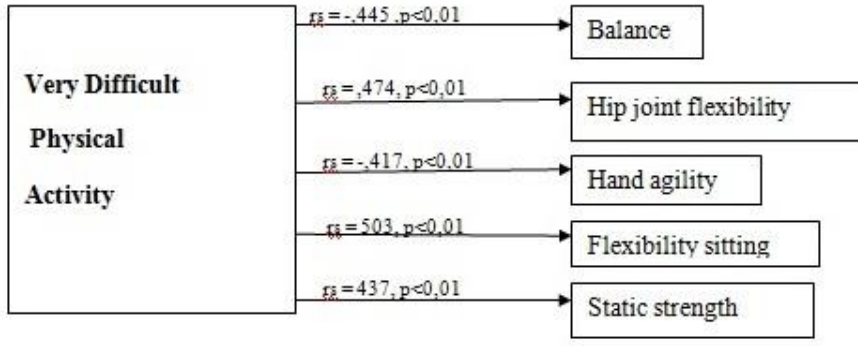

Fig 2. Relationship between very difficult PA and motor readiness ability

2. Between moderate PA and motor readiness ability: the more often the respondent performs moderate PA, the better the functional strength in hang (r_s = .544, p<0.01). The longer the respondent performs moderate PA, the better the balance (r_s = .519, p<0.01).

3. Between walking and motor readiness ability: the more the respondent walks, the better the functional strength (r_s = .500, p<0.01).

4. Between how much time the respondent spends sitting and overall physical fitness: the more time the respondent spends sitting, the worse the hip joint flexibility (r_s = -.541, p<0.01) and the worse the explosive strength in vertical jump (r_s = -.478, p<0.01).

Several moderately close (0.4<r_s<0.7) relationships between PA and the respondent's cardiorespiratory system's work capacity have been determined (fig.3):

1. Between moderate PA and physical work capacity: the more often the respondent performs moderate PA, the higher her work capacity is (r_s = .504, p<0.01).

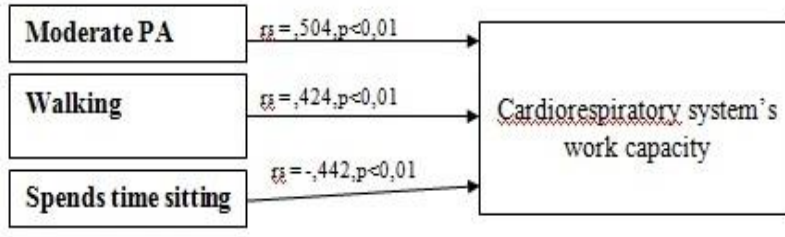

Fig.3. Relationship between PA and cardiorespiratory system's work capacity

2. Between walking and physical work capacity: the more the respondent walks, the better the cardiorespiratory system's work capacity is (r_s = .424, p<0.01).

3. Between the time the respondent spends sitting and cardiorespiratory system's work capacity: the more time the respondent spends sitting, the lower her cardiorespiratory system's work capacity is (r_s = -.442, p<0.01).

Several moderately close (0.4<r_s<0.7) significant relationships between PA and indicators of body composition have been determined:

1. Between walking and indicators of body composition: the longer and more frequently the respondent walks, the lower the body weight (r_s = -.456, p<0.01), the lower the percentage composition of fat (r_s = -.637, p<0.01), the lower the metabolic age (r_s = -542, p<0.01), the lower the visceral fat coefficient (r_s = -700, p<0.01), the higher the water percentage in the body (r_s = .565, p<0.01), the lower the percentage of obesity (r_s = -.548, p<0.01) (fig.4).

