Original Article

Perceived motor competence and self-efficacy in children: Competitive sports vs sedentary lifestyle

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ABSTRACT

Background: the study of physical self-perception is fundamental to understand how children perceive their movement skills, identify their level of perception of physical self-efficacy as well as their opinion on their motor skills. It can provide useful key information to give appropriate feedback and to plan some programmes aimed to develop fundamental movement skills. Purpose: The aim of this study was to investigate the perceived competences and physical self-efficacy in a sample of young, sedentary subjects and athletes, through a fact-finding survey. The core of the investigation was to verify whether there were substantial differences between subjects who practice sports at a competitive way and in sedentary one. Methods: The study was carried out from 100 young people aged between 8 and 14 years. 75 athletes (38 F 38 M) were recruited in three small sport associations the same district in southern Italy and 25 students who do not participate organized sports (13 F, 12 M), were recruited in a secondary school in the same district. Written consent was obtained in through a formal letter to parents explaining the study's goals, procedures, and methods. The selection of the investigation tools ware carried out by identifying two tests validated in the literature. Two tests were used: the Perceived Motor Competence Questionnaire in Childhood (PMC-C) (Dreiskaemper, 2018) and the Self-efficacy scale (Colella, 2008). The data were analysed by SPSS statistical software. The two observations were analysed separately; for each item and groups (sedentary subjects, swimmers, soccer players and gymnasts), were calculated mean value, standard deviation and level of significance. These values have been highlighted in the descriptive tables and in the histogram graphs. The differences between gender and between groups (sedentary subjects and athletes) have been calculated with the Mann-Whitney test. Results: the data shows significant differences in both tests highlighting a strong relationship between sport activity and self-related aspects. The comparison of means between sedentary subjects and athletes confirms a significant difference between the two groups with $p < .01$ both in Self-Efficacy Test and Perception of Motor Competence test.
Keywords: Self-efficacy; Perceived motor competence; Sport; Sedentary lifestyle; Children.

Cite this article as:
D'Anna, C., Mucci, M., & Vastola, R. (2021). Perceived motor competence and self-efficacy in children: Competitive sports vs sedentary lifestyle. *Journal of Human Sport and Exercise*, *16*(4), 889-901. https://doi.org/10.14198/jhse.2021.164.12

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Submitted for publication February 16, 2020.
Accepted for publication April 03, 2020.
Published October 01, 2021 *(in press* June 19, 2020)
JOURNAL OF HUMAN SPORT & EXERCISE ISSN 1988-5202

doi:10.14198/jhse.2021.164.12

INTRODUCTION

Psychomotor development in children is influenced not only by biological, environmental and physical factors, but also by cultural factors, such as the set of attitudes, values, beliefs and behaviours shared by a group of people living in a specific place (Matsumoto et al.,1997).

Considering a systemic perspective, each person is an open, adaptive and dynamic system, as a function of continuous exchanges of energy and information with their environment (Ford & Lerner, 1992; Bertalanffy, 1950). The environment, in particular the cultural context of each country, provides a system of shared meanings that allows us to internalize the values and develop adaptation skills that strongly affect the perceived competence in each domain of behaviour (Santo et al., 2013). Self-perception is the mental representation that a person has about himself. It can be divided into cognitive, social and physical domains (Harter, 1987; Shavelson et al., 1976). It is a systemic phenomenon which includes many factors (extrinsic and intrinsic), strictly dependent on lived experiences and the values shared among people and their cultural context.

The perception of a specific self-competence is not only linked to the self-evaluation considering the own performance but is also strongly influenced by the opinions and judgments of others, as well as by culture.

