Available online at www.sciencedirect.com

SciVerse ScienceDirect

Journal of Science and Medicine in Sport 15 (2012) 220–225

Journal of Science and Medicine in Sport

www.elsevier.com/locate/jsams

Original research

Relationship between sports participation and the level of motor coordination in childhood: A longitudinal approach

Barbara Vandorpe [a,*], Joric Vandendriessche [a], Roel Vaeyens [a], Johan Pion [a], Stijn Matthys [a], Johan Lefevre [b], Renaat Philippaerts [a], Matthieu Lenoir [a]

[a] *Department of Movement and Sports Sciences, Ghent University, Belgium*
[b] *Department of Biomedical Kinesiology, K.U. Leuven, Belgium*

Received 16 March 2011; received in revised form 14 June 2011; accepted 7 September 2011

Abstract

Objectives: This study examined the stability of motor coordination and the relationship between motor coordination and organized sports participation over time.
Design: Longitudinal design.
Methods: A total of 371 children between six and nine years of age at initial testing completed a test battery measuring motor coordination in three consecutive years and a questionnaire on their club sports participation in year 1 and year 3 of testing.
Results: Correlation coefficients revealed the motor coordination of children to be a highly stable factor, ranging from 0.662 (6–8 years) to 0.873 (7–9 years). Results of the Repeated Measures ANOVA indicated that children who consistently practiced sports in a club environment over the three years of testing displayed better coordination levels than children who only partially participated or did not participate in a club environment at all. Moreover, stability was further indicated as consistent sports participation over time and changes or lack thereof did not substantially influence the development of motor coordination over time. In addition, the basic level of motor coordination and the amount of club sports participation significantly predicted sports participation two years later.
Conclusion: The importance of the stability of motor coordination levels in childhood and its role in determining organized sports participation may have implications for talent identification purposes as well as potential health-related benefits in childhood and throughout the lifespan.

Keywords: Children; Physical activity; Sport; Motor skills

1. Introduction

Sports participation, a subcategory of leisure-time physical activity,[1] is an important context of physical activity for the majority of children and youth.[2] In Flanders, most children engaged in sporting activities practice in a club-environment.[3] Sports participation emphasizes the enjoyment, wellbeing, fitness, health and social development of its participants.[2] Considering the short- and long-term health-related outcomes that children regularly participating in sports and physical activity in general benefit from (better sport-specific skills, higher physical fitness levels, enhanced social and ethical development, lower likelihood of becoming obese, reduced risk of cardiovascular diseases, etc.),[2,4] investigating the possible determinants of physical activity in children is important.

Fundamental movement skills (FMS) (locomotor, e.g. running, jumping and object-control, e.g. catching, throwing) are not only required for normal everyday functioning,[5] but are considered building blocks for the development of higher context-specific skills[6–8] and even essential to determine sport and physical activity participation.[8–10] The role of an adequate movement skill level in the initiation and maintenance of physical activity participation was contended in the conceptual model by Stodden and colleagues.[10] They described a "negative spiral of engagement" in children with low levels of FMS. These children might exhibit low values of perceived movement skills competence and would be, by consequence, less physically active, in turn leading

* Corresponding author.
E-mail address: Barbara.Vandorpe@UGent.be (B. Vandorpe).

1440-2440/$ – see front matter
doi:10.1016/j.jsams.2011.09.006

to lower health-related fitness levels, increased weight and even obesity. These outcomes would negatively feed back into the model, further lowering opportunities to develop their movement skill level.

A number of experimental studies reported on the relationship between FMS and physical activity, especially on the low end of the motor continuum in children with Developmental Coordination Disorder (DCD)[11]: Preschoolers,[12] children[13–15] and adolescents[16] with lower levels of movement skills were found to be less physically active than their normal or highly skilled peers (sports activities, organized and free play, recess time, etc.) probably due to a cycle of previous negative movement experiences leading to lower perceived self-efficacy levels.[14] Though these aforementioned studies confirm the association between movement skills and physical activity, their cross-sectional nature precludes statements on causality. In one of the few longitudinal studies, the importance of an adequate movement skill level in childhood was highlighted by demonstrating that a good level of object-control skills in childhood is a key predictor of physical activity and fitness outcomes in adolescence mediated through its influence on building a positive perception of motor competence. On the other hand, locomotor skill proficiency was not able to predict adolescent physical activity and fitness.[17]