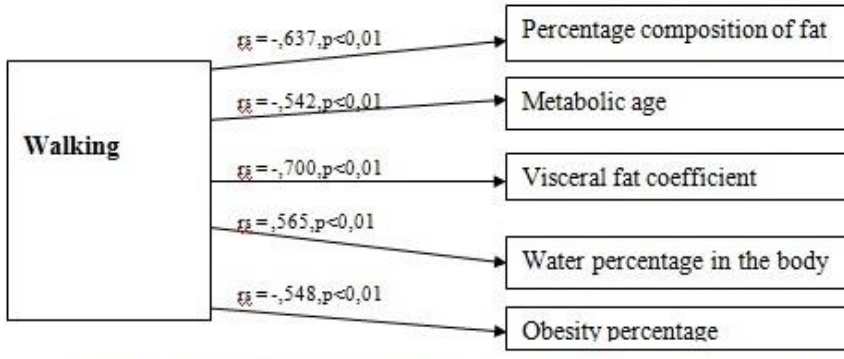

Fig.4. Relationship between PA walking and indicators of body composition

1. Between moderate PA and indicators of body composition: the more often the respondent performs moderate PA, the lower the metabolic age (r_s= -.470, p<0.01), the lower the visceral fat coefficient (r_s = -.431, p<0.01), the lower the obesity percentage is (r_s = -.434, p<0.01).

2. Between very difficult PA and indicators of body composition: the longer the respondent performs very difficult PA, the lower the water percentage in the body (r_s = -.435, p<0.01), the greater the muscle mass (r_s = .554, p<0.01), and, however, then there is a greater body weight (r_s = .550, p<0.01).

Several moderately close and close (r_s>0.7) (Dravnieks, 2012) relationships between PA and functional state have been determined:

1. Between very difficult PA and functional state: the more often the respondent performs very difficult PA, the better the heart training indicator (r_s = .723, p<0.01), physical load power supply level (r_s = .723, p<0.01), the

better psycho-emotional state (r_s = .690, p<0.01), the better physical health indicator (r_s = .729, p<0.01) and the greater the functional state index (r_s = .719, p<0.01).

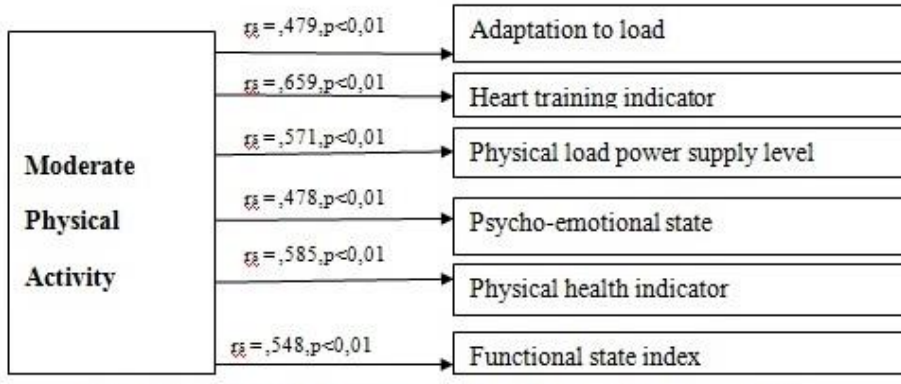

Fig. 5. Relationship between moderate PA and functional state

2. Between moderate PA and functional state: the more the respondent performs moderate PA, the better the adaptation to load (r_s = .479, p<0.01), the better the heart training indicator (r_s = .659, p<0.01), the better the physical load power supply level is (r_s = .571, p<0.01), the better the psycho-emotional state (r_s = .478, p<0.01), the better the physical health indicator (r_s = .585, p<0.01) and a better functional state index (r_s = .548, p<0.01) (fig.5).

Based on the obtained results, it can be concluded that PA has significant relationships with each of objective indicators of physical capital. Several moderately close (0.4<r_s<0.7) significant relationships between PA and indicators of body composition, physical work capacity and motor readiness ability have been determined. Between PA and respondents' functional state moderately close (0.4<r_s<0.7) and close (r_s>0.7) significant relationships were determined. Due to the obtained results we form an understanding of the way how PA influences the objective indicators of physical capital.

