EFFECTS OF DIVERSIFIED MOTOR ACTIVITY ON THE LEVEL OF MOTOR FITNESS IN CHILDREN AND YOUTH FROM CRACOW (POLAND)

by

STANISŁAW ŻAK *, JAN SZOPA**

Findings described in this paper are supported with results of continuos examinations of children and youth aged from 7 to 15 years. The investigations deal with basic somatic features and selected tests of motor abilities and motor co-ordination. The material is worked out in two fractions (high and low motor activity). Results of motor fitness tests are presented in standardized relative values (advancement in somatic development is neglected). The regression in motor abilities in groups of youth with low motor activity is caused by environmental factors. Those factors have a greater influence on girls than on boys. The aforementioned facts allow us to formulate several postulates concerning theoretical and practical aspects of physical education.

Key words: motor abilities , motor activity, functional development

Introduction

Over the last twenty years changes in the development of somatic traits and motor abilities in contemporary population of children and youth are not of parallel character (Żak & Szopa 1989; Żak 1991, 1994). The secular trend in somatic development is accompanied with adverse changes in motor fitness. The young generation of Poles show positive changes in the development of basic morphological features; young people are getting slimmer and taller. These changes are accompanied, however, with regressed motor fitness specifically based on endurance and strength abilities.

* Assist. Prof., dr hab. Dept. Sports Games. Acad. Edu., Kraków, Al. Jana Pawła II 78, Poland.

** Prof. dr hab. Acad. Physical Educ. Katowice, Raciborska 1, Poland

Research on the development of children and youth have become more interesting for representatives of bio-medical sciences like teachers, physicians, health centres, educational institutions and parents. These researches are usually of cross-sectional character, while continuos research is rarely performed. (in Cracow Gołąb 1993, Mleczko 1993).

The astonishingly low level of physical exercise and daily exertion performed by the contemporary population of children and youth indicate that sport and physical education are usually the only form of physical activity (Żak 1994, Oya 2001).

In this relation, theory of physical education highlights the need of making pupils aware of their physical stature and shaping their expectations and attitude in a positive direction - health-related fitness (Oya,Tuxworth 1995, Bouchard & Shephard 1994).However, effectiveness of such education may be assessed only by comparing the expectations with their practical effects .

This discussion on dynamics of movement development must also cover the stimulating role of motor activity having the decisive impact on the functional aspects of the organism. Limited or non-existent stimulation calls the completion of developmental conditions into question, as structural and functional maturity itself does not guarantee a sufficiently high level of motor abilities.

This paper aims at arriving at a definition of impact of current structure of motor activity in contemporary population of children and youth in Cracow elementary schools on the level and development of their motor fitness, neglecting the factor of somatic development.

Material and methods

The material consisted of a fragment of extensive comprehensive continuos research in children who started their elementary education in 1991 in Cracow (schools no 11,12,26,91,130) - 196 girls and 192 boys examined once a year (in autumn) for 9 years (up to 1999).

The following variables were selected for analysis:

1. Basic somatic features: body height, body mass, thickness of three skin folds (shoulder, shoulder-blade, belly), fat mass determined by egrafion Garn method (1957).
2. Motor fitness tests based on main motor abilities:
   a) Grip strength and shoulder strength – measured with a specially constructed and calibrated dynamometer (static strength)
   b) Standing broad (MAP maximal anaerobic power)
   c) Endurance (aerobic efficiency) measured by the result of 20x20 m shuttle run (indoor gym),
   d) Flexibility – evaluated with the depth of forward bend in sitting position .
3. Co-ordination abilities (Szopa at al.. 1996):
   a) plate tapping (Eurofit 1988),
   b) eye movement co-ordination (tested with Piórkowski's apparatus constructed and tested in Poland),
   c) space orientation - with AKN 102 "cross apparatus"
   d) balance - evaluated by "flamingo balance test" (Eurofit 1988). The results of particular co-ordination tests were normalised, average values were calculated and expressed in % of global sum: we took this value as an indicator of "general co-ordination".
4. Questionnaires including information on motor activity of a child, opinions on exercise, tests and grades applicable in school physical education programs. Possible reasons of giving up active forms of relaxation, recreation and sport.

