Anthropometry, physical performance, and motor coordination of medallist and non-medallist young fencers

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Manuscript Preparation
E Funds Collection

Mohd Rozilee Wazir Norjali Wazir[1,2ABCDE], Mireille Mostaert[1ABD], Johan Pion[3ABCD], Matthieu Lenoir[3ABCDE]

[1] Movement and Sports Sciences, University of Ghent, Ghent, Belgium
[2] Department of Sport Studies, Faculty of Educational Studies, University Putra Malaysia, Serdang, Selangor, Malaysia
[3] Sport Talent Research, HAN University of Applied Sciences, Nijmegen, The Netherlands

Received: 28 November 2017; **Accepted:** 09 January 2018; **Published online:** 07 February 2018

AoBID: 11827

Abstract

Background and Study Aim: Fencing is a sport that relies on a complex intra play of numerous performance characteristics. Evaluation of these characteristics is important in the field of talent identification and talent development. Multidimensional test batteries have proven their value in different sports. The present study aimed to identify anthropometric, physical performance and motor coordination characteristics that discriminate medallist and non-medallist fencers.

Material and Methods: In this cross-sectional study, 83 young fencers (21 national medallists, 62 non-medallist) between 11 and 16 years old were tested in 2010-2015 using a test battery consisting of four anthropometrical, nine physical performance and three motor coordination tests. The fencers were divided into two groups (medallist and non-medallist at national youth championships). First, descriptive analysis explained their general score (means) for anthropometric, physical performance and motor coordination. Second, MANCOVA (multivariate analysis of covariance) was used to explain to what extent the two groups were different from each other, taking into account the effect of maturity (age at peak height velocity – APHV) and calendar age (CA).

Results: Generally, the results showed no differences between medallist and non-medallist fencers in anthropometry, physical performance and motor coordination. APHV significantly affected anthropometry and several strength, speed and explosivity variables. Chronological age affected nearly all indicators of anthropometry, physical performance, and motor coordination. MANCOVA, correcting for APHV and CA showed no significant difference for anthropometric, physical performances and motor coordination between medallist and non-medallist fencers.

Conclusions: This study a shows a significant effect of APHV and chronological age in anthropometric, physical performance and motor coordination among young fencers. The possibility that only taking into account anthropometry, physical performance, and motor coordination of young fencers in the talent identification process is limited due to the complexity of fencing is discussed.

Keywords: EUROFIT • talent development • talent identificationw

Conflict of interest: Authors have declared that no competing interest exists

Ethical approval: This study has been conducted in accordance with recognised ethical standards and approved by the local Ethics Committee of the Ghent University Hospital

Provenance & peer review: Not commissioned; externally peer reviewed

Source of support: Departmental sources

Author's address: Mohd Rozilee Wazir Norjali Wazir, Department of Movement and Sports Sciences, Ghent University, Watersportlaan 2, 9000, Gent, Belgium; e-mail: rozilee.norjali@ugent.be

Talent identification (TI) – is defined as the process of recognising current participants with the potential to excel in a particular sport.

Talent development (TD) – provides the required learning environment to maximise Talent Identification potential.

Physical Performance Test – set of tests to evaluate speed, strength and flexibility in non-sport specific context.

APHV – the age at peak height velocity.

KörperkoordinationsTest für Kinder" (KTK) – Test for gross motor coordination consisting of 4 non-sport specific tests.

MANCOVA (multivariate analysis of covariance) – the main difference between MANOVA and MANCOVA is the "C," which stands for "covariance." Both a MANOVA and MANCOVA feature two or more response variables, but the key difference between the two is the nature of the IVs. While a MANOVA can include only factors, an analysis evolves from MANOVA to MANCOVA when one or more covariates are added to the mix.

INTRODUCTION

Talent identification is a serious component of many sports and a scientific approach that has long been of great interest to coaches, researchers, communities and governments. Many countries have implemented formal talent identification (TI) and talent development (TD) models in the sport to increase their success on the international scene. TI is defined as the process of recognising current participants with the potential to excel in a particular sport, while TD provides the required learning environment to maximise this potential [1, 2]. Efforts to develop TI and TD models stem from the general conviction that gifted youngsters do not automatically end up at the highest performance level in a particular sport. However, returns from investment on current TI and TD models of sport in youth are generally subpar, meaning that only a few young athletes continue their career to achieve podium positions at the elite sport level in adulthood [3]. Understanding the underlying performance characteristics that relate to international success in various sports might help the TI process as well as the TD process.