In recent years there has been a specific attention to the relationship between physical activity and self-related aspects, between organic and cognitive functions, also considering the proposal of specific programs. There are many factors which determine physical activity (Sallis et al., 1992) and it is very difficult to define which of these can influence the change in children's physical activity. Many studies show that these factors may have different degrees of influence at different times in a child's development (Sallis et al., 1992). The application of the dynamic systems theory of cognitive and motor development views behaviours as emergent from the complex and changing interaction of factors and are not solely pre-determined through maturation (Thelen & Smith, 1994). In the different stage of development, the various factors can interact with each other to support and enable physical activity behaviours, whilst some will limit or "*constrain*" physical activity levels. Several cross sectional explorations have investigated to identify the influences on physical activity. Sallis et al. (1992) identified four types of factors, biological and developmental factors (such as motor skills and physical fitness), psychological factors (such as self-efficacy and attitudes), social and cultural factors (such as race and ethnicity, peer and parental influences), and physical environmental factors (such as geographic locations, access to facilities and programs).

Regarding the physical self-concept, it is necessary to consider the subdomains of strength, fitness, body perception and perceived sporting competence (Fox & Corbin, 1989). The success in sport competitions, as just stressed by Bandura (2000), is obtained by some abilities not only physical. The cognitive factors have a fundamental function of both the development and the motor learning. Be resolute, work regularly and constantly, facing the difficulties and obstacles be determined, are basic aspects to the agonistic activity in all sporting activities. The choice of a competitive level is mainly conditioned by the psycho-physical conditions of the athlete and by their personal motivation towards that sport, but it strongly influences performance and competitive results the sense of the perceived efficacy (Gomez Paloma et al. 2014).

In Bandura's theory (1997, 2001), self-efficacy is the cognitive mechanism that mediates information on personal capacities to successfully execute necessary courses of action in a specific domain. Self-efficacy is a particular function that changes on the strength of situation and influences the cognitive processes and the level and persistence of motivation and affective states. According to this theory, perceived self-efficacy is

strongly linked to motivation, affect and behaviour. If the athlete is certain to be able to obtain his aims with sacrifice and work, he will have a higher motivation to train and reach the goals. Self-efficacy regarding motor activities has been widely investigated. Feltz (1983) has shown that it is mainly the recent experiences that influence the perception of effectiveness that the athlete perceives.

Other studies have demonstrated that a circular relation between self-efficacy and physical activity exists, in which the first represents the factor that support the adhesion and the persistence to achieve the goal and the physical activity promote the perceived self-efficacy. In particular some researches have highlighted that in the meantime self-efficacy is both important and determinant, and a consequence of physical activity (McAuley & Blissmer, 2002).

Perceived motor competence (PMC) is another psychological construct within the subdomain of physical competence. It refers to the self-evaluation of a person related to his real motor competence. Therefore, corresponds to the judgment of the skills that the person believes to possess (Harter, 1978; 1982). As shown by some studies, higher PMC scores have been identified in a strong correlation with the real motor skills (Barnett, 2011, Barnett et al., 2016) and it is believed to be associated with health benefits (Babic et al., 2014), particularly in regard to physical activity and weight status (Lopes et al., 2011; Lopes et al., 2014; Robinson et al., 2015; Rodrigues et al., 2016). However, according to the development model of Stodden et al. (2008), this relationship between real motor competence and physical activity is mediated by the perceived motor competence of children. A recent study found that children with lower motor skills have lower perceived competence and are less likely to be physically active (Khodaverdi et al., 2015).

Conversely, children who have high levels of perceived competence are more likely to develop and show physical skills, such as higher motor skills and physical participation. Goodway and Rudisill (1997) and Robinson (2011), revealed that motor skills have a significant predictive relationship with perceived motor competence. According to the theory of competence motivation (Harter, 1978; White, 1959), a self-evaluation of a person on his own competence can also influence his performance. Robinson et al. (2009) found that providing a motivational climate of mastery in pre-schoolers significantly increased their perceived competence for fine motor skills. Positive motor experiences contribute to the shaping of a positive self-image and to the development of self-perception of his own motor skills, a prerequisite for the convictions of physical self-efficacy and individual self-esteem in the various age groups.