In literature, there is a lack of consensus regarding the definition and evaluation of the numerous movement skills, causing instability in the strength of its relationship with physical activity. FMS do not naturally occur in children, but instead develop through the interaction of biological and environmental constraints.[6,18] The development of FMS is not age-specific and entrance into the next phase will differ for each of the FMS.[6,7,19] Motor coordination on the other hand is a general construct underlying the development of FMS and specialized motor skills. Unlike movement skills, motor coordination is assumed to be a relatively stable factor,[20] which was supported by previous research.[21] In a recent longitudinal study, it was demonstrated that the initial level of motor coordination measured at the age of six was a predictor of physical activity at the age of ten.[22] In line with the framework of Stodden et al.,[10] it was suggested that motor coordination is an important determinant of physical activity in childhood.

There is a scarcity of information regarding the stability of motor coordination and its causal relationship with physical activity in all children. The aim of this longitudinal study was to examine the stability of motor coordination and to further explore the direction of the relationship between motor coordination and organized sports participation – as a measure of physical activity – over time. As stability implies minimal impact of training,[20] it was hypothesized that the level of sports participation would not greatly influence the development of motor coordination in childhood. In order to investigate the inverse relationship, the initial level of motor coordination was then checked for its predictive value in combination with initial sports participation in determining future sports participation in childhood. In accordance with previous studies[10,22] it was hypothesized that motor coordination would play a significant role in predicting sports participation in childhood.

2. Methods

This study was part of a large-scale longitudinal project covering three years (Flemish Sports Compass; a cooperation between the Flemish government and Ghent University). During the first year of testing (2007), 29 elementary schools were randomly selected from all five Flemish provinces and the Brussels-capital region of Belgium. To ensure a representative sample of school-aged children, stratification based upon education type (special/normal), geographic area (rural/city) and school system (Catholic, governmental, provincial/city) was taken into account. From a time-economic point of view, it was not possible to re-measure all children from the 29 schools. Therefore, thirteen schools were selected for longitudinal assessment using the aforementioned stratification conditions. In 2007, 2926 children were measured on a motor coordination test battery. In 2008, 1457 children (of which 954 already tested in 2007) performed the test battery and during the 3rd consecutive year of testing (2009), 1230 children (of which 712 already tested in 2007 and 2008) were tested. From this sample of 712 pupils, only the children being six years or older and younger than 12 and only those who completed the assessment of the motor coordination test annually were retained for this study, resulting in a total of 638 children (327 girls and 356 boys). In 2007, the cohort was aged 6–9 years (8.3 ± 1.1 years), maturing to 8–11 years of age (10.3 ± 1.1 years) in 2009. Written parental/guardian consent was obtained prior to testing. Children and parents were informed that participation was voluntary and that they could withdraw from the study at any time. All recruiting and testing procedures were approved by the Ghent University Hospital Ethics Committee.

The KörperkoordinationsTest für Kinder (KTK)[23] was used to assess the children's gross motor coordination. The German test battery was selected for assessment because it is a frequently used, highly reliable and valid instrument, with a test–retest reliability coefficient of 0.97,[22–24] which places every child on a motor coordination continuum. In addition, as the same tests are used in children from 5 to 15 years of age, it is suitable for longitudinal research. The KTK consists of four test items: (1) Walking backwards three times along each of three balance beams of decreasing width: 6.0, 4.5 and 3.0 cm respectively; (2) Moving sideways on wooden boxes during 20 s; (3) Jumping sideways with two feet over a wooden slat during 15 s; (4) Hopping on one leg over a pile of pillows increasing in height with consecutive steps of 5 cm per pillow. The raw performance scores of each subtest are converted relative to age- and gender-specific reference values (motor quotients) upon which the KTK was established.[23] The sum of the four standardized motor quotients comprises a Motor Quotient (MQ), which is used as a value for the motor coordination of the children, making comparisons between

different ages and gender possible. According to the original authors' classification, MQ values between 86 and 115 relate to a normally developing coordination. Values below 86 and above 115 relate respectively to a low and a high motor coordination level.[23] The present sample proved to be representative of the current Flemish children as this subsample showed score distribution in accordance with Vandorpe et al.,[24] classifying respectively 20.2%, 71.7% and 8.0% in the low, normal and high range. The assessment of motor coordination took place in the school gymnasium and was repeated at the same time period at each of the three consecutive years (from September to January) by a team of qualified examiners of the Department of Movement and Sports Sciences, using standardized instructions in accordance with the test guidelines. Children performed the tests in bare feet and wore light sports clothing.