The following methods were applied:

1. Basic statistic values for all motor tests and somatic features were calculated each year (between 7 –15 years of age).
2. Results of motor tests and body height were Z-standardised with reference to the population of Cracow. Relationship of particular motor variables to body height was presented in percentage (percentage quotient indices). The above procedure was applied in all investigated generations of children in two small fractions separated according to the degree of motor activity (highly active and minimally active).
3. Motor activity of children and youth was defined on the basis of questionnaires (amended with interviews with a child, gym teacher and

parents) on going in for sport, recreation, exercise and membership in sport clubs. The questionnaire and interviews were held in the last year of investigation. The following division was applied: sport activity in sport club or sport class – highly active (group 1), systematic attendance without a sports club membership (recreation oriented activity) – medium activity (group 2), rare exercise, only compulsory gym classes – low activity (group 3).

Results

The structure of motor activity of Cracow school population is illustrated with Fig. 1. Low activity dominates in girls (43,6%), medium in boys (38%), and a high percentage of boys show minimal activity (35,4%). The percentage of young adults participating in sport seems rather low (21,4% girls and 26,6% boys).

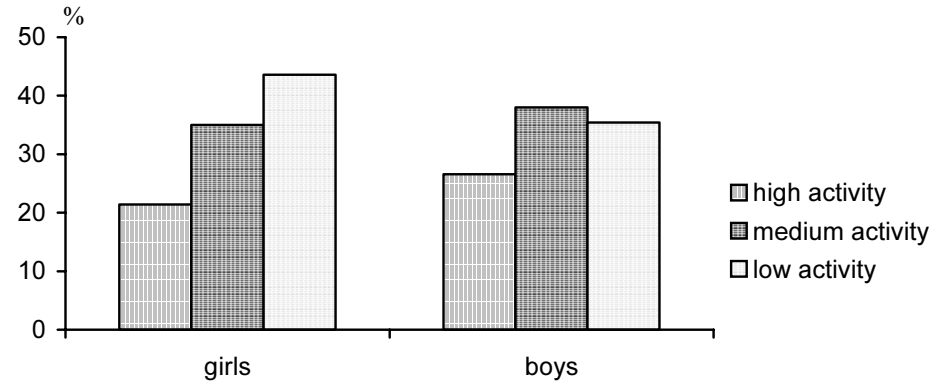

Fig. 1. Structure of motor activity in population of children and young adults, expressed in percentage

The above presented structure of motor activity of Cracow population of school children is distinctly reflected by proportion of body components. The fat content in girls not showing motor activity is at an identically high level – with only a small fluctuation, during the whole period of investigation that is 7-15 years of age (fig. 2). Girls who are highly active show fat reduction beginning from the 11 year of age and then the difference between the separated fractions gradually increases (when they are 15, the difference reaches 11%).

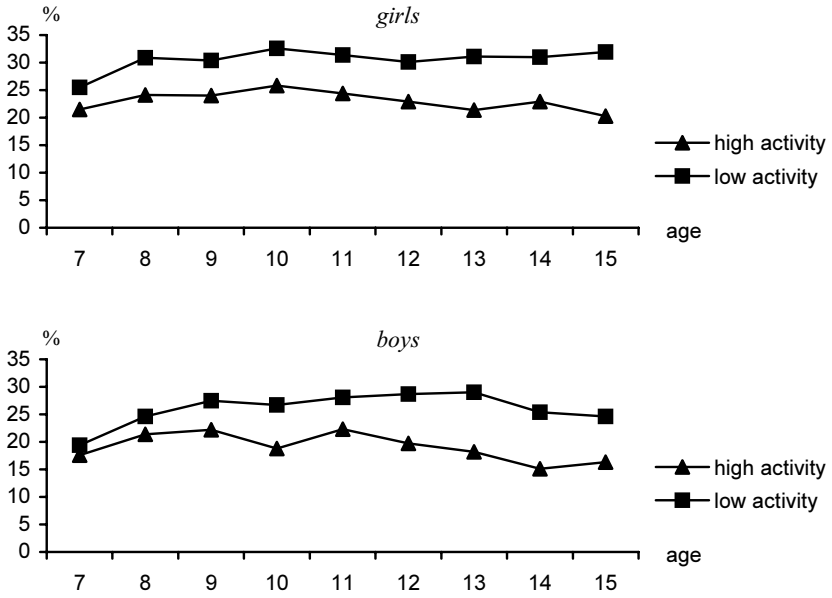

Fig. 2. Body fat content changes in girls and boys in groups formed according to the level of physical activity

In boys with low motor activity, fat content increases up to the 13th year of age and then it drops, the largest between 13th and 14th year of age (pubertal growth spurt). In the fraction of boys with the highest level of motor activity, the decrease in level of fat content starts in the 11th year of age and is visible until the end of the period under investigation.

As shown in fig. 3, the factor of motor activity is different in population of girls and boys and within particular motor fitness tests.