Positive correlations have been identified between the levels of physical activity and the physical self-perceptions, irrespective of gender. The self-perception and the beliefs about own abilities arising from the execution of motor skills, are constantly restructured and updated throughout life, with differences that differ in relation to age, sex, experiences, interpersonal relationships, physical and psychological changes and this assign to physical and sports activities carried out in childhood and adolescence, an unavoidable mediation role. The study of self-perception is fundamental to understanding children's motivation for physical activity (Barnett et al., 2015; Slykerman et al., 2016), as well as to guide future intervention programs aiming to increase the commitment of children and adolescents in physical activity. Understanding how children perceive their movement skills and at the same time identify their level of perception of physical self-efficacy can provide useful key information for giving appropriate feedback and planning interventions aimed at developing skills of fundamental movement. These are aspects that not only affect the levels of physical activity and fitness (Barnett et al., 2016), but assume a decisive role for the positive effects they generate in the areas of social life and on health status (Timler et al., 2018; Burns et al., 2017). The scientific evidence just outlined, show the relevance of self-perception, as a highly incisive variable for the future participation in

motor and sports activities, the promotion of active lifestyles and greater social involvement in the developing age.

The aim of this study was to investigate the perceived competence and physical self-efficacy in a sample of young, sedentary subjects and athletes, through a fact-finding survey. The core of the investigation was to verify whether there were substantial differences between subjects who practice sports at a competitive level and those who do not. Individual sports (swimming and gymnastics) and team sports (soccer) were considered within the group of agonists.

MATERIALS AND METHODS

Participants

The study was carried out from100 young people aged between 8 and 14 years. 75 athletes (38 F 38 M) were recruited from three small sport associations from the same district in southern Italy and 25 students who do not practice organized sports (13 F, 12 M), were recruited in a secondary school. The sample was divided into two groups:

- Experimental group (competitive sportspeople):
  - 25 females aged between 8 and 14 years who practice gymnastics with an average frequency of 4 weekly sessions;
  - 25 males aged between 8 and 14 years who play soccer with an average frequency of 3 days per week;
  - 25 swimmers aged between 8 and 14 years, (13 M and 12 F), who practice swimming with an average of 3 sessions per week;
- Control group (sedentary people):
  - 25 people who do not practice any organized and constant sport activity aged between 8 and 14 years (13 F and 12 M).

Written consent was obtained through formal letter given to parents explaining the study's goals, procedures, and methods.

The selection of the investigation tools was carried out by identifying two tests validated in the literature that was capable of providing information on both physical self-efficacy and perceived motor competence.

Two tests were used: the Perceived Motor Competence Questionnaire in Childhood (PMC-C) (Dreiskaemper, 2018) and the Self-efficacy scale (Colella, 2008). The PMC-C is composed of 8 items. In this case people must indicate the specific competence perceived by a self-assigning a value from 1 to 3 (from I to VII item), 1-2 (VIII item). The first 4 items (throwing, catching, kicking, bouncing) investigated the ability to handle an object, the last 4 relate to locomotion skills: running, hopping on, jumping in relation to height (leaping) and jumping in relation to distance (jumping forward). The Self Efficacy scale consisted of 6 items that investigated own perception of running skills, performing exercises, muscle strength, rapidity, safety and profuse effort in performing movements. For each of these 6 items, the person can self-assign a value from 1 to 4 points.

RESULTS

The data were analysed by SPSS statistical software. Considering that the normality of the distribution of scores is not adequate (Shapiro-Wilk Test), a nonparametric test were used to calculate the differences between gender and between groups (sedentary subjects and athletes) (Mann-Whitney Test). The two