General information about the children's participation in organized sports was obtained through self-reported physical activity using the Flemish Physical Activity Computerized Questionnaire.[25] A paper version of the questionnaire was handed out in order to prevent non-response due to the absence of a home-computer. This version was then entered on a computer by a staff member. Given the young age of the tested population, the questionnaire was filled in with the help of their parent(s)/guardian. Good test-retest reliability (0.69–0.93) and acceptable validity (correlation with accelerometer data) was found for the physical activity indexes in children completed with parental assistance.[26] A total of 535 questionnaires was completed in the first year of testing, from which 371 were also returned in the third year. Post hoc analysis revealed that the drop-out sample did not significantly differ in motor coordination nor sports participation levels from the sample used in this study. Approximately 20% of the children reported not to be engaged in sporting activities (2007: $n = 79/371$; 2009: $n = 77/371$) and approximately 70% reported to be exercising in a club environment for at least 1 h each week (2007: $n = 249/371$; 2009: $n = 265/371$). The remaining part (approximately 10%) practiced sports in a non-club-related environment (2007: $n = 43/371$; 2009: $n = 29/371$) and were therefore not retained for further analysis considering the focus of the present study on participation in organized sporting activities. This resulted in a total of 301 children reporting on their participation in organized sports both in 2007 and 2009.

In order to investigate the stability-hypothesis, the children were divided into three groups of sports participation according to the evolution in organized sports participation from respectively the first to the third year of testing: "no participation" ($n = 45$): not actively involved in a sports club in year 1 and year 3, "partial participation" ($n = 46$): started or quitted sports participation from year 1 to year 3, and "consistent participation" ($n = 210$): consistent engagement in sports between for at least 1 h/week in year 1 and year 3.

All data were analyzed using SPSS 15.0 for Windows. Pearson product correlations were initially applied over four age-intervals to explore the general stability of the motor coordination of children: from 6 to 8 years, from 7 to 9 years, from 8 to 10 years and from 9 to 11 years. A 3 (Time) × 5 (SportsChange) Repeated Measures Anova (RMA) was then conducted with MQ values as within-subjects variables in order to gain insights into the influence of organized sports participation on the stability of motor coordination. Finally, a logistic regression analysis was applied in order to predict the probability of sports participation in 2009 (YES (1 h or more/week) (1) or NO (0)) based upon MQ values and sports participation in 2007 (dichotomous; yes (1 h or more/week) (1) or no (0)). Significance level was set at $p < 0.05$.

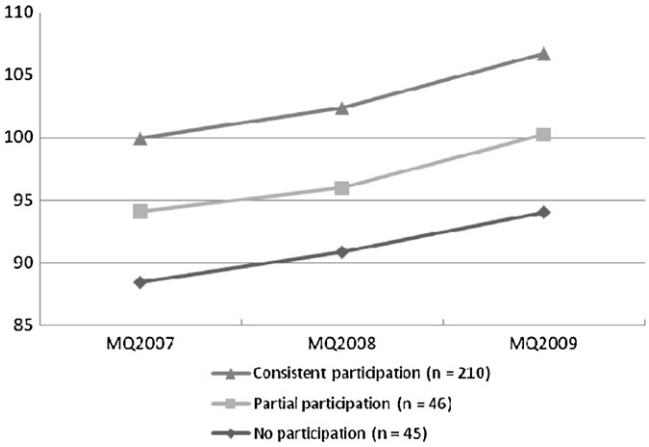

Fig. 1. Changes in mean MQ values over a two-year interval in children classified by organized sports participation over time.

3. Results

The guidelines of Malina[27] were used to determine the magnitude of inter-test correlation coefficients in appointing the level of stability of motor coordination over a two-year interval. Motor coordination was found to be highly stable in elementary school children, with correlation coefficients ranging from 0.662 (age 6–8) to 0.873 (age 7–9). Stability coefficients for age 8–10 and 9–11 were respectively 0.845 and 0.819 (all p-values < 0.001).

The influence of club sports participation on the evolution of motor coordination in childhood is presented in Fig. 1. A significant between-groups effect (SportsParticipation) was found ($F(2, 298) = 16.83$, $p < 0.001$)). Post hoc results revealed that the children in the "no participation" scored significantly worse on the KTK than the "partial participation" group ($p = 0.004$) and the "consistent participation" group ($p < 0.001$). In addition, the group reporting to be consistently engaged in organized sports over the three years of testing outscored the partially participating group over the three test assessments ($p = 0.043$).

