



RELATIONSHIPS BETWEEN THE COMPONENTS OF PHYSICAL FITNESS AND ATHLETIC PERFORMANCE IN YOUTH POLE VAULTERS: A PROSPECTIVE STUDY IN A TUNISIAN SECONDARY SCHOOL SETTING

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Abstract

This study examined relationships between the components of physical fitness and athletic performance in youth pole-vaulters in a secondary school setting. Twenty-five adolescents of both genders, between the ages of 15 and 18, participated in the study. This case study was grounded on qualitative and quantitative approaches of data analysis, measuring physical abilities self-assessment based on the questionnaire developed by Borg et al. [11] and measuring high-performance effect linking age and gender with the levels of the pole vault performance. The results indicate that, overall, the six dimensions of fitness (coordination, strength, flexibility, speed, endurance, and body self-image) are correlated with physical fitness (r varies between 0.29 and 0.65, $p < 0.05$). The significance is very high in teenage boys for perceived strength and perceived endurance respectively ($r = 0.61$, $p < 0.001$ and $r = 0.65$, $p < 0.001$), whereas in teenage girls global physical fitness is highly correlated with endurance ($r = 0.63$, $p < 0.001$). Moreover, while endurance and flexibility have become a determinant of performance in the girl group in the perceived physical fitness category, strength and perceived speed are the most important components in the boy group. An effect of age was only considered for strength, endurance and perceived fitness. No effect of body self-image on pole vault performance was identified, with non-significant correlation in the two genders, girls and boys respectively ($r = 0.11$, $r = 0.16$). The significant role of physical fitness levels in determining motor exercise performance in adolescence may have further implications for gender roles and talent prospecting as well as potential physical condition benefits for exploring new sports.

***Key words:** adolescents, physical fitness, performance, pole vault*

Introduction

The concept of competence was principally developed by Bandura [1] and later refined by Harter [2] to show, based on their studies, the meaning of competence in several domains. This notion indicates a subject's appreciation of his or her skills in different areas, which are multidimensionally conceived in the structure of self-concept [2]. According to the multidimensional approach, self-concept or self-esteem is considered as a self-perception of several domains of competence, such as sport and physical conduct [3]. The latter has developed and validated a questionnaire (Self Perception Profile) for each major period of life (childhood, adolescence and adulthood). If body perception plays an important role in

building adolescent self-esteem [3], the levels of self-perceived physical fitness could influence performance. In addition, several studies show the relationship between regular participation in physical activity, self-assessment of physical skills in physical education and physical fitness indicators in adolescents [4, 5, 6]. For a teenager, a positive perception of their body contributes to their well-being [7].

Therefore, we are interested in finding the relations between the perceptions of the dimensions of physical fitness resulting from the global perception of the self and the performance in pole vault. This relationship operates in an ascending or descending way in the hierarchical structure. For example, a high

degree of satisfaction in a pole vault task strengthens the sport skill subfield, which is of great importance to the subject matter. This reinforcement improves the area of the perceived physical value. Conversely, a sudden depreciation of the dimensions of physical fitness in the field of physical education and sports (PES) influences self-evaluation in a specific sub-domain such as pole vaulting.

The assumption of this model is that the tangible dimensions (physical condition, coordination, strength, flexibility, speed, endurance, physical appearance) are subject to variations in self-evaluation, while performance is dependent on the level of fitness.

Orientations towards teaching physical activities and sports in PES

General guidelines valid for the three levels of a training program (general, technical and professional) in physical education and sports (PES) were defined by the function of PES, which is a long-term training to create a wholesome citizen. Within this framework, responsibility, autonomy, and good education are to be developed by promoting access to cultural heritage in the form of a variety of sports and artistic physical activities. In addition, good health, knowledge and skills acquired and socially recognized can play an important role in personal and professional lives. Ideally, practitioners are able to find a path of specialization to pursue in the field of physical activities.