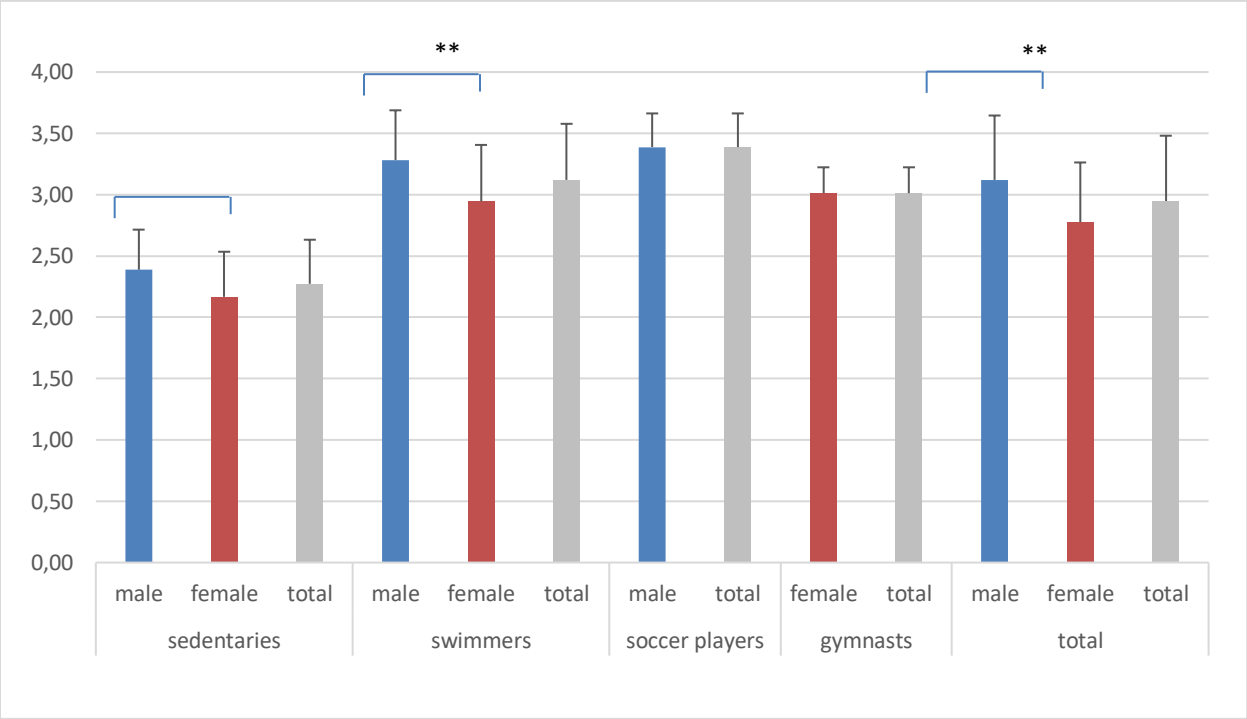
observations identified were analysed separately; for each item and group (sedentary subjects, swimmers, soccer players and gymnasts), mean value, standard deviation and level of significance were calculated. These values are highlighted in the descriptive table (No.1 and No.2) and in the histogram graphs (Figure 1 and Figure 2), which briefly illustrate the average and standard deviation of the two tests.

Table 1. Descriptive table for Self-efficacy Test (SE).

Item	Sedentary behaviour/ sports participation		Mean	SD	Item	Sedentary behaviour/ sports participation		Mean	SD
SE item 1	Sedentary subjects	Male	2.25	0.754	SE item 4	Sedentary subjects	Male	2.33	0.651
		Female	1.85	0.689			Female	2.31	0.630
		Total	2.04	0.735			Total	2.32	0.627
	Swimmers	Male	3.08	0.494		Swimmers	Male	3.08	0.494
		Female	2.92	0.669			Female	2.75	0.754
		Total	3.00	0.577			Total	2.92	0.640
	Soccer players	Male	3.52	0.510		Soccer players	Male	3.60	0.500
		Total	3.52	0.510			Total	3.60	0.500
	Gymnasts	Female	2.96	0.455		Gymnasts	Female	3.08	0.277
		Total	2.96	0.455			Total	3.08	0.277
	Total	Male	3.10	0.763		Total	Male	3.16	0.738
		Female	2.66	0.745			Female	2.80	0.606
		Total	2.88	0.782			Total	2.98	0.696
SE item 2	Sedentary subjects	Male	2.17	0.389	SE item 5	Sedentary subjects	Male	2.25	0.622
		Female	1.92	0.494			Female	2.31	0.630
		Total	2.04	0.455			Total	2.28	0.614
	Swimmers	Male	3.31	0.480		Swimmers	Male	3.31	0.751
		Female	3.08	0.515			Female	2.92	0.793
		Total	3.20	0.500			Total	3.12	0.781
	Soccer players	Male	3.24	0.523		Soccer players	Male	3.28	0.614
		Total	3.24	0.523			Total	3.28	0.614
	Gymnasts	Female	3.08	0.277		Gymnasts	Female	2.76	0.663
		Total	3.08	0.277			Total	2.76	0.663
	Total	Male	3.00	0.670		Total	Male	3.04	0.781
		Female	2.78	0.648			Female	2.68	0.713
		Total	2.89	0.665			Total	2.86	0.766
SE item 3	Sedentary subjects	Male	2.42	0.669	SE item 6	Sedentary subjects	Male	2.92	0.669
		Female	2.31	0.630			Female	2.31	0.751
		Total	2.36	0.638			Total	2.60	0.764
	Swimmers	Male	3.23	0.599		Swimmers	Male	3.69	0.480
		Female	2.75	0.622			Female	3.25	0.866
		Total	3.00	0.645			Total	3.48	0.714
	Soccer players	Male	3.24	0.523		Soccer players	Male	3.44	0.507
		Total	3.24	0.523			Total	3.44	0.507
	Gymnasts	Female	3.12	0.332		Gymnasts	Female	3.08	0.640
		Total	3.12	0.332			Total	3.08	0.640
	Total	Male	3.04	0.669		Total	Male	3.38	0.602
		Female	2.82	0.596			Female	2.92	0.804
		Total	2.93	0.640			Total	3.15	0.744

