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PHYSICAL ACTIVITY LEVELS, MOTOR PERFORMANCE AND RELATED FACTORS IN ADOLESCENCE. THE UNIVERSITY OF FOGGIA REGIONAL OBSERVATORY IN ITALY

COLELLA DARIO [1], BELLANTONIO SERGIO [*]

ABSTRACT. Physical activities promotion in developmental age is a public health priority and numerous studies highlight the benefits of various structured and unstructured activities for the prevention of non-communicable diseases and health promotion. Curricular physical education in secondary school offers several and different opportunities to practice physical activities that help promoting learning competences, complying with international guidelines on physical activity and acquiring correct lifestyles. Increasing levels of daily physical activity as well as the development of motor skills are a specific curricular area necessary to structure the conditions for motor learning and the premises for the continuation of sports and physical activities in extracurricular hours. Unfortunately, environmental and socio-cultural characteristics in Italy contribute to increase sedentary habits, limit opportunities to practice unstructured physical activities and lead to a reduction in motor performance. The aim of the following paper is to present the project of the University of Foggia in Italy aimed at systematic monitoring the adolescents' levels of physical activity and motor development. The Regional Observatory at the University of Foggia wants to assess motor skills related to health, analyze correlations with body weight and gender differences, compare the results of prevention interventions carried out in school and structure the premises for regional health promotion projects.

Keywords: *Adolescence, Health Promotion, Health Prevention, Motor Abilities, Physical Education*

Introduction

Promoting physical activities for children and young people is a priority for public health and school. Daily structured and unstructured motor activities – according to WHO guidelines (2010, 2016) helps to foster the individual

[1] University of Foggia, Department of Clinical and Experimental Medicine, Foggia, Italy
** Correspondent authors: dario.colella@unifg.it; sergio.bellantonio@unifg.it*

educational process through a balanced cognitive, motor, social and developmental process. The systematic assessment of children's physical activity levels and physical efficiency is of particular importance, because it allows the acquiring of cross-cutting and longitudinal information on the evolution of motor skills and abilities necessary to personalize educational actions.

Acquired data – both quantitative and qualitative – can be used to carry out systematic monitoring of adolescent's motor development and "surveillance" studies necessary to implement evaluation of multi-component interventions, promoting the awareness of student's health condition. Surveillance studies are the first level for intervention studies because they are the basic research for methodological-didactic experiments. The following three-year research project (2019-2021), approved by the Administration of the Puglia Region (south Italy), concerns the implementation of the Regional Observatory on monitoring of physical efficiency related to adolescent's health. The three-year research project will involve secondary schools and it will be coordinated by the University of Foggia (Italy) - Degree Course in *Science and Techniques of Preventive & Adaptive Motor Activities* and the *University Laboratory of Motor Activities Didactics.*

Sedentary habits are a risk factor for human health at all ages. Physical inactivity is a global pandemic and is one of the leading causes of non-communicable diseases (Lee *et al*., 2012). The increase in daily physical activity and the decrease in sedentary behaviors require concrete educational actions to have a positive impact on the promotion of health during the developmental age (Carson *et al*., 2016; Poitras *et al*., 2016). Blair (2009) warns that regular physical activity is an inescapable preventive factor because it contributes to a reduction in the risk of chronic diseases such as heart disease, type II diabetes, certain types of cancer, etc.

Guthold *et al.* (2020) in a recent study based on a sample of 1.6 million subjects from 146 countries, found that more than 80% of 11 to 17-year-old adolescents do not follow WHO recommendations to perform at least one hour of physical activity per day. Globally, girls are more inactive than boys are, with 85% compared to 78% of boys. The authors analyzed data collected through schools. The assessment included all types of physical activity: time spent in active games, recreational and sports activities, household chores, walking, cycling or other types of active transport, as well as physical education hours. Girls are more inactive than boys are: as many as 85% move less than an hour a day compared to 78% of boys.

The European HBSC (Health Behaviour in School-aged Children) study and 2014 data for Italy (Cavallo *et al*., 2016) show that the percentage of boys who say they do not engage in physical activity increases from 4.2% in 11-year-olds to 7.4% in 13-year-olds, to reach 12.1% in 15-year-olds. The frequency of

those achieving the recommended value of one hour of daily physical activity (seven days a week) is 13.7% at the age of eleven, 9.6% at 13 years and 8.3% at 15 years, respectively. Males are on average more active than females, in all age groups: 17% vs 10% in 11-year-olds, 13% vs. 6% at 13 years old and 11% of males vs. 6% in females in 15-year-olds. Low levels of physical activity contribute to reduce the preventive and protective effects of motor activities and are among the main causes of the decline in motor skills, which indirectly express the degree of efficiency of systems, organs, apparatuses of the organism.