Numerous studies have led to a wealth of data describing the factors that discriminate between athletes of different levels, providing a scientific basis for talent identification programs. Talent identification should play a major role in modern sport, as international competition has become more intense and involved even younger participants [4, 5]. Identification programmes help to direct children towards sports [6] and searching for talent or assessing early development is valuable stages in almost any multi-step sport programme [7, 8].

In the past decade, several studies have convincingly demonstrated that the identification of characteristics in young children can form a solid basis to identify those subjects with the chance to excel in the future. Such an approach does not only allow the discrimination between successful and less successful young athletes or the profile of young athletes in specific sports but also allowed to predict the future performance level to a certain extent. Researchers have been investigating different sports for the purpose of talent identification or to distinguish performance and achievement between athletes from different sports and discipline within the same sport and playing the position. This has been demonstrated in skating [9], wrestling [10], volleyball [11], gymnastics [12, 13] soccer [1], judo [14] and many other sports [13]. Next, to such sport-specific tests, the importance of general motor coordination has long been neglected in the literature [15, 16]. The importance of motor coordination has been demonstrated for performance prediction [11] as well as for sports orientation. The same generic test battery showed that it was possible to orient athletes towards different sports [13] as well as to sports that are to a certain extent similar to each other, like martial arts, karate, judo and taekwondo [17].

Despite the wealth of evidence shortly described above, little information is available on the sport of fencing. Fencing is an Olympic discipline essentially based on the combat of two competitors and winning points are made through the contact with an opponent. The sport is composed of individual and group disputes, using three different combat weapons: a foil, sword or sabre [18]. Fencing was one of the sports to be played in the Olympics, and this sport has been present since the first modern Olympic Games. The electric sword was introduced in 1936 Olympic Games, the foil in 1956 and the sabre in 1988. Since then the sport has been improved in many ways, i.e. the rules, attire, weapon and the scoring system.

Fencing is an intermittent combat sport with high intensity, relying on the combination of mastery of specific technical skills, tactical decision-making ability, and physical performance. Although success in sports competitions has often been associated with specific anthropometric characteristics for a given sport, the anthropometric data for fencers is limited, inconclusive and mainly reported for descriptive purposes. Analysis of internal proportions of factors of the athletes' body composition revealed significant differences in particular groups of features [19]. Anthropometric characteristics seem to be a significant factor to distinguish between differences group or level of participation. The anthropometrical characteristics of fencers show a typical asymmetry of the limbs as a result of the practice of asymmetrical sports activity, and it is difficult to identify a significant relationship between any one physiological characteristic and performance [20]. Previous studies have shown that fencers are taller but more slender with wide shoulders and thinner waists [21]; Male fencers are taller and have a higher body mass with longer segment lengths compared to female fencers [22]. The lower skinfold thickness may be advantageous for faster segmental movements, and lower physiological demands during fencing [23] might also provide fencers with more advantages.

Concerning physical performance, elite fencers are stronger and produced more leg power than national level fencers [22]. There was also the previous study discussed on the relation with physiological [23] and dermatoglyphics (finger print) [18]. The physiological and morphological profile of world-class fencers were also studied which they measure the dynamic and static strength of the forward and backward extremities individually [24].

Finally, reaction time and spatial anticipation have been suggested to be considered as one of the major predictors of talent in fencing: Elite fencers reduced their time of sensorimotor responses in the middle phase of an attack, i.e. they perceive and make decisions much faster than novice fencers [25].

Overall, little information is available on profiles of young fencers of different performance levels. A generic, i.e. non-sport specific, test battery (see Material and Methods) has proven its value in discriminating gymnasts, volleyball players, or soccer players of different levels.

The study aimed to identify anthropometric, physical performance and motor coordination characteristics that discriminate medallist and non-medallist fencers.

MATERIAL AND METHODS

Participants and design

The data for this study is part of the Flemish Sport Compass (FSC), a project that started in 2007 is still on-going [12, 26-28]. A sample of 83 (43 males and 40 females) fencers between the age of 11 and 16 years were measured in this cross-sectional study during the selection for entering Flemish Top Sport School. Twenty-one were classified as medallist group, managed winning at least one medal in national youth championships competitions one year before or after they were tested, while the remaining 62 were classified as a non-medallist group.