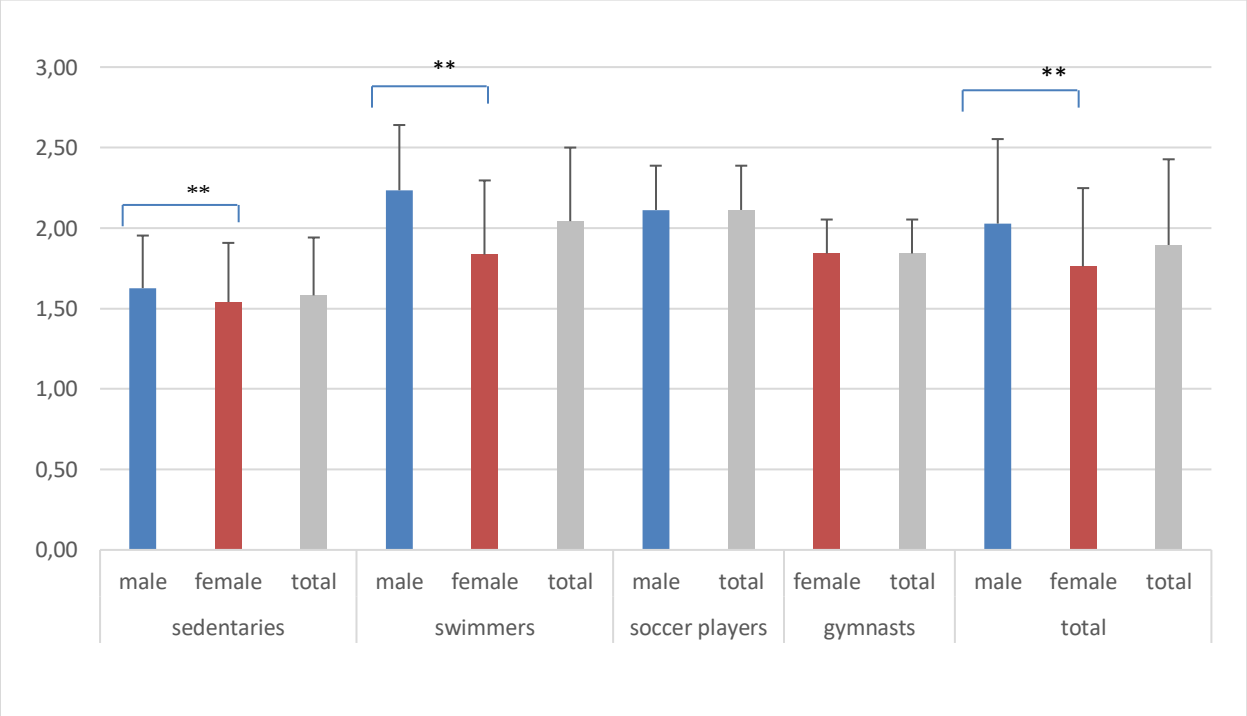
Table 2. Descriptive table for Perceived Motor Competence Questionnaire in Childhood (PMC-C).