In this regard, a study by Uddin *et al.* (2019) warns that the precursors of non-communicable diseases often manifest themselves during childhood and adolescence with little knowledge about the coexistence of the related lifestyle risk factors. For this purpose, the prevalence and grouping of six main risk factors for non-communicable diseases in adolescents around the world were assessed. Data from the School Student Health Survey, collected between 2007 and 2016, were analyzed in 304,779 adolescents aged 11 to 17 (52.2% female) from 89 countries. Overall, 82.4% of adolescents had two risk factors, while 34.9% had 3. Teenagers between the ages of 16 and 17, compared to those aged 11 to 13, were more likely to report 3 risk factors.

Many children and adolescents around the world do not comply with the WHO guidelines on physical activity and sedentary behavior. Schools are the ideal setting to intervene, although despite the numerous interventions made in this context, the positive results that can be appreciated on a large scale are still limited (Cassar *et al*., 2019). Unfortunately, the sedentary habits of young people and a poorly systematic participation in motor activities and sports limit the effects of mediation for the development of the cognitive, emotional-affective and social factors of individuals (Stodden *et al*., 2008). In addition, the decline in habitual physical activity levels also leads to a consequent decline in motor performance and related factors in different ages, with particular reference to muscle strength and endurance (Tomkinson *et al.*, 2012). Low levels of physical activity and physical efficiency in adolescence have been shown to be associated with low levels of physical activity and physical efficiency in adulthood, preconditions for sedentary living (Huotari *et al*., 2011).

Recent scientific evidence, in fact, warns that the sedentary habits of young people are among the main causes of the decline in motor skills, predisposing the organism to several non-communicable pathologies as the preventive and protective effects of daily motor activities are progressively reduced. Lifestyle changes, including the reduction of opportunities to engage in motor activities in formal and informal settings (school, equipped parks, sports clubs, etc.), lead to a progressive increase in health problems, the most obvious being overweight and childhood obesity (Hills *et al.*, 2014). Periodic

collection of data in schools, motor development and behavioral risk factors through evidence-based data and self-reporting should be encouraged to facilitate sustainable global surveillance.

Motor Activities, Physical Education and Health Promotion at School

The contribution of motor activities and physical education to the growth, development and promotion of children and young people's health is confirmed by various studies that highlight the need to develop integrated and joint interventions in different educational contexts (school, health, sport). For each institution it is a priority to study the cause-and-effect relationships among different factors: socio-environmental determinants of daily physical activity, reduction in children's physical activity levels, increased overweight and obesity in developmental age, cognitive, emotional and social development (Hills *et al*., 2007; Trost *et al*., 2014).

Childhood and adolescence are significant periods for individuals, in which they can intervene effectively with educational actions aimed at promoting health through motor activities and sport. Particularly in developmental age, physical activity positively influences the various factors characterizing metabolic syndrome and it is associated with numerous health and physical efficiency benefits (Brambilla *et al.*, 2011).

The European Commission (2015) warns that physical education in school is a significant opportunity to raise awareness of the importance of HEPA (Health-Enhancing Physical Activity) and to implement health prevention and promotion programs through physical and sporting activities. Urgent cross-sector strategic interventions in the field of HEPA promotion are necessary and urgent. Therefore, evaluable actions are needed to promote HEPA policies through the development of a cross-cutting policy approach involving different institutional sectors, including sport, the Ministry of Health, education, environment and transport, in order to design, implement and monitor levels of physical activity at different ages. Physical education during adolescence, supported by correct methodologies, offers many and varied opportunities to practice structured physical activity, promote the development of motor, coordination and conditional skills. The significant contribution of motor experiences to the development of the organic, affective, social and cognitive area and their relationships is crucial to promote education for the health of young people through physically active lifestyles (Bailey, 2006; Le Masurier & Corbin, 2006).

This process is the result of the educational and mediation intention among the teacher, the pupil, the various motor tasks and organizational arrangements, as well as the context in which motor experiences are realized. Numerous recent studies, in fact, show that many of these benefits will not necessarily be the result of participation in activities but the effects could be mediated by the nature of the interactions among pupils and their teachers, parents and adults of reference at school, in family and in socio-cultural context (Lonsdale *et al*., 2013). In particular, physical activity offers significant benefits on school performance, cognitive function and classroom behavior (Watson *et al*., 2017; Singh *et al*., 2019), involving the individual in its entirety. The control of the outcomes of curricular and extracurricular interventions is inescapable to study the effects of the educational process, analyze relationships with related factors, make comparisons at different periods of school cycle, share the results among the different educational agencies.