This study has been conducted in accordance with recognised ethical standards [29] and was approved by the local Ethics Committee of the Ghent University Hospital [30]. For all participants, written informed parental consent was obtained. None of the participants refused participation.

Measurements

The participants were measured between 2010-2015 and completed four anthropometrical, nine physical performance and three motor coordination tests. A team of experienced examiners from the Department of Movement and Sports Sciences assessed the generic test battery. At any given time, instruction and demonstration were standardised according to the test guidelines [29]. The participants performed all tests barefoot except the sprints, the countermovement jump and the endurance shuttle run test, which were all performed with running shoes.

Anthropometry

Height and sitting height (0.1 cm, Harpenden, portable Stadiometer, Holtain, UK), body weight was assessed using a digital balance scale with a foot-to-foot bioelectrical impendence system (0.1 kg, Tanita, BC-420SMA) according to previously described procedures [30] and manufacturer guidelines. Arm span was measured with a tape measure in the upright position with arms spread horizontally (to the nearest 0.1 cm). Maturity offset was estimated with Mirwald's gender-specific formula for the age of peak height velocity (APHV) [31, 32], which consists of height, sitting height, age and weight.

Physical Performance

Flexibility was assessed by the sit-and-reach test of the EUROFIT test battery with an accuracy of 0.5 cm [26]. The shoulder rotation test [28] was used to measure shoulder flexibility (shoulder rotation to the nearest 1 cm). The 10x5m shuttle run (SR) test (EUROFIT) [26] was used to measure speed and agility. The time children needed to run back and forth as quickly as possible between two lines 5 meters apart, 10 times in a row, reflected their speed and agility. To estimate explosive leg power, the countermovement jump (CMJ), hand on the hips and the standing broad jump was performed. The participants performed three single jumps without arm swing recorded with an OptoJump device (MicroGate, Italy).

The highest of three jumps was used for further analysis (0.1 cm) and standing broad jump (SBJ) was measured to the nearest 0.5 cm. Static strength was measured by the handgrip (HG) [26] in Nm. Speed was evaluated by two maximal sprints of 30 meters with split time measured at 10 meters and 20 meters. The recovery time between each sprint was set at two minutes. The fastest time for the 10m sprint, 20m sprint and 30m sprint was used for analysis [33]. The sprint tests were recorded with MicroGate Racetime2 chronometry and Polifemo Light photocells at an accuracy of 0.001s (MicroGate, Italy).

Motor Coordination

Gross motor coordination was evaluated using three subtests of the "KörperkoordinationsTest für Kinder" (KTK) [34]. The fourth test hoping for height was not performed, due to the risk of injuries at the ankles [35, 36]. First, participants had to walk backwards along balance beams of decreasing width (6 cm; 4.5 cm and 3 cm respectively). Secondly, participants had to perform two-legged jumps sideways over a wooden slat (2 x 15 s), summing the number of jumps over the two trials. Thirdly, participants had to move sideways on wooden platforms (2 x 20 s), summing the number of relocations over two trials.

Statistical analyses

All data were analysed using SPPS for Windows version 23.0. The present study had a cross-sectional design, involving two study groups: medallist and non-medallist. The basic descriptive indicators (mean and standard deviation) were calculated for all analysed variables. MANOVA was conducted to examine the difference between the medallist and non-medallist fencers for the different anthropometry, physical performance and motor coordination tests. The influence of maturity and chronological age was taken into consideration by the using MANCOVA function. For all analyses, a p-value of <0.05 was used, and partial eta squared was computed to obtain the effect size.

RESULTS

Demographic

APHV was estimated at 14.15 years for medallist group and 14.50 years for the non-medallist group (Table 1).

APHV and CA significantly affected anthropometric results. The medallists scored higher in anthropometry compare to the non-medallist fencers, but MANCOVA analysis did not show significant between-group differences (Table 2).

Anthropometric

Significant APHV (CMJ, HG, sprint 30m) and CA (SR, CMJ, HG, sprint 5m, sprint 30m) effects on several physical performance tests were observed. There were no significant differences (MANCOVA) in physical performance tests between medallist and non-medallist fencers (Table 3).