As regards pole vaulting, it is important to distinguish between pole vaulting as a sport of performance and competition and pole vault as a physical and sport activity that helps increase skills in physical education [8, 9, 10]. The former level, called a sport of performance, tends to be described as sporting in the sense that it is institutionalized, i.e. included in the program of the Olympic Games, which naturally involves the organization of a system of competitions. While institutionalized pole vault is an international codified practice, the adopted pole vault activity could be one of physical activities supporting physical education, with regard for the differences in masculine and feminine abilities. This study

will first check whether the public would embrace this proposal. Findings obtained will lead to another issue: Is pole vault by its nature, with its characteristics and its specificity a masculine practice and therefore totally in opposition to feminine perceptions and aspirations? In brief, could both boys and girls benefit from this practice and even enjoy pole vaulting at school?

Pole vaulting is an activity with strong masculine connotations and pronounced masculine characteristics, generalized and immutable, and involves a set of physical qualities (coordination, flexibility, strength, agility, speed etc.), psychological features (seriousness, perseverance, concentration etc.) as well as mental representations of self confidence, competence, and body image. We are convinced, however, that both boys and girls are sensitive to the notions of feat, prowess and risk-taking inherent in pole vaulting, as well as imbalances, reversals, rotations and multiples acrobatics that this activity entails. Therefore, the questions arises whether boys and girls alike would be thrilled at the prospect of the challenges and vertigo associated with pole vaulting?

In an attempt to address the questions indicated above, we will examine mental representations and expectations of girls and boys regarding pole vault with reference to the set to skills pole vault could help acquire in PES, i.e. self-regulation, motivation, self-confidence, self-esteem, skills, fitness, self-efficacy etc. To achieve this, we will rely on strategic didactic and pedagogical approaches, the teaching content, the requirements as well as the issues favored by PE teachers in pole vault cycles.

Materials and Methods

Participants

The study population consists of 25 secondary school students, divided into two gender and age groups (15-16 year-olds and 17-18 year-olds). All participants, selected from a population of 48 subjects based on their membership in sport-classes, physically active and participating in a pole vault training program have been asked to complete questionnaires.

Procedure

The participants completed a modified physical abilities self-assessment questionnaire based on Borg, Skinner and Bar'Or [11] and Rowe, Benson and Baumgartner [12] for the assessment of their satisfaction with their body self-image in sports as part of self-assessment of physical abilities. The instrument used in this study was Physical Fitness Scale Questionnaire (PFSQ) (see appendix). It included six factors: perceived coordination, perceived endurance, perceived strength, perceived speed, perceived flexibility, and body self-image, with three items in each subscale. Afterwards, the participants underwent a practice cycle in a pole vault training program during which their performance in this sport was evaluated. Each dimension was measured according to a 5-point

category scale, punctuated by seven labels that rank the levels in relation to the population average. For example, for the physical fitness scale, the choice was as follows: (1) "I run faster than the average student my age", (2) "I have a flexible body with good fitness", (3) "My endurance is quite normal with regard to my age", (4) "I have a well-coordinated body for my age", (5) "I have a higher average strength than my peers"; 6: "I am exceptionally fit".

Testing performance: measuring a high-performance effect linking age and gender to the levels of the pole vault exercise [8, 9, 10]. Upon completion of the pole vaulting cycle of training, the teacher provided grades obtained by the participants in a pole vaulting competition. Grades are scores ranging from 0 to 20, with the score of 10 as a mean measure.