The Development of Health-Related Motor Skills

Motor development during the developmental age depends and is influenced by organic growth, as well as maturation and interaction with the environment in which the individuals grew (Malina, 2003). Others may regress to less mature stages before moving on to a more advanced stage, others can show seemingly continuous progress (Malina, 2003; Gallahue, Ozmun, & Goodway, 2011). Motor experiences take place in various contexts including home, school, spaces equipped to play in the neighborhood. Sports facilities and all this contributes to the development of motor skills through the learning of skills gradually more specific and which are the essential basis for the promotion of health in different aspects (Lubans *et al*., 2010; Barnett *et al*., 2016).

Recently, Faigenbaum, Rebullido, & Mcdonald (2018), highlights that most of children and adolescents in the world do not reach the 60-minute threshold of moderate to intense daily physical activity, resulting in reduced levels of physical efficiency. This is coupled with a progressive reduction in motor repertoire of motor skills and the resulting levels of individual coordination development. Today's children are weaker, slower and heavier than their peers in the past, with an increasing tendency to develop physical, psychosocial and cognitive health problems, especially in school age. The recommendations proposed by international institutions (WHO, 2018) provide guidance for the practice of habitual physical activities - both of quantitative and qualitative type – differentiated also according to the age group considered and taking into account various types of physical activity.

In general, the World Health Organization recommends 150 minutes per week of moderate-intensity activity for adults and 60 minutes per day of moderate-to vigorous intensity activity for the developmental age (WHO, 2018). Despite the global recommendations, therefore, the decline in levels of physical activity in recent years does not seem to stop. In this regard, Faigenbaum, Rebullido, & Mcdonald (2018) propose an interpretation of this phenomenon from a threefold perspective. We speak of the Triad of Physical Inactivity in childhood, in which three distinct but closely related factors are identified: exercise deficit disorders, pediatric dynapenia and motor literacy (physical illiteracy).

The first component of the triad of physical inactivity is the *Deficit Disorders of Exercise*: this is a condition characterized by reduced levels of MVPA (Moderate-to Vigorous Physical Activity), which do not comply with the global health recommendations. Young people who do not reach the minimum recommended levels of physical activity can be considered in a pre-morbid condition, such as to be treated with the same methods that would be the same as a hyperthetic individual or adolescent smoker, in order to prevent possible pathological progress. In this context, targeted programmes would be needed to improve the lack of physical activity, maintain a certain level of participation in activities and promote a proper lifestyle, regardless of the weight state in which young people find themselves, as interventions aimed only at obese individuals eliminate a large proportion of them. Even those who have a BMI (Body Mass Index) in the norm, associated with poor levels of physical activity, must be "supervised" and therefore participate in such programs.

The second component of the triad of physical inactivity, is the *Pediatric Dynapenia*, understood as the condition characterized by low levels of strength and muscle power, resulting in functional limitations not related to neurological or muscle diseases. The ability to force in its various expressions, in fact, is necessary to perform some simple activities such as jumping, climbing, kicking, and young people who have low levels of strength are more likely to remain inactive to avoid failures and are also exposed to increased risks of accidents even lean later ages. It is therefore necessary to urge these individuals to join motor activity programmes aimed at improving the performance of muscle strength and power, so they can achieve optimal levels, as well as their peers.
The third component of the triad is *Physical Illiteracy*, understood as a lack of motivation, confidence, perceived self-efficacy, reduced repertoire of motor skills and executive variants, knowledge and self-awareness to evaluate and engage responsibly in motor activities (Faigenbaum, Rebullido, & Mcdonald, 2018).

This triad creates a dangerous circular process: those with low levels of MVPA will be less inclined to participate in motor activities, even free/ deconstructed, and this results in a lower fitness to practice physical or sport activities that involve achieving a state of joy/fun, associated with movement (joy of movement). Therefore, the concept of physical illiteracy must be considered as a whole: it includes cognitive, affective, social, and organic-metabolic factors, characterizing learning processes.

Several studies highlight the importance of promoting physical efficiency in adolescents, particularly for the effects on BMI and related effects on cardiorespiratory efficiency levels (Ortega *et al*., 2008), on relationship between physical activity and overweight, between fitness and overweight (Rauner *et al*., 2013), and between motor skills levels and body weight (Cattuzzo *et al*., 2014).