Motor coordination

MANCOVA analysis did not result in significant differences in motor coordination tests between the groups (Table 4). Similar to anthropometry and physical performance scores, CA did affect motor coordination performance. The discriminant analysis applied to all tests as predictor variables shows that all the young fencers (80.4%) were correctly classified in their respective group (medallist, non-medallist). Even though the discriminant percentage of 80.4% athletes correctly assigned to the medallist or non-medallist group, it is clear that a significant overlap between the profiles of both groups exists (Figure 1).

Table 1. Demographic characteristic of medallist (n = 21) and non-medallist (n = 62) fencers between the age of 11 and 16 years.

Variable (indicator)	Medallist			Non-medallist		
	overall (n = 21)	male (n = 9)	female (n =12)	overall (n = 62)	male (n = 34)	female (n = 28)
	The results of empirical variables [mean (in brackets standard deviation)]					
Calendar age (CA – years)	13.01 (1.29)	13.28 (1.77)	12.83 (0.91)	13.53 (1.77)	13.63 (1.89)	13.38 (1.61)
Age at peak height velocity (APHV – years)	14.15 (0.83)	14.30 (0.55)	14.05 (0.98)	14.50 (1.24)	14.86 (1.03)	13.99 (1.35)

DISCUSSION

The present study is the first to investigate differences in anthropometric, physical performance and motor coordination between medallist and non-medallist among young fencers using a generic test battery. In general, this study provides the profile characteristics of U16 young fencers, either medallist or non-medallist aged. The main finding of this study is that, apart from the anticipated effects of maturity status and calendar age on anthropometry, physical performance level, and motor coordination, no clear differences between medallists and non-medallists were observed.

The absence of anthropometric differences might be characteristic of the sport of fencing, which allows different profiles to excel at a competitive level. Previous

Table 2. Anthropometric indicators of the medallist and non-medallist young fencers (**significant difference between groups p<0.01).

Variable (indicator)	Medallist (n = 21)	Non-medallist (n = 62)	Covariate		MANCOVA
			APHV	CA	F-value (no significant)
Age at peak height velocity APHV (years)					1.391
Chronological age CA (years)					1.426
Anthropometric			**	**	1.221
Weight (kg)	**45.5** (10.15)	**45.2** (11.55)	**	**	0.995
Height (cm)	**159.43** (12.91)	**155.88** (12.11)	**	**	0.833
Sitting height (cm)	**82.77** (5.99)	**81.68** (6.35)	**	**	0.460
Arm span (cm)	**157.00** (12.29)	**155.21** (13.37)	**	**	0.297

Table 3. Physical performance indicators of the medallist and non-medallist young fencers (**significant difference between groups p<0.01); *trend towards significant p<0.05; n.s. no significant; APHV age at peak height velocity; CA chronological age).

Variable (indicator)	Medallist (n = 21)	Non-medallist (n = 62)	Covariate		MANCOVA
			APHV	CA	F-value (no significant)
Physical performance			**	**	0.881
Sit & reach (cm)	20.38 (7.55)	24.19 (12.69)	n.s	n.s	1.048
Shoulder Flexibility (cm)	90.43 (16.97)	85.97 (21.46)	n.s	n.s	0.284
Shuttle Run (s)	20.59 (1.58)	20.62 (1.56)	n.s	*	0.392
Counter movement jump (cm)	**24.77** (6.33)	**23.57** (5.29)	**	**	1.160
Standing broad jump (cm)	169.90 (28.58)	166.29 (26.44)	n.s	**	1.461
Hand grip (N)	**24.35** (9.92)	**24.10** (10.68)	**	**	0.315
Sprint 5m (s)	1.23 (0.07)	1.27 (0.11)	n.s	**	0.592
Sprint 30m (s)	**5.38** (0.50)	**5.43** (0.49)	*	**	1.159

studies also showed no significant differences anthropometric characteristic between athletes of different levels in female water polo [37], powerlifters [38] and ice hockey players [39]. Apparently, the nature of the sport dictates to what extent anthropometric variability is allowed and does not hinder performance development, as is the case in youth female artistic gymnastics for example [30].