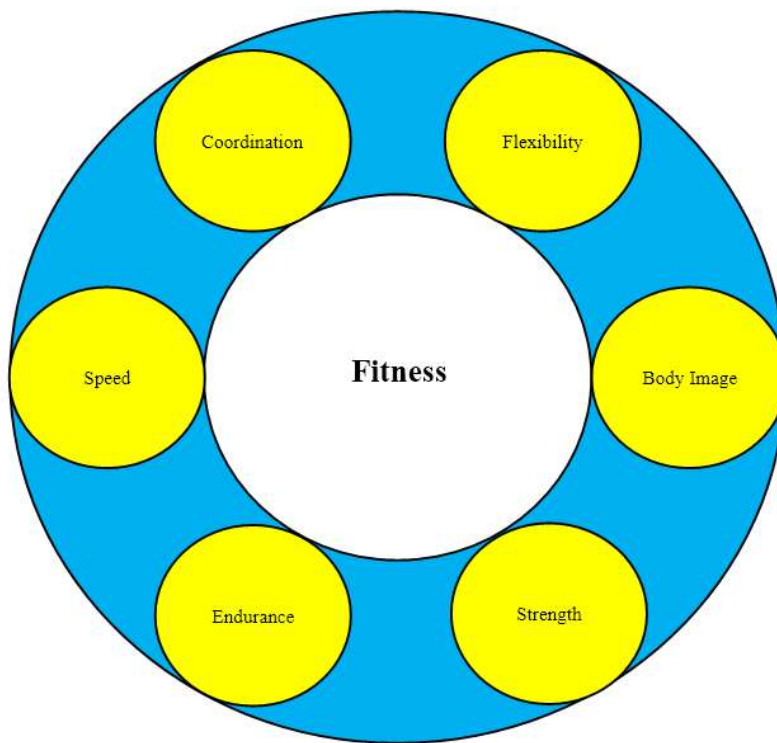


Figure 1. Six Components of Fitness

Notes. a) Coordination: the ability to use different parts of the body harmoniously to obtain results; b) Strength: the capacity to manifest energy and to withstand great force; c) Speed: the ability to move quickly across the ground or move limbs rapidly to grab or throw; d) Flexibility: the range of movement possible at a joint to achieve a more effective or efficient position; e) Endurance: the body's physical capability to sustain an exercise for an extended period; f) Body image: the perception that a person has of their physical self.

Statistical analysis

The relationship between the different dimensions of fitness was analyzed as a correlation matrix of variables based on Spearman's correlation coefficients and descriptive statistics (mean, standard deviation). The existence of a specific effect of age or gender on self-assessment of fitness and pole vault performance was analyzed with the application of a multivariate analysis of variance and Post-Hoc tests (Tukey HSD test). For all analyses, the significance limit was set at $p < 0.05$.

Results

The role of gender and age for fitness in pole vault

With respect to performance-related fitness, assessing the effects of gender and age are crucial in pole vault practice. No effects of age and gender are identified for perceived coordination and perceived fitness. In general, the scores for perceived coordination and perceived physical fitness respectively ($M = 4.8$, $SD = 1.2$; $M = 4.3$, $SD = 1.3$) are only obtained for those who perform this activity regularly. Age-related factors are assessed by the effect of gender on perceived strength, flexibility, and physical fitness. In adolescent groups, boys tend to perceive themselves to be in better physical condition than girls ($M = 4.8$, $SD = 0.8$ vs. $M = 3.9$, $SD = 1.5$, $p < 0.05$). On the other hand, girls are more flexible than boys ($M = 4.1$, $SD = 1.3$ vs. $M = 3.6$, $SD = 1.7$, $p < 0.05$). Age effects are only taken for strength, endurance and perceived fitness, however, scores in these two age categories (15-16 and 17-18) demonstrate that these subjects perceive themselves as having a high level of physical fitness, and indicate a high-performance effect linking age and gender to the level of the pole vault exercise.

Relationships between self-evaluation scales of physical fitness

Table 1 shows that correlations between the six dimensions of fitness and overall fitness are all significant for the 15 to 16 age group. They are also significant for a mixed group of 17 and 18 year-olds and for both genders (r varies between 0.29 and 0.47). While noting that

the significance is very high for young boys for perceived strength and perceived endurance respectively ($r=0.61$, $p<0.001$ and $r=0.65$, $p<0.001$), whereas in young girls the global physical fitness is highly correlated with endurance ($r=0.63$, $p<0.001$). Overall, the six dimensions of physical fitness (coordination, strength, flexibility, speed, endurance, and body self-image) are correlated with actual physical fitness (r varies between 0.29 and 0.65, $p<0.05$).