A significant within-groups effect (Time) was found (MQ2007 = 97.31 ± 14.27, MQ2008 = 99.68 ± 15.03, MQ2009 = 103.83 ± 15.09; $F(1, 298) = 51.104$, $p < 0.001$).

Table 1
Logistic regression analysis of 301 children's organized sports participation over a two-year interval (from year 1 to year 3).

	β	S.E. β	Wald χ^2	*df*	Sig. (*p*)	e^{β} (Odds ratio)	95% CI for (exp) β	
							Lower	Upper
MQKTK year 1	.038	.013	9.234	1	.000	1.039	1.014	1.065
Sports club year 1	2.722	.346	61.882	1	.000	15.210	7.720	29.969
Constant	−4.236	1.206	12.336	1	.000	.014		

Post hoc tests revealed significant improvements between consecutive test moments for all three groups (all *p*-values < 0.001).

The Time × SportsParticipation interaction effect was not significant ($F(2, 298) = 0.298, p = 0.74$)) indicating that sports participation over time did not influence the time course of motor coordination development.

The results of the logistic regression analysis showed both MQKTK and sports participation in year 1 were significant predictors of sports participation in year 3 (all *p*-values < 0.001) (see Table 1). The log of the odds of a child practicing sports in year 3 is positively related to MQ values and sports participation in year 1. In other words, the higher the MQ values at initial testing, the more likely it is that a child will participate in sports two years later. In addition, given the same MQ score, children practicing sports in year 1 will – almost 15 times more likely – practice sports in year 3 as well. The Hosmer–Lemeshow test ($\chi^2 = 4.112$; df = 8; $p = 0.85$) showed the model fits the data well. The degree to which the model parameters improved upon the prediction of the null model is indicated by the Cox and Snell R^2 of 0.269.

4. Discussion

In this study, the impact of the level of sports participation and changes thereof on the evolution of motor coordination in childhood was examined to test the stability of motor coordination in childhood. In addition, the predictive value of initial motor coordination and sports participation on whether or not children would be actively involved in sporting activities two years later was investigated.

Stability refers to the maintenance of the relative rank, position or percentile position in a group over time.[27] Understanding the stability of motor coordination is important/relevant as it can help determine until which age improvements in the motor coordination domain through interventions are still possible, which might be important for the early identification of both talented and motor-impaired children.[21] Our results are in agreement with Ahnert et al.,[21] who found motor coordination stability coefficients of $r > 0.72$ over a two-year interval in elementary school children. Moreover, our hypothesis was confirmed as even an environmental influence like sports participation did not affect the development of motor coordination in the early childhood years. This was demonstrated by the absence of an interaction effect indicating a similar evolution of the motor coordination levels over time for the children reporting a relatively constant amount of sports participation (actively engaged in a sports club or not engaged at all) as well as children entering into sporting activities or dropping out of club sports participation.

Interestingly, in the youngest age group (from 6 to 8 years of age), the lowest stability coefficients were found ($r > 0.80$ in all other age groups). This might be explained by a higher plasticity of the brain. By the age of six, the brain has basically reached its full size.[6] Until that age, plasticity of the brain is high. For motor development, the critical developmental period ("window of opportunity") – in which experience may be most effective – is before the age of five/six.[7] The level motor coordination – as measured with the KTK – is based upon previous movement experiences in preschool (before the age of six) and the stage of normal development. Presumably, motor coordination is less stable in preschoolers, but more research is needed regarding the level of motor coordination and its stability in preschool children.

Whereas motor coordination is relatively stable from the age of six, the FMS and more specialized skills might still be improved through physical activities and sports.[6,18] Indeed, Barnett et al.[19] found that locomotor FMS did not track from childhood to adolescence. They did however found a certain level of stability for the object control FMS, but these were lower than the stability coefficients for motor coordination as reported in the present study. This was also reflected in the predictive power of object control skills (and not locomotor skills) in determining adolescent physical activity and fitness[17] as stable variables have better predictive values.

The relative increase in MQ values of all groups, independent of the level of sports participation over time, could be attributed to a systematic practice effect caused by repeated measuring. Such a test-effect has already been shown in studies that repeatedly tested the children with the Movement Assessment Battery for Children.[5,28]

The results of this study corroborate the outcome of several cross-sectional studies, clearly demonstrating that children's movement skill levels (underpinned by the level of motor coordination) are related to their degree of physical activity, as measured by participation in organized sports in the present study.[13–15] It was observed that the group of children reporting to be consistently engaged in sporting activities over the three consecutive years of testing consistently exhibited higher coordination levels than all other groups, even at initial test assessment, hereby confirming the direction of the relationship as the initial level of motor coordination

being an important contributor towards sports participation in childhood.[10,22] Children with low levels of motor coordination will probably lack fundamental movement skills or will be less proficient. Since these basic skills form the foundation for more advanced and specific movement activities,[6,8,9] children with low/immature fundamental motor skill levels will likely have arrears to learn new skills (in sports/daily activities) and are therefore less likely to engage in physical activities.