Both the raw data and the results of the MANCOVA resulted in similar profiles of fencers successful and unsuccessful at national youth championships. These results contrast with the similar analysis in other sports like judo, soccer, volleyball or gymnastics [1, 11, 13, 14] where higher level athletes systematically outperformed their less successful counterparts. Similarly, no significant differences concerning

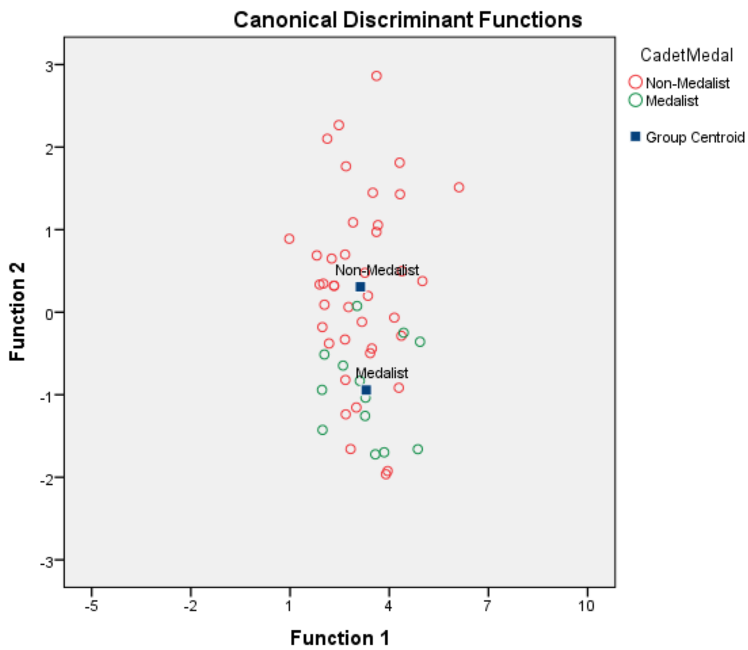

Figure 1. Graphical representation of the discriminant analysis between medallist (n = 21) and non-medallist (n = 62) young fencers.

Table 4. Motor coordination indicators of the medallist and non-medallist young fencers (**significant difference between groups p<0.01); *trend towards significant p<0.05; n.s. no significant; APHV age at peak height velocity; CA chronological age).

Variable (indicator)	Medallist (n = 21)	Non-medallist (n = 62)	Covariate		MANCOVA
			APHV	CA	F-value (no significant)
Motor coordination			n.s	**	0.740
KTK jumping sideways	86.10 (13.25)	86.13 (11.66)	n.s	**	0.083
KTK moving sideways	55.33 (8.43)	55.47 (10.71)	n.s	**	0.207
KTK walking backwards	47.62 (12.93)	51.95 (13.28)	n.s	**	1.179

motor coordination were observed in this study, which is also in sharp contrast with the studies mentioned above.

The absence of differences in between the performance levels in this study might be explained from different perspectives. First, the sport of fencing might allow for a large degree of anthropometric, physical performance level, and general coordination in order to excel at national youth competitions. When observing adult elites fencers, remarkable differences in for example anthropometric measurements are present. This might indicate that there is more room for the so-called 'compensation phenomenon' [4] that allows compensating shortcomings on a specific aspect of the athlete's profile by excelling on another component. This might be especially the case in youth fencers. Such a phenomenon is hardly present in sports like female artistic gymnastics, where profiles of the majority of the athletes are rather homogeneous. A second explanation might stem from the idea of 'proficiency barrier' that is well known in motor development research [40].

The group observed in this study might be so far above average in most of the characteristics observed concerning reference values for that age group, that they all achieved the minimum requirements of the variables measured here that are necessary to excel. As a result, the variables in this study have no discriminant value anymore in this selected group. Related to this argument, the sport of fencing is featured by its open and unpredictable character, also relying on decision-making [26] capacities that were not measured in this study. So future research on young fencers should include one or several measures of perceptual-cognitive evaluations like response inhibition, reaction time, that subserve the decision-making process. Finally, the absence of differences between groups at a specific point in time does not allow conclusions on the potential predictive power of this generic test battery in the future, as has been shown already in judo and gymnastics. Research with a longitudinal character might shed more light on this issue in the future.

CONCLUSIONS

Apart from the anticipated effects of maturity and calendar age on anthropometry, physical performance, and general coordination, no differences between successful and less successful athletes were observed. This contrasts with earlier studies in other sports using a similar test battery and pleads for the inclusion of other variables with discriminative power in fencing, which is likely to be situated at the level of decision-making ability. In addition, a longitudinal follow-up study could shed light on the long-term predictive power of a generic test battery for talent identification.