Item	Sedentary behaviour/ sports participation		Mean	SD	Item	Sedentary behaviour/ sports participation		Mean	SD
PMC-C item 1	Sedentary subjects	Male	1.67	0.778	PMC-C item 5	Sedentary subjects	Male	1.50	0.674
		Female	1.69	0.630			Female	1.69	0.855
		Total	1.68	0.690			Total	1.60	0.764
	Swimmers	Male	2.46	0.660		Swimmers	Male	2.54	0.519
		Female	1.75	0.754			Female	2.08	0.793
		Total	2.12	0.781			Total	2.32	0.690
	Soccer players	Male	2.28	0.792		Soccer players	Male	2.12	0.600
		Total	2.28	0.792			Total	2.12	0.600
	Gymnasts	Female	1.96	0.539		Gymnasts	Female	1.92	0.862
		Total	1.96	0.539			Total	1.92	0.862
	Total	Male	2.18	0.800		Total	Male	2.08	0.695
		Female	1.84	0.618			Female	1.90	0.839
		Total	2.01	0.732			Total	1.99	0.772
PMC-C item 2	Sedentary subjects	Male	1.42	0.669	PMC-C item 6	Sedentary subjects	Male	1.75	0.866
		Female	1.38	0.650			Female	1.92	0.494
		Total	1.40	0.645			Total	1.84	0.688
	Swimmers	Male	2.23	0.927		Swimmers	Male	2.00	0.913
		Female	1.67	0.778			Female	1.92	0.793
		Total	1.96	0.889			Total	1.96	0.841
	Soccer players	Male	2.00	0.913		Soccer players	Male	1.92	0.759
		Total	2.00	0.913			Total	1.92	0.759
	Gymnasts	Female	1.56	0.870		Gymnasts	Female	1.60	0.707
		Total	1.56	0.870			Total	1.60	0.707
	Total	Male	1.92	0.900		Total	Male	1.90	0.814
		Female	1.54	0.788			Female	1.76	0.687
		Total	1.73	0.863			Total	1.83	0.753
PMC-C item 3	Sedentary subjects	Male	1.75	0.754	PMC-C item 7	Sedentary subjects	Male	1.92	0.900
		Female	1.23	0.599			Female	1.46	0.660
		Total	1.48	0.714			Total	1.68	0.802
	Swimmers	Male	1.92	0.760		Swimmers	Male	2.00	0.816
		Female	1.42	0.793			Female	1.75	0.622
		Total	1.68	0.802			Total	1.88	0.726
	Soccer players	Male	2.12	0.666		Soccer players	Male	1.88	0.781
		Total	2.12	0.666			Total	1.88	0.781
	Gymnasts	Female	1.68	0.802		Gymnasts	Female	2.08	0.812
		Total	1.68	0.802			Total	2.08	0.812
	Total	Male	1.98	0.714		Total	Male	1.92	0.804
		Female	1.50	0.763			Female	1.84	0.766
		Total	1.74	0.774			Total	1.88	0.782
PMC-C item 4	Sedentary subjects	Male	1.67	0.888	PMC-C item 8	Sedentary subjects	Male	1.33	0.778
		Female	1.31	0.630			Female	1.62	0.961
		Total	1.48	0.770			Total	1.48	0.872
	Swimmers	Male	2.46	0.776		Swimmers	Male	2.23	1.013
		Female	2.25	0.754			Female	1.83	1.030
		Total	2.36	0.757			Total	2.04	1.020
	Soccer players	Male	2.44	0.821		Soccer players	Male	2.12	1.013
		Total	2.44	0.821			Total	2.12	1.013
	Gymnasts	Female	2.36	0.757		Gymnasts	Female	1.56	0.917
		Total	2.36	0.757			Total	1.56	0.917
	Total	Male	2.26	0.876		Total	Male	1.96	1.009
		Female	2.06	0.843			Female	1.64	0.942
		Total	2.16	0.861			Total	1.80	0.985



*Note: p < .05 ; **p < .01.*

Figure 1. Gender differences between different sport in Self-Efficacy Test.