As far as static strength is concerned in a group of boys, curves representing the level of the discussed effects in two separated fractions until the 9th year of age are similar and near the limit of 100%. After this period, lines representing boys active in sport and boys showing minimal activity slowly depart from each other, and it should be noted that this phenomenon is caused rather by the growth of strength in the sportive group than by decrease of effects of boys showing low motor activity. Differences between these two fractions reaches about 13% in boys 15 years of age.

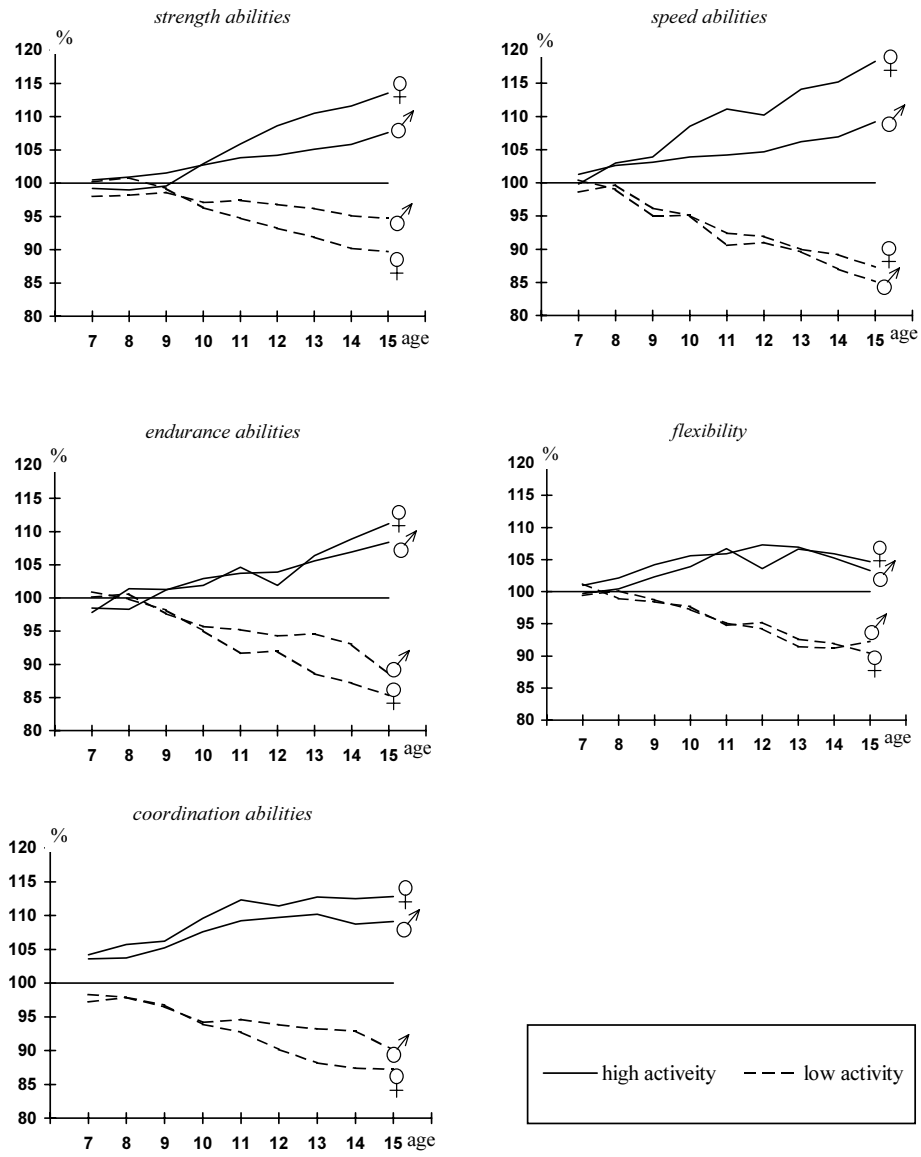

Fig. 3. Percentage diversity in motoric abilities of girls and boys resulting from motor activity factor. Factor of somatic development is neglected

Results similar to the group of boys are observed also in girls: the only difference is, that motor activity factor was clearly stronger here and the difference between fractions of girls who are 15 years old was about 24%.

Much higher diversity - higher in population of girls than that of boys was visible when analysing speed and endurance abilities. Both in girls and boys inter-fractional differences get larger with age, and what is very important, negative factor of low motor activity plays a significant role. This diversity in the last investigated age group in case of speed and endurance abilities in girls was about 31% and 26% and respectively 24% and 26% in boys.