REFERENCES

1. Williams AM, Reilly T. Talent identification and development in soccer. J Sport Sci 2000; 18(9): 657-667
2. Vaeyens R, Lenoir M, Williams AM et al. Talent identification and development programmes in sport – Current models and future directions. Sports Med 2008; 38(9): 703-714
3. Suppiah HT, Low CY, Chia M. Detecting and developing youth athlete potential: different strokes for different folks are warranted. Brit J Sport Med 2015; 49(13): 878-882
4. Alabin V, Nischt G, Jefimov W. Talent selection. Modern athlete and coach 1980; 18: 36-37
5. Hahn A. Identification and selection of talent in Australian rowing. Excel 1990; 6: 5-11
6. Bloomfield J, Ackland TR, Elliot BC. Applied anatomy and biomechanics in sport. Melbourne: Blackwell Scientific; 1994
7. Williams AM, Reilly T. Talent identification and development in soccer. J Sport Sci 2000; 18(9): 657-667
8. Brown J. Sport talent: How to identify and develop outstanding athletes. Champaign, IL: Human Kinetics; 2001
9. Mostaert M, Deconinck F, Pion J et al. Anthropometry, physical fitness and coordination of young figure skaters of different levels. Int J Sports Med 2016; 37(7): 531-538
10. Garcia Pallares J, Lopez-Gullon JM, Torres-Bonete MD et al. Physical fitness factors to predict female Olympic wrestling performance and sex differences. J Strength Cond Res 2012; 26(3): 794-803
11. Pion J, Fransen J, Deprez D et al. Stature and Jumping Height Are Required in Female Volleyball, but Motor Coordination Is a Key Factor for Future Elite Success. J Strength Cond Res 2015; 29(6): 1480-1485
12. Vandorpe B. The value of a non-sport-specific motor test battery in predicting performance in young female gymnasts. J Sports Sci 2012; 30(5): 497-505
13. Pion J, Segers V, Fransen J et al. Generic anthropometric and performance characteristics among elite adolescent boys in nine different sports. Eur J Sport Sci 2015; 15(5): 357-366
14. Norjali Wazir MRW, Torfs M, Mostaert M et al. Predicting judo champions and medallists using statistical modelling. Arch Budo 2017; 13: 161-168
15. Vandendriessche JB, Vaeyens R, Vandorpe B et al. Biological maturation, morphology, fitness and motor coordination as part of a selection strategy in the search for international youth soccer players (age 15-16 years). J Sports Sci 2012; 30(15): 1695-1703
16. Deprez D, Coutts AJ, Fransen J et al. Relative Age, Biological Maturation and Anaerobic Characteristics in Elite Youth Soccer Players. Int J Sports Med 2013; 34(10): 897-903
17. Pion J, Fransen J, Lenoir M et al. The value of non-sport-specific characteristics for talent orientation in young male judo, karate and taekwondo athletes. Arch Budo 2014; 10(1): 147-154

18. Cunha RSP and Filho JF. Identification of dermatoglyphics, somatotype and basic physical qualities profile of feminine brazilian fencing team. Fit Perform J 2005; 4(1): 34-44

19. Jagiello W, Jagiello M, Kalina RM et al. Properties of body composition of female representatives of the Polish national fencing- the sabre event. Biol Sport 2017; 34(4): 401-406

20. Roi GS, Bianchetti D. The science of fencing: implications for performance and injury prevention. Sport Med 2008; 38(6): 201-216

21. Ochoa A, Gutiérrez G, Margain L. Determining anthropometry related with Fencing using social data mining. J Phys Educ Sport Manag 2013; 4(3): 31-35

22. Ntai A, Zahou F, Paradisis A et al. Anthropometric parameters and leg power performance in fencing. Age, sex and discipline related differences. J Sci Sports 2017; 32: 135-143

23. Tsolakis Ch, Vagenas G. Anthropometric, physiological and performance characteristics of elite and sub-elite fencers. J Hum Kinet 2010; 23: 89-95

24. Nystrom J, Lindwall O, Ceci R et al. Physiological and morphological characteristics of world class fencers. Int J Sport Med 1990; 11(2): 136-139

25. Borysiuk Z, Cynarski WJ. Psychomotor aspects of talent identification: A new approach in the case of fencing. Arch Budo 2010; 6(2): 91-94

26. Council of Europe, Eurofit: Handbook for the EUROFIT Tests of Physical Fitness. Rome: Secretariat of the Committee for the Development of Sport within the Council of Europe; 1988