In addition, the relationship between these two dimensions shows the highest correlation coefficient in the group of 17-18 year-olds, for boys and girls $r = 0.63$ and 0.65 respectively (Table 1). no significant difference in age was identified for these two groups, $F(1.13)=0.45$, $p<.71$, and gender does not appear to affect the dependent variables of physical fitness, $F(6.11)=2.15$, $p<0.23$.

Among the particular measures of the correlational relationship between performance measured in pole vault and the components of perceived physical fitness, in the male sample, coordination, speed, and physical condition show the strongest correlations with performance measured in 15-16 year-olds and with a significant correlation of inferior degree for strength and flexibility. However, male subjects at the age of 17-18 years reach higher levels ($r=0.71$, $p<0.001$ and $r=0.41$, $p<0.05$), increasing their physical condition as well ($r = 0.77$; 0.001). Conversely, in the female population, the six components of physical fitness, coordination, strength, flexibility, speed, endurance and coordination, are significantly correlated with performance at ages 15-16 (Table 2). The correlations measured are very significant for performance and coordination and for performance and physical fitness respectively ($r=0.61$; $p<0.001$ and $r=0.74$; $p<0.001$). Moreover, while endurance and flexibility have become determinants of performance, based on perceived physical fitness results, in the female group, strength and perceived speed are the most important factors identifies in the male group.

Finally, no effect of physical appearance on pole vault performance, that was shown with non-significant correlation respectively in the two genders, girls and boys ($r=0.11$, $r=0.16$).

Table 1. Correlation between the levels of perceived fitness and the six dimensions of fitness

	Coordination	Strength	Flexibility	Speed	Endurance	Body Self-Image
Physical fitness						
Group 15-16 years						
• Boys	0.47 *	0.49 *	0.20 *	0.34 *	0.45 *	0.48 *
• Girls	0.33 *	0.31 *	0.27 *	0.29 *	0.43 *	0.46 *
Group 17-18 years						
• Boys	0.43 *	0.61 **	0.25 *	0.37 *	0.65 **	0.33 *
• Girls	0.33 *	0.31 *	0.47 *	0.29 *	0.63 **	0.39 *

Note. * $p < 0.05$; ** $p < 0.001$

Table 2. Correlation between performance levels in pole vault and the six dimensions of perceived fitness

	Coordination	Strength	Flexibility	Speed	Endurance	Body Self-Image	Physical Fitness
Perf. Pole Vault							
Group 15-16 years							
• Boys	0.76 **	0.49 *	0.34 *	0.58 **	0.19	0.14	0.59 **
• Girls	0.65 **	0.37 *	0.52 **	0.38 *	0.08	0.17	0.51 **
Group 17-18 years							
• Boys	0.63 **	0.71 **	0.41 *	0.55 **	0.13	0.11	0.77 **
• Girls	0.61 **	0.29 *	0.44 *	0.27 *	0.21 *	0.16	0.74 **

Note. * $p < 0.05$; ** $p < 0.001$

Discussion

Age intensifies disparities in perceived fitness and physical condition due to gender differences. However, motor exercises are not the sole determinant of performance and sport practice in adolescence. The importance of fitness and physical condition levels in teenage years may have implications for talent identification in continued participation in sports and overall wellbeing.

This study seeks to explain, on the one hand, the age-based variations in the perceptions of the level of fitness and physical condition, and on the other, the impact of related identity specificities of gender and age on the assessment of the characteristics of perceived physical fitness. For athletes who practice pole vault and other sports on a regular basis, the relationship between their perceptions of fitness and physical condition is significant in adolescence (between 15 and 18 years of age). In this context, the link between performance and physical condition in students' representations could be related to the positive effect of physical activity on continuity, with a positive influence of exercise on the psychomotor factors of

performance. Findings have been consistently demonstrated in studies that have examined physical fitness indicators in adolescents [4] and given robust evidence of the effects of physical education on student fitness and achievement [13].

According to Derbali, Matoussi and Elloumi [14], for perceived difficulties in sport exercises there is assessment of specific physical abilities is available as a possible predictor of performance. Then, related to Fox and Corbin [15], the evaluation of physical abilities is determined by a general level of self-concept, which denotes the perceived physical value, by finding a modeling of the determinants of self-esteem, which allows the analysis of correlations between the subjective evaluations of the components of physical fitness and physical well-being and perceived physical fitness. As reported by Ishihara et al. [16], we can model relationships of achievement motivation and physical fitness with academic performance by gender.