Increase of results under influence of the increased motor stimulation is related to motor co-ordination (treated globally) is more than 8% in girls and 5,5% in boys. Regression of effects resulted in too low motor activity is respectively 11% and 7%.

Results of diversified motor stimulation of spine flexibility were rather irregular changes observed both in girls and boys. It should be noted however, that this phenomenon relates only to the influence of the increased dose of motor activity and generally brings positive results. Regression of flexibility in both sexes arising from the lack of motor activity is regular in girls and in boys and reaches respectively, 11% and 7%.

Discussion

Assuming that preferable (target) values present in people showing higher motor activity, very often of sport character or intensive physical work in their profession, are normal values of morphological and physiological variables, the above outlined structure of activity in Cracow school population is not optimistic. The reasons of this phenomenon lie in improper or insufficient efforts of school to provide pupils with physical education, or sport facilities (socialising and pedagogical functions). Therefor we need a dramatic reconstruction of quantity and quality of physical education in schools. It is very important to undertake efforts aiming at implementation of more adequate resources and methods, taking into consideration individual abilities and interests of pupils, to affect the growing organism. This problem was widely discussed in many publications (Przewęda 1986, Raczek 1986, Oya 2001).

Though this paper does not include (because of editorial reasons) any statistic analysis concerning results of the questionnaire and interview, it should be noted that analysis of certain open questions allows us to assume that

contemporary youth often do not take part in physical exercise because of their short stature (genetic or developmental reasons) in comparison to their taller peers. The model of family life is significant, or even decisive, for functioning of social mechanisms. This opinion can be justified with answers of the questioned parents concerning family style of life and activity of their children. The physical exercise shows the highest level – though it is also diversified - in families of former athletes and is related with the way of spending free time, number of sport disciplines and time devoted to physical culture. The level of education of parents is also significant (the higher education the higher awareness of the need of physical exercise). Higher level of motor activity and consequently better level of a motor abilities in children of former athletes (genetic preconditions are neglected) may be the result of the fact that children follow the life of their parents.

The positive influence of motor activity on the body of youth organism is widely known and does not need further explanations - was reflected in their somatic diversity – especially visible in proportions of body components.

The trend common for all tests of motor abilities in both sexes is that differences in "raw" results of both fractions successively grow in age. It should be noted that young adults included in the research are diversified in the sense of body stature resulted from genetic or developmental reasons. It is important to remember that, from among morphological features, this is the most representative feature for the somatic structure of an individual – it carries the largest amount of information about the state and dynamics of human physical growth (especially in the period between 11th and 15th year of age). It is difficult to separate the factor of natural development from the stimulating factor, such as motor activity . Results described in relative manner seem to be more reliable.

It may be stated on that basis, that the motor activity factor is stronger in girls than in boys, and this suggests that potential ability to develop motor abilities is higher in females than in males.

It seems however, that differences related to sex are smaller in groups with higher motor activity result from the structure of activity of girls and are caused by their relatively "natural" lower motor activity. (Żak 1994). Sport activity of boys is always higher than the one of girls in the whole population (two

extreme fractions – high and low activity – are neglected). The relative potential of boys is similar to that of girls, significant differences refer only to motor abilities which is justified with environmental and social conditions (different lifestyle, interests, etc.). Extensive motor activity gives stronger effect in girls than in boys. More significant results of such impact on motor abilities of girls may also be caused by – as indicated by certain authors – weaker genetic control of their functional properties (Siniarska 1982, Szopa 1983, Malina 1984, Bouchard et al. 1997).

It should also be noted that the share of motor activity factor (expressed in percent) in diversification of particular motor effects is of two-way character. Sport activity results in a development of all motor abilities, and its minimal level not only prevents any improvement of fitness but, what is interesting – results in significant decrease of effectiveness, often drops below the level designated by natural developmental predispositions. It may be stated, that youth that is not provided with minimal motor stimulation does not make use of their potential, resulting from the growth of their body.

Disregarding the biological value of motor activity, its significance in physical development in childhood and youth is visible in the level of physical fitness and adaptation abilities in the mature and old age (Kozłowski 1987). The problem of the level of applied load is also important and needs resolving. It results from a number of investigations (Astrand 1952, Kućera 1980 a. a.), that spontaneous activity of a child is sufficient for stimulation of development of the majority of basic somatic, energetic and co-ordinative predispositions, under the condition that it is not limited by adverse influence of social and cultural environment. However, young people should be stimulated with proper forms of motor activities. The contemporary researchers (Malinowski 1987, Przewęda 1994, Bouchard & Shephard 1994, Oya 2001) underline that apart of very important biological adaptation reached in the characteristic period of ontogenesis with carefully selected forms of motor activity, psychological adaptation oriented to one's own body and health status is also very important (but often underestimated). It is the only stage when it is easy to get accustomed to motor activity and learn various forms of physical exercise.