With regard to the relationship between motor skills and BMI, Gontarev & Ruzdija (2014) showed on a sample of 2228 adolescents that those with a higher than normal BMI have a lower percentage of muscle mass and achieve lower results in muscle strength assessment tests, speed and coordination and low aerobic capacity, compared to their peers. Groups with a high BMI achieved similar results to the normal weight group only in terms of flexibility and greater in static force. An interesting study (Smith *et al*., 2016) aimed at studying adolescent healthy behaviors (group ATLAS-Active Teen Leaders Avoiding Screen-time), measuring physical activity and motor skills and assessing the reciprocal effects of mediation, showed that improving resistance outcomes can be an effective strategy to achieve a positive impact on body composition and strength in different expressions.

The ASSO Multi-Component Project (Jemni, Viana, & Tabacchi, 2016) is being carried out in Italy involving more than 800 adolescents and using technologies to evaluate different factors (lifestyle, eating habits, smoking, alcohol consumption), shows that 78% of adolescents are sedentary. 22% of adolescents are active because they play sports at competitive or uncompetitive levels; the most worrying factor is the cardiorespiratory resistance of the sample with no difference between the under-16s and the over-16s.

With reference to the assessment of health indicators, Lang *et al*. (2018), warns that systematic control of cardiorespiratory efficiency (resistance in its expressions) allows to reactively assess and study the links between physical activity and health related to the child and youth population. Monitoring of cardiorespiratory efficiency promotes monitoring of health of children and young people in each country: the data can be used in scientific research, physical education and clinical. Last but not least, the development of guidelines could support future efforts to interpret monitoring data at national and international level (Santander *et al*., 2019).

The studies presented in this paper demonstrate the relationships between motor performance and levels of physical activity, and the importance of systematically controlling physical efficiency and factors related to the health of young people, with reference to different variables as age, gender, BMI, socio-cultural condition, extracurricular sports practice. Interdisciplinary didactics actions – diversified according to the needs of individuals – aimed at the promotion of health and prevention of various pathologies, and they require an inter-institutional and cross-cutting approach. Interventions should involve practitioners from different sectors (health, education, sport) to encourage pupils and parents the necessary understanding of the main meanings underlying the movement. In particular, any proposed action "for the school" and "in the school" must include the measurement and evaluation of motor skills and related factors to analyze temporal variations and the impact of interventions on behavioral change.

The *University of Foggia Motor Skills Monitoring and Health Promotion Regional Observatory*

According to several studies, the assessment of adolescents' physical efficiency takes on particular importance because it allows the acquiring of information – transversal and longitudinal – on evolution and development of motor skills. Surveillance studies are the first level for intervention studies, basic research for methodological-didactic experiments. The *University of Foggia Regional Observatory for Monitoring Adolescent Motor Development* involves several educational institutions and arises from the need to annually acquire quantifiable data on the development of motor skills related to health and levels of physical activity during developmental age. These data provide direct information on the evolution of children's motor skills in Apulia Region and indirectly the effectiveness of interventions in schools, as well as the quality of physical education in secondary schools. Furthermore, the data promote the self-assessment of motor performance and health conditions by pupils, a prerequisite of education in daily motor activities. The data can be shared among national, regional and local institutions that cooperate in the design and implementation of health promotion interventions in the school.

Why a Regional Observatory?

1.1 Aims

(*a*) establish a territorial database on motor development and levels of physical activity accessible to different professionals and helping institutions to achieve national benchmark regulatory values; (*b*) compare levels of physical activity and motor development of pupils at different ages (cross sectional and

longitudinal study); (*c*) facilitate the communication of data obtained among different sectors (school, university, health, sports, local administrators), in order to design integrated educational actions according to evidence-based data; (*d*) motivate teachers and pupils to control the teaching process; (*e*) promote pupils' self-assessment of physical activity levels, motor performance and the dangers related to sedentary lifestyle; (*f*) analyze changes in lifestyles at various periods of developmental age and promote the spread of healthy habits; (*g*) guide the sport practice of young people; (*h*) promote the use of testing in school assessment; (*i*) identify the relationships among motor practice, eating habits, school performance and related psychological and social factors.

1.2 Participants

The participants of the University of Foggia Regional Observatory are middle and high school students from Apulia Region who are affiliated with the University of Foggia and who agree to participate in the study. Additional involved participants are the parents of the pupils and the teachers of the participating schools. The establishment of this observatory is a reference for the design of motor activities in the field of health education in the school, a "container" of information to draw on to study the main emerging issues and formulate solution hypotheses, by the school and other educational agencies. Monitoring levels of physical activity and motor development in adolescence – through objective and self-reporting measures – can help to improve the quality of physical education by returning useful and necessary information to plan teaching, identify pupils' needs, vary teaching methodologies, and prepare measures to contrast sedentary habits. Territorial benchmarks can also be developed to identify inter-individual differences, national and international comparisons. In addition, up-to-date information on psychological and socio-cultural factors related to physical education and guidance necessary to change activities and environments can also be given.