In our study, these privileged dimensions of physical fitness were reinforced, on the one hand, according to age and, on the

other hand, according to gender. The present findings, highlighted by an observed improvement in a meta-analysis work, show that gender stereotypes affect sport activities of girls and that this is particularly true for sports typically considered suited to males [17]. In addition, if perceived coordination is the most valued component as reported by the subjects, its influence increases with age during the period of adolescence in the male population, yet appears to be replaced by flexibility and endurance in adolescent girls, specifically with reference to pole vaulting. In line with Rodriguez et al. [18], fitness improvement

positively influences elite performance in youths. However, the improvement of physical components, through a cyclical program of physical activity in PES, seems to have a beneficial effect not only on the dimensions of self-esteem and physical fitness but also on performance in pole vault. What is more, there are relationships between physical activity, fitness, motor skills and academic performance in children [19]. Therefore, the effect of applying a fertile pole vault program and other new sports in PES might successfully help promote fitness, high self-esteem and good health.

APPENDIX Factor structure of the 18-item Physical Fitness Scale Questionnaire (PFSQ) with corresponding factor loadings

Physical Fitness Dimensions and Scales	Exploratory Factor Analysis EFA	Confirmatory Factor Analysis CFA
	Factor Loading	
Perceived Coordination		
• I am definitely not well-coordinated.	0.87	0.76
• I have a properly coordinated body with regard to my age.	0.91	0.83
• I have an exceptionally well-coordinated body.	0.73	0.81
Perceived Endurance		
• I have poor endurance with regard to my age.	0.71	0.62
• My endurance is quite normal with regard to my age.	0.65	0.83
• I have very good endurance with regard to my age.	0.86	0.78
Perceived Strength		
• I have absolutely no strength.	0.83	0.91
• My strength is quite normal with regard to my age.	0.77	0.82
• I have higher average strength than my peers.	0.74	0.61
Perceived Speed		
• I have poor speed with regard to my age.	0.74	0.85
• I run faster than the average student my age.	0.91	0.87
• I have very good speed with regard to my age.	0.76	0.64
Perceived Flexibility		
• I have poor flexibility with regard to my age.	0.82	0.79
• I have flexible body with good fitness.	0.58	0.62
• I have an exceptionally flexi.	0.86	0.94
Body Self-Image		
• I feel depressed about my body.	0.78	0.80
• My body is overweight.	0.57	0.61
• I have a high level of fitness.	0.93	0.88

Note: - a) This table presents a modified questionnaire of self-appraisal of physical performance by Borg, Skinner and Bar'Or (1972) measuring perceived physical abilities. - b) EFA = Exploratory Factor Analysis; CFA = Confirmatory Factor Analysis. - c) Factor loading for EFA ranged from 0.57 to 0.93 while the factor loading for CFA ranged from 0.61 to 0.94. - d) Cronbach alpha (α) ranged from 0.73 to 0.86. - e) X^2 Chi Square = 242,28; df = 93; X^2/df = 2.61; Comparative Fit Index (CFI = 0.93); Non-Normed Fit Index (NNFI = 0.92); Standardized Root Mean Square Residual (SRMR = 0.065); Root Mean Square Error of Approximation with Confidence Interva (RMSEA = 0.051); RMSEA [90% CI = 0.049-0.54].

Conclusion

The findings of this study provide that the relationships between physical fitness dimensions and athlete performance in pole vault are mediated by gender specific physical abilities and reinforced by the age factor. This suggests that the development of various fitness components (coordination, strength, flexibility, speed, endurance, and body self-

image) in athletic pole vaulters requires appropriately diversified programs for developing specific motor skills in both gender groups of adolescents. The importance of physical fitness levels in adolescence for determining motor performance may have implications for gender roles and talent prospecting as well as potential physical condition benefits for exploring new sports.

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