*Note: p < .05 ; **p < .01.*

Figure 2. Gender differences between different sports in Perceived Motor Competence Questionnaire in Childhood (PMC-C).

DISCUSSION

According to the Self-efficacy scale, sedentary subjects in item n.1 (running skill) perceived themselves slow or very slow in running; swimmers and gymnasts stated to be fast, but not as fast as young players who perceived themselves to be very fast. Females who do not carry out regular sports perceived themselves slow in running more than males in the same category.

Taking into account women, young gymnasts outperform young swimmers in self-evaluation, fast and very fast. Considering the item 2 (ability to perform difficult exercises), control group have shown a poor perception of competence in performing difficult exercises; most of them stated that they feel capable of performing only easy or very easy exercises. Young swimmers and footballers excel in asserting their competence in carrying out difficult exercises; slightly lower than the average, gymnast who stated to be able to perform difficult exercises.

Regarding item no. 3 (strength), young players perceived their muscles as very strong, slightly greater compared to players and gymnasts who still feel strong. The difference within the same gender was very significant for this item, between gymnasts and swimmers who have a very low value, referring to perceive their muscles as very weak.

With regard to the item 4 (speed), the football players perceived themselves to be the most rapid in their movements, defining themselves "*very fast*"; followed immediately by young gymnasts and swimmers who perceived themselves as rapid, and sedentary subjects who perceived themselves as slow. The indications generally provided by the tests on item no. 5 (self-confidence and decision in movements), showed that most young people perceived themselves confident in movements. The highest value was in the group of football players who excel in perceiving themselves as "*very self-confident*"; gymnasts and swimmers perceived themselves self-confident compared to the control group, that is considered uncertain and insecure in performing movements. In the overall assessment of the effort made to make movements and the perception of effort, young swimmers record the highest value, followed by soccer players and gymnasts who stated that they do not struggle when they move.

The data obtained taking into account swimmers, could be explained considering the fact that these subjects carry out sport activities in an anti-gravity environment with lower frequencies of movement than the others, but nevertheless against water resistance. In the PMC-C test the data showed a very similar trend compared to those recorded by the SE Test; in fact, the two tests showed a strong correlation (Spearman coefficient r = .89 and Person coefficient p = .94).

In the PMC-C Test (item n.1), swimmers and soccer players stated to be skilful in knowing how to throw an object on a target; the data of gymnasts is slightly lower since in the specific discipline it does not exercise the skills in controlling objects. In fact, this tendency of gymnasts to judge themselves less skilled also presents the ability to block and kick a ball (item 2-3) while the average of the values in these two items for footballers and swimmers is confirmed. On the other hand, almost 70% of sedentary subjects, stated to be only able to block a ball excluding the size and speed of throwing.

As expected in the kicking item, the soccer players had the highest rating and the data were confirmed in items 1-2-3-4, this latter related to the ability to control a bouncing ball; swimmers and gymnasts judge themselves on the average, while the group of sedentary subjects feels less able by stating that they feel able to bounce a ball but are unable to control it.

Concerning the running, young swimmers perceived themselves as more skilled compared to the maximum expression of ability (running as fast as possible); slightly lower, was the value of the football players and gymnasts who still clearly detach themselves from sedentary subjects. The group of sedentary subjects taken into account, stated to feel able to run only for a short time (60%) and only a small minority (8%) is perceived as equal to those who practice sports.

About the items 6-7 which concern hopping only on one leg by pushing forward and hopping with both legs pushing upwards, swimmers and footballers felt very skilled; on the other hand, gymnasts felt more able in jumping upwards. For the sedentary group, the only item that differed from all average trends is that of leaping forward in which there is a higher average value than gymnasts. Gymnasts excel in high jumping where they felt more competent than other sportsmen. Regarding the jump using both feet, the groups that practice sports are detached from the average value of the control group.