However, motor coordination is not the sole determinant of the initiation and continuation of sports participation in childhood. This is reflected in the lower value of motor coordination in comparison with sports participation in the early childhood years in predicting organized sports participation in the later childhood years. Weiss[29] postulated the major motives essential to initiating and maintaining involved in organized sports: develop and demonstrate competence (skills, fitness, etc.), gain social acceptance and support (parents, peers, coach, etc.) and enjoyment derived from participation. As previously suggested in literature, (perceived) motor competence might be a part of this motivation: Children evaluating themselves as having a good level of motor coordination are more likely to enroll in sports participation, enjoy it and consequently continue to be (physically) active (in sports). On a more negative note, there seems to be a threshold of motor coordination below which children show an increased chance of dropping out or not even enter a sports club because they would feel not sufficiently proficient when comparing their own abilities to that of their peers.

5. Conclusion

Our results highlighted that the importance of an adequate level of motor coordination in childhood. This attribute seems to be fixed from an early age (six years of age), relatively stable throughout elementary school and an important contributor towards sports participation in childhood. Considering the general agreement that motor coordination underlies the development of fundamental motor skills (running, catching, etc.) and that these will in turn influence the development of more (sport-)specific skills and even determine physical activity participation as well, measuring this factor from an early age might be relevant for both health-related and talent identification purposes.

Practical implications

- It is recommended that children (especially preschoolers, because of the high plasticity of the nervous system at those early ages)[6] engage in daily physical activity that promotes movement skill development and health related fitness. There is a need for community-based and school-based programs to enhance the motor skill level and the quality of moving of all children. Teachers and coaches need to offer the children a challenging, non-competitive environment with appropriate equipment (e.g. monkey bars, tires, ropes, etc.) and need to build structured physical activity routines into each day.
- In the scope of getting as many children involved in physical activities (e.g. sports) as possible, it is important that all children are offered activities for which they have the most appropriate building blocks and that they love to do.
  - The children with high motor coordination scores are those with a natural giftedness for motor skill development (and/or with a well-developed coordination through previous experiences). It is therefore recommended that those children may be stimulated towards (high-level) competitive sports to receive further guidance in a sports context to increase their skillfulness (general and sport-specific) in order to fulfill their potential.
  - Unfortunately, not all young children naturally learn how to jump, run, throw, catch, etc.[18] It is suggested that children with lower scores should be provided with opportunities to develop their FMS until they can successfully participate in a variety of games and sports.

Acknowledgements

This work was funded by the Flemish Government, Department of Culture, Youth, Sports and Media. We would like to thank the schools, parents and children for participating in this longitudinal research.

References

1. Bouchard C, Shephard RJ, Stevens T. Physical activity, fitness and health. In: *A consensus of current knowledge.* Champaign, IL: Human Kinetics; 1993.
2. Malina RM. Children and adolescents in the sport culture: the overwhelming majority to the select few. *J Exerc Sci Fit* 2009;**7**:S1–S10.
3. Lefevre J, Taks M, Matton L, et al. *Deelrapport II Graad van sportparticipatie en fysieke activiteit op Vlaams niveau. IOS rapport*. Brussel: BLOSO; 2002.
4. Gutin B, Barbeau P, Yin Z. Exercise interventions for prevention of obesity and related disorders in youth. *Quest* 2004;**56**:120–141.
5. Henderson SE, Sugden DA. *Movement assessment battery for children*. London: Psychological Corporation; 1992.
6. Malina RM, Bouchard C, Bar-Or O, chapter 10 Motor development. In: *Growth maturation and physical activity.* 2nd ed. Champaign, IL: Human Kinetics; 2004.
7. Gabbard C. *Lifelong motor development*. 5th ed. San Francisco, CA: Pearson Benjamin Cummings; 2008.
8. Clark JE, Metcalfe JS. The mountain of motor development. In: Clark JE, Humphrey JH, editors. *A metaphor in motor development: research and reviews*. Reston, VA: National Association of Sport and Physical Education; 2002.
9. Seefeldt V. Developmental motor patterns: implications for elementary school physical education. In: Nadeau C, Holliwell W, Newell K, et al, editors. *Psychology of motor behavior and sport*. Champaign, IL: Human Kinetics; 1980.