Conclusions

1) The observed regression in fitness of children and youth is caused by environmental factors and not, as it may be supposed, by biological reasons. These factors have larger impact on motor abilities of girls than of boys.
2) As results from the facts described above, larger and more effective motor stimulation should be applied, especially to young people with retarded development (regardless of the reason – whether connected with growth dynamics or genetic base), as it is one of the elements of developing physical soundness and proper wide-ranging biological, mental and social development.
3) Dramatic reconstruction of quantity and quality of physical education in schools and correct synchronising of actions developing directional and instrumental dispositions seem to be important issues.
4) Parents should also be included in the physical education system. It is necessary to support the family not only in the form of verbal teaching but also by creating friendly conditions encouraging the family to make use of various form of active recreation.

REFERENCES

Astrand P. O. 1952. Experimental studies on physical working capacity in relation to sex and age. Ejner Munksgaard, Copenhagen.

Bouchard C., Shephard R.J. 1994. Physical activity, fitness and health: the model and key concepts.(W:) Physical activity, fitness, and health (eds.) C. Bouchard, R.J. Shephard, T. Stephens, Human Kinetics Publishers, Champaign, II., 77 - 88.

Bouchard C., Malina R.M., Perusse L. 1997. Genetics of Fitness and physical performance. Human Kinetics. Publ. Champaignn, Illinois.

Eurofit. 1988. European test of physical fitness. Brussels.

Garn S.M. 1957. Roentgenogrametric determination of body composition. Hum. Biol. vol. 29.

Gołąb S. 1993. Biologial and social conditions of chaneability in physical growth in children and young adults in Nowa Huta (results of continual

research). Wydawnictwa Monograficzne, AWF Kraków, no 53. (in Polish, English Summary).

Kozłowski S. 1987. Importance of motor activity in physical development of humans.. (W:) Factors of human development. Introduction to human ecology Editor. N. Wolański, PWN Warszawa (in Polish, Engish summary).

Kućera M. 1980. Analysis of spontanious motor activities in children. Wych. Fiz. i Hig. Szkolna, nr 1 (in Polish).

Malina R. H. 1984. Genetics of motor development and performance. Mat. Olimp. Sc. Congress Eugene.

Malinowski A. 1987. Biological standard and somatic development of humans. IWZZ, Warszawa (in Polish).

Mleczko E. 1993. The environmental differentiation of level and rate of functional development of children in Cracow between the ages of seven and fourteen. Antropomotoryka, nr 10 (in Polish, English Summary).

Oya P. 2001. New perspectives for the assessment of physical activity and fitness. (W:) Acta Kinesiologiae Universitatis Tartuensis, vol 6.

Oya P., Tuxworth B. (red.) 1995. Eurofit for adults. Assessment of healthrelated fitness. Council of Europe

Przewęda R. 1986. Physical ability of Polish young adults and related problems of physical education.. (W:) Motority of children and younfg adults AWF Katowice (in Polish).

Przewęda R. 1994. Environemntal conditions of human motority – structure, changeability and conditions. Monography, AWF, Poznań, nr 310 (in Polish).

Raczek J. 1986. Trends in changes in development of motoric ability in school population. (W:) Motority of children and young adults. AWF Katowice (in Polish).

Siniarska A. 1982. Biological status in population from areas with diverisified level industrialisation. (W:) Ecology of human population. Ossolineum, Wrocław (in Polish).

Szopa J. 1983. Changeability and genetic preconditions of certain symptoms of muscular strength in humans – results of family tests.

Żak S. 1991. Fitness and co-ordination abilities of children and young adults from large cities in relation to the selected somatic conditions and motor activity. Wydawnictwa Monograficzne AWF, Kraków, nr 43 (in Polish, English Summary).

Żak S. 1994a. Social and pedagogical effects of diversified motor activity of children and young adults. Wychowanie Fizyczne i Sport, no 1 (in Polish, English Summary).

Żak S. 1994b. Developmental conditionings of selected motor abilities of children and youth from Cracow population. Antropomotoryka, nr 11.

Żak S., Szopa J. 1989. Level of motoric development in children and young adults from the selected schools in Krakow in 1983 as compared with standards applicable for South-East Region of Poland in 1973-1974. 1973-1974. Roczniki Naukowe AWF, Kraków, t. 23(in Polish, English Summary).