Discussion

The study is aimed to determine the relationship between PA and the objective indicators of physical capital. By studying the scientific literature in this field we can conclude that mostly physical capital is viewed as a social aspect. In scientific studies physical capital is characterized indivisibly, as the body's interpretation type, investment in the body, exchange values in social life (Hutson, 2012, 2013) or as the body's social forming through sports and leisure activities (Shilling, 1991), but it is not

precisely described in what way physical capital accumulation takes place. Based on the theory, it can be concluded that one of the measurable indicators that characterize the physical capital is physical ability (Hutson, 2013, Jutel & Buetow, 2007; Hamermesh, 2011). In our study we use a broader concept as the objective indicator of physical capital, physical fitness in general. A number of studies have determined the relationship between a person's PA and physical fitness (Sloan et al., 2009; Kaupuzs & Larins, 2010; Mammen & Faulkner, 2013; Napolitano et al., 2011; Stewart et al, 2003), indicators of body composition (Brach, et al., 2004; Hills et al., 2013; Ara, et al., 2006), functional state (Vecenāne & Fernāte, 2013; Edward et al., 2006). Our study also showed a significant relationship between PA and motor readiness ability, cardiorespiratory system's work capacity, body composition and functional state as the objective indicators of physical capital.

The term physical capital is characterized as a person's attitudes towards their own health, indicator of a person's knowledge and morality (Hutson, 2012, 2013; Shilling, 1991; Hamermesh, 2011). Based on the data obtained during the study, we can hypothetically assume that by performing PA it is possible to influence the physical capital. Taking into account the results obtained during the study, it can be assumed that by measuring the performed PA it is possible to measure a person's investment in the body and the way how the person's body changing process occurs, taking into account the changes of the objective indicators of the person's physical capital.

It has been scientifically proven that physical capital is a symbol of how much time, resources and energy has been invested in each person's body in order to increase their status in the society or to transform it into other types of capital, for instance, economic or cultural (Giddens, 1991; Saguy & Riley, 2005; Bourdieu, 1984). In this study a significant relationship between PA and the objective indicators of physical capital was determined and further all aspects of physical capital accumulation will be explored which will enable the opportunity to analyze the transformation of physical capital into other capitals.

Conclusions

The data obtained during the study show that physical activity has significant relationships with the objective indicators of physical capital, such as physical fitness, including motor readiness ability, cardiorespiratory system's work capacity, body composition and functional state.

Based on the obtained results, it can be concluded that moderate PA has a significant relationship with all objective indicators of physical capital, for instance, the more often the respondent performs moderate PA, the better the functional strength in hang and balance, the higher her cardiorespiratory system's work capacity is, the lower the metabolic age, visceral fat coefficient and obesity percentage is. Moderate PA has a significant relationship with functional ability as well, for example, the more often the respondent performs moderate PA the better the adaptation to the load, the better the indicator of heart training, the better the level of physical load energy supply, the better the psycho-emotional state, the better the physical health indicator and the better the functional state index is.

Furthermore, during the study a significant relationship between walking and physical fitness indicators was determined, for instance, the more the respondent walks, the better the functional strength is, the better the cardiorespiratory system's work capacity, the lower the body weight is, the lower the fat percentage composition, the lower the metabolic age, the lower the visceral fat coefficient, the higher the water percentage in the body and the lower the obesity percentage.

For very difficult PA a significant relationship with physical fitness and functional state has been determined, for example, the more often the respondent performs very difficult PA, the better the balance is, the better the hip joint flexibility, the better the hand agility, flexibility while sitting, with arms extending to the feet and the better the static strength is; the more often the respondent performs very difficult PA, the better the heart training indicator is, the level of physical load energy supply, the better the psycho-emotional state, the better the physical health indicator and the higher the functional state index is. However, during the study it is determined that the longer the respondent performs very difficult PA, the smaller the water percentage in the body is and the greater the body weight is.

The time that the respondent spends sitting has a significant relationship with physical fitness, for example, the longer the respondent sits, the worse the hip joint flexibility is, the worse the explosive strength in vertical jump is and the lower her cardiorespiratory system's work capacity is.

Moderate PA has a significant moderately close relationship with all objective indicators of physical capital. Walking has the largest number of significant moderately close relationships with body composition indicators. Very difficult PA has a closer (r_s>0.7) relationship with functional ability than moderate PA and walking. On the other hand, sedentary lifestyle is related to lower physical fitness indicators.

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