27. Fransen J, Pion J, Vandendriessche J et al. Differences in physical fitness and gross motor coordination in boys aged 6-12 years specializing in one versus sampling more than one sport. J Sport Med 2006; 40(7): 379-386

28. Matthys SP, Vaeyens R, Fransen J et al. A longitudinal study of multidimensional performance characteristics related to physical capacities in youth handball. J Sport Sci 2012; 31(3): 325-334

29. Harriss DJ, Atkinson G. Ethical Standards in Sport and Exercise Science Research: 2016 Update. Int J Sports Med 2015; 36(14): 1121-1124

30. Vandorpe B, Vandendriessche J, Vaeyens R et al. Relationship between sports participation and the level of motor coordination in childhood: A longitudinal approach. J Sci Med Sport 2012; 15(3): 220-225

31. Sherar LB, Mirwald RL, Baxter-Jones AD et al. Prediction of adult height using maturity-based cumulative height velocity curves. J Pediatr 2005; 147(4): 508-514

32. Malina RM, Claessens AL, Van Aken K et al. Maturity offset in gymnasts: application of a prediction equation. Med Sci Sport Exerc 2006; 38(7): 1342-1347

33. Matthys SPJ, Vaeyens R, Vandendriessche J et al. A multidisciplinary identification model for youth handball. Eur J Sport Sci 2011; 11(5): 355-363

34. Kiphard EJ, Schilling F. Körperkoordinationstest für Kinder. 2. Überarbeitete und ergänzte Auflage. Weinheim: Beltz, Test GmbH; 2007 [in German]

35. Prätorius B, Milani TL. Motorische Leistungsfahigkeit bei Kindern: Koordinations- und Gleichgewichtsfâhigkeit: Untersuchung des Leistungsgefälles zwischen Kindern mit verschiedenen Sozialisationsbedingungen. Deutsche Zeitschrift fur Sportmedizin 2004; 55(7/8): 172-176 [in German]

36. Novak AR, Bennet JMK, Beavan A et al. The Applicability of a Short Form of the KörperKoordinationsTest für Kinder for Measuring Motor Competence in Children Aged 6-11 Years. J Motor Learn Dev 2017; 5(2): 227-239

37. Martinez JG, Vila MH, Ferragut C et al. Position specific anthropometry and throwing velocity of elite female water polo players. J Strength Cond Res 2015; 29(2): 472-477

38. Keogh JWL, Hume PA, Pearson SN et al. Anthropometric dimensions of male powerlifters of varying body mass. J Sport Sci 2007; 25(12): 1365-1376

39. Agre JC, Casal DC, Leon AS et al. Professional ice hockey players: physiologic, anthropometric and musculoskeletal characteristics. Arch Phy Med Rehabil 1998; 69(3 Pt 1): 188-192

40. 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: 314-323

41. Taylor JJ. Statistical Soup: ANOVA, ANCOVA, MANOVA, & MANCOVA [accessed 2017 Nov 13]. Available from: URL: http://www.statsmakemecry.com/smmctheblog/stats-soup-anova-ancova-manova-mancova

Cite this article as: Norjali Wazir MR, Mostaert M, Pion J et.al. Anthropometry, physical performance, and motor coordination of medallist and non-medallist young fencers. Arch Budo 2018; 14: 33-40

EDITORIAL NOTE

In the discussion of research on selecting candidates to combat sport in a synthetic way [42], the authors emphasizes that Jerzy Wężowski already in the 1970s (the previous century) empirically demonstrated that “a test of fencing fight” ensures high prediction and should be the basic criterion for the selection of candidates for fencing [43, 44].

RECOMMENDED REFERENCES

42. Kalina RM, Jagiełło W, Chodała A. The result of “testing fights in a vertical posture” as a criterion of talent for combat sports and self-defence – secondary validation (part II: the accuracy). Arch Budo Sci Martial Art Extreme Sport 2016; 12: 163-168

43. Kalina RM, Jagiełło W, Chodała A. The result of “testing fights in a vertical posture” as a criterion of talent for combat sports and self-defence – secondary validation (part I: the reliability). Arch Budo Sci Martial Art Extreme Sport 2015; 11: 229-238

44. Niedomagała W. The result of “testing fights in a vertical posture” as a selection criterion for professional training of judo sport – prognostic value TFVP. Arch Budo Sci Martial Art Extreme Sport 2016; 12: 181-190