To calculate the differences between gender and groups were used the Mann-Whitney test. The comparison of means between sedentary subjects and athletes confirms a significant difference between the two groups with $z = -6,977$, $p < .01$ for the Self-Efficacy Test and $z = -3,804$, $p < .01$ for the Perception of Motor Competence test.

The comparison of means between gender highlights the differences with significantly lower values in females with $z = -3.584$, $p < .01$ for the Self-Efficacy Test and $z = -2.692$, $p < .01$ for the Perception of Motor Competence test.

Regarding differences between sports for women there are gymnasts who demonstrate the highest levels in the perception of motor competence and in physical self-efficacy. This is probably due to the specific work of gymnastics which has its basis in the skills investigated by the two tests (running, jumping, strength and speed etc.).There are no significant differences in the perception of motor competence between male footballers and swimmers; on the other hand, the level of physical self-efficacy in the latter is significantly higher ($p < .05$). In fact, the results show that swimmers excel in the perception of having very little difficulty to move, probably because of the anti-gravity environment within which they perform their discipline. The absence of extreme resistance to advancement (players and gymnasts must however move at least their weight) could favour ease of movement and consequently affect the perception of fatigue.

CONCLUSION

The analysis of the two tests proposed, certainly shows that young male swimmers and gymnasts perceive better motor skills compared to the other groups. However, there is no advantage in favour of a specific discipline.

However, there is a very big difference between the values recorded by young sportsmen and the sedentary group. In relation to the 14 items proposed, this group has excelled only in the ability of the jump, but in the remaining 13 there has been a gap with the most "*skilful*" group on average of 25%. This shows the importance of promoting the practice of physical activity in sedentary people.

The school context can represent a particularly suitable area for investigating the aspects related to self-perception in young people; the ease administration of the tests and the contained costs would allow to activate training courses aimed not only to a greater self-awareness, but also to the promotion of active lifestyles and starting sports practice.

This type of investigation could represent a proof of the students' psycho-motor status and could represent an excellent tool to plan a better work within schools and in sports context in general.

If the simplicity of the administration of the tests represents strength, an aspect that could be a possible interference, considering the age of people, is the environment (peer group, coach, etc.).

The results of the present study could allow new types of investigations. All training methodology manuals identify in the practice of many kinds of sports disciplines the best way for building different skills in young people. Investigating the difference between motor skills perceived by subjects who practice sports related to a single discipline and those perceived by subjects who practice multidisciplinary activities, could be the first step for deeper research in this sector.

A longitudinal study could be useful to investigate the effects of the psycho-somatic maturation of young people and the continuous or non-continuous practice of a specific sporting activity. Moreover, the application of this research could be particularly interesting taking into account disabled people, through the comparison of those who regularly practice organized sports with sedentary people.

Hopper (1988) and Ulrich et al. (1990) worked in this research area through their works with deaf people and with intellectual-relational disabilities, demonstrating that the lowest perception of their skills lies precisely in the domain of social acceptance and that sporting competence is linked to the sense of self-esteem. Some studies carried out on athletes with intellectual disabilities participating in Special Olympics competitions have recorded a significant improvement in self-concept linked to a significant increase in motor skills (Luttrell, 1991; Castagno, 2001).

In this historical period, it becomes of fundamental importance to identify the levels of perceived competence in the motor domains, the sense of physical self-efficacy and the overall concept of self in disabled and non-disabled people; an adequate knowledge of these constructs can facilitate the identification of different areas of intervention for an effective personalization of the training courses aiming to obtain a personal and social development considering an inclusive perspective.

AUTHOR CONTRIBUTIONS

Cristiana D'Anna designed the study, carried out the statistical analysis, interpreted the data and wrote the manuscript. Michele Mucci collected and interpreted the data and wrote the manuscript. Rodolfo Vastola wrote and revised the manuscript. All authors contributed intellectually to the manuscript, and all authors have read the manuscript and approved the submission.

SUPPORTING AGENCIES

No funding agencies were reported by the author.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author.

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