1.3 Timeline

The activities of the University of Foggia Regional Observatory will develop over a three-year period according to the following timeline:

First Year: (*a*) identification of the sample of adolescents residing in Apulia Region, neurotypical, special needs, and disadvantaged social classes; (*b*) analysis of the scientific literature to choose objective assessment protocols and self-reports according to the international literature; (*c*) first anthropometric, motor, postural and related assessment; (*d*) website structure for data collection and documentation; (*e*) presentation of the study of parents, teachers and school leaders.

Second Year: (*a*) communication to parents and teachers of schools affected by the preliminary results; (*b*) methodological and curricular interventions according to experimental teaching and organizational models; (*e*) second anthropometric, motor, postural and related factors assessment.

Third Year: (*a*) continuation and development of experimental methodological-didactics interventions; (*b*) third anthropometric, motor, postural and related factors assessment; (*c*) dissemination of results to parents and teachers of the schools involved.

During the three-year period, the website will be managed to ensure the documentation of the detected and processed data. The study provides: (*a*) cross-and-longitudinal analyses on the socio-cultural determinants of physical activity; (*b*) assessment and monitoring of adolescents' physical activity and motor development levels (11-13 years/14-18 years), in relation to individual and socio-cultural variables (T_0, T_1, T_2). The research will also analyze (*c*) the effects of experimental curricular experimental methodological and organizational interventions, aimed at learning motor skills, promoting daily physical activity, developing factors of motor performance (resistance, strength, joint mobility, speed, motor coordination), some psychological constructs (physical self-efficacy, enjoyment and motivations) and analysis of correlations with school results.

1.4 University of Foggia Regional Observatory Strengths and Weaknesses

The following strengths are identified: (*a*) three-year duration to perform longitudinal analysis and studies through object methods and self-reporting; (*b*) schools spread across the Apulia Region; (*c*) developing reference standards to identify international and national inter-individual differences; (*d*) surveillance of those at risk of obesity; (*e*) promotes pupils' awareness of their own state of health; (*f*) analyzing data to improve the quality of physical education at school.

The following weaknesses are identified: (*a*) physical activity levels are measured by self-reporting; (*b*) availability of financial resources for the duration of the project; (*c*) systematic communication with institutional stakeholders (health, sports, local government); (*d*) lack of interdisciplinary relationships in educational design; (*e*) lack of informed consent for some parents to detect data.

Methodological Conclusions and Educational Implications

Motor assessment in secondary school enables data on methodological quality of physical education, levels of physical activity and motor development of pupils. The collection of quantitative and qualitative data in the school should

be aimed at improving the quality of teaching. Frequently physical education teachers annually detect numerous data on the motor development of pupils that are not properly or fully used to improve the teaching process, that is, the data are not transformed into information useful to educational action. Regarding scientific research, the quantity and quality of studies of physical activity during developmental age and sedentary behaviours have rapidly increased in recent years, but research directions are often pursued in an uncoordinated manner among scholars. There has been a wide-ranging comparison so far to identify the characteristics of quality curricular interventions aimed at physical education for health promotion.

To reach an international consensus on the priorities of physical activity and motor development research for adolescent health, two independent groups of scholars (Delphi procedure) were compared to define a list of research priorities for the next ten years (Gillis *et al*., 2013). Among the top three research priorities (out of 29) for the next 10 years were identified:

a) to develop effective and sustainable interventions to increase the physical activity of long-term pupils
b) to implement policies to promote environmental change and their influence on physical activity levels and reduction of sedentary behaviours
c) to foster longitudinal studies on the effects of physical activity on sedentary habits and health promotion

Several areas of action emerge: school, family, sports, urban furniture (park presence, bike lanes, equipped play spaces, sports facilities) among the fundamental determinants of deconstructed and structured motor practice. Particularly at school, the process of learning motor skills, as well as the development of motor skills, are conditioned by reduced opportunities for motor practice that predispose young people to overweight and obesity and limit the motor repertoire of each pupil.

Custom methodological intervention is a priority to propose activities adapted to the motor skills of children with greater BMI in the parameters of executive difficulty, duration and intensity, in order to help to increase the quantitative and qualitative levels of physical activity, promoting success and motivation to continue physical activity outside of school. Among the essential and indispensable skills of physical education teachers, we can found the analysis of the motor tasks and the customization of intervention in the motor and sports field of youth supported and guided by appropriate teaching styles and didactics strategies.

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