10. Stodden DF, Goodway JD, Langendorfer SJ, et al. A developmental perspective on the role of motor skill competence in physical activity: an emergent relationship. *Quest* 2008;**60**:290–306.
11. Rivilis I, Cairney J, Hay JA, et al. Physical activity and fitness in children with developmental coordination disorder: a systematic review. *Res Dev Disabil* 2011;**23**:894–910.
12. Fisher A, Reilly JJ, Kelly LA, et al. Fundamental movement skills and habitual physical activity in young children. *Med Sci Sports Exerc* 2005;**37**:684–688.
13. Bouffard M, Watkinson E, Thompson L, et al. A test of the activity deficit hypothesis with children with movement difficulties. *Adapt Phys Act Q* 1996;**13**:61–73.
14. Cairney J, Hay JA, Faught BE, et al. Developmental coordination disorder, generalized self-efficacy toward physical activity, and participation in organized and free play activities. *J Peds* 2005;**147**: 515–520.
15. Wrotniak BH, Epstein LH, Dorn JM, et al. The relationship between motor proficiency and physical activity in children. *Pediatrics* 2006;**118**:1758–1765.
16. Okely AD, Booth ML, Patterson JW. Relationship of physical activity to fundamental movement skills among adolescents. *Med Sci Sports Exerc* 2001;**33**:1899–1904.
17. Barnett LM, Morgan PJ, van Beurden E, et al. Perceived sports competence mediates the relationship between childhood motor skill proficiency and adolescent physical activity and fitness: a longitudinal assessment. *Int J Behav Nut Phys Act* 2008;**40**:1–12.
18. Goodway JD, Branta CF. Influence of a motor skill intervention on fundamental motor skill development of disadvantaged preschool children. *Res Q Exerc Sport* 2003;**74**:36–46.
19. Barnett LM, van Beurden E, Morgan PJ, et al. Gender differences in motor skill proficiency from childhood to adolescence: a longitudinal study. *Res Q Exerc Sport* 2010;**81**:162–170.
20. Magill RA. *Motor learning: concepts and applications*. 4th ed. Dubuque, IA: Brown & Benchmark; 1993.
21. Ahnert J, Schneider W, Bös K. Developmental changes and individual stability of motor abilities from the preschool period to young adulthood. In: Schneider W, Bullock M, editors. *Human development from early childhood to early adulthood: evidence from the Munich Longitudinal Study on the Genesis of Individual Competencies (LOGIC)*. Mahwah, NJ: Erlbaum; 2009.
22. Lopes VP, Rodrigues LP, Maia JAR, et al. Motor coordination as predictor of physical activity in childhood. *Scand J Med Sci Sports* 2011;**21**, doi:10.1111/j.1600-0838.2009.01027.
23. Kiphard EJ, Schilling F. *Körperkoordinationstest für Kinder 2. Überarbeitete und ergänzte Auflage*. Weinheim: Beltz Test GmbH; 2007.
24. Vandorpe B, Vandendriessche J, Lefevre J, et al. The Korperkoordinationstest fur Kinder: reference values and suitability for 6-12-year-old children in Flanders. *Scand J Med Sci Sports* 2010;**21**:378–388.
25. Philippaerts RM, Matton L, Wijndaele K, et al. Validity of a physical activity questionnaire in 12–18-year-old boys and girls. *Int J Sports Med* 2005;**26**:1–6.
26. Verstraete S, Chapter 2 Reliability and validity of a questionnaire to measure usual physical activity in children with and without parental assistance. In: *The effectiveness of an intervention promoting physical activity in elementary school children.* Ghent: Ghent University; 2006.
27. Malina RM. Tracking of physical activity and physical fitness across the lifespan. *Res Q Exerc Sport* 1996;**67**:48–57.
28. Van Waelvelde H, Peersman W, Lenoir M, et al. The reliability of the Movement Assessment Battery for Children for preschool children with mild to moderate motor impairment. *Clin Rehab* 2007;**21**:465–470.
29. Weiss MR. Psychological effects of intensive sport participation on children and youth: self-esteem and motivation. In: Cahill BR, Pearl AJ, editors. *Intensive participation in children's sports*. Champaign, IL: Human Kinetics Publishers; 1993.