DOI: 10.5114/areh.2021.105878

Original article

Advances in Rehabilitation, 2021, 35(2), 9–16

Training profile and performance in european adaptive surfing athletes

Gonçalo Cruz[1,A-F], Bruno Silva*[2,A-F], Renato Bentes[1,A-F]

[1]Surf Clube de Viana, Portugal
[2]Instituto Politécnico de Viana do Castelo; Escola Superior de Desporto e Lazer, Portugal

A – Research concept and design
B – Collection and/or assembly of data
C – Data analysis and interpretation
D – Writing the article
E – Critical revision of the article
F – Final approval of article

Received: 2020-12-09
Accepted: 2021-05-03
Published: 2021-05-06

***Correspondence**: Bruno Silva; Instituto Politécnico de Viana do Castelo; Escola Superior de Desporto e Lazer; email: silvabruno@esdl.ipvc.pt

Abstract

Introduction: Over the last decade, Adaptive Surfing, recently designated as Para Surfing was been growing worldwide. This exponential growth led to an increased number and level of competitive athletes. However, despite some knowledge about the fitness levels of elite surfers and the development of Para Surfing, from the author's knowledge, there are limited to none published research examining Para Surfing. This study aimed to measure how Para Surfing athletes' profiles, training habits, and time spent performing in-water surfing and out-of-water training affected these athletes' final scores in the 1º European Para Surfing Championship.

Material and methods: Ninety-five per cent of the participants in the 1º European Adaptive Surfing Championship in Viana do Castelo Portugal, fulfilled a questionnaire according to Para Surfing characteristics, habits and training profile.

Results: Congenital conditions were reported by more than 57% of females". Participants' final competition scores were significantly influenced by prior Para Surfing experience ($p = 0.026$). Final competition scores were significantly correlated with average days per month spent surfing ($r = 0.436$) and prior Para Surfing experience in years ($r = 0.578$). Females' final scores were significantly correlated with swimming time per month ($r = 1.000$) and disability duration in years ($r = –1.000$). Males competition final scores were significantly correlated with prior Para Surfing experience in years ($r = 0.753$).

Conclusions: Competitive European male and female Para Surfing athletes present significant differences in terms of surfing experiences before becoming disabled and years of competition experience. Time spent surfing and previous surfing experience are key factors for achieving better performance in Para Surfing competitions.

Keywords: competition, disability, Para Surfing, adaptive sports

Introduction

Aquatic physical activities, like surfing, offer a stimulating learning environment and several benefits for individuals with disabilities [1,2]. Adaptive surfing is an outdoor sport practised in a natural, dynamic, and highly challenging environment [3]. Over the last decade, adaptive surfing has become more popular worldwide, not only as a sport but also as a social and economic activity. It has also become associated with therapeutic surfing programs, adaptive surfing tourism, and adaptive surfing events [1]. This exponential

growth has led to an increased number of athletes at the competitive level.

Adaptive surfing, recently designated as Para Surfing by the International Surfing Association (ISA), can influence the quality of life, social interactions, and well-being of athletes with visual impairments. Such athletes are often admired by other surfers and included in the local surfing culture [4]. Furthermore, surfing has been proved as an important stimulating learning environment for children with disability [5,6] and improve outcomes related to several other disabilities [1,7].

Surfing is characterised by intermittent exercise bouts of varying intensities and durations involving different body parts and numerous recovery periods [8]. Previous studies on surfing have reported that surfers spend 44% to 54% of a surf session paddling, 28% to 53% waiting, 2.2% to 16% on other activities (e.g. duck diving, recovering the board), and only 2 to 8% wave riding [9–11]. To the best of our knowledge, no researchers have performed a Para surfing time-motion analysis. Nevertheless, the authors expect the results of such an analysis to be similar to those reported based on empirical observations.

Surf training sessions and competitions can be held under various environmental conditions, which can impact the underlying physiological demands of surfing practice [8]. Athletes who compete in Para Surfing competitions must have an impairment that influences their surfing performance. Regarding the ISA Para Surfing Championship, athletes need to be assessed before the competition by the ISA Para Surfing Classification Committee. Eligible athletes are divided into six divisions depending on their disabilities.

The same criteria used in performance surfing are also used in performance Para Surfing, and competitive success is determined by judging criteria (applied only to the act of wave riding) [12]. Different factors can influence surfing performance, one of which is the physical capacities of the athlete, both during training and competition [13–16]. Well-developed physical skills enable the surfer to move better in the competition peak, catch more waves, and more easily meet the physical demands required to execute technical manoeuvres [13–15].

There is a significant amount of literature about the fitness levels of elite surfers and the development of Para Surfing over the last few years. However, to the best of the authors' knowledge, minimal published research has examined the physical characteristics or training profiles of elite Para Surfers and their influence on competition outcomes. Furthermore, training methodologies for surfers (and especially Para Surfers) is a new concept compared to other sports [17].

The purpose of this research was to measure how Para Surfing athletes' gender, profiles, training habits, and time spent performing in-water surfing and out-of-water training affected these athletes' final scores in the 1º European Para Surfing Championship. We hypothesised that in-water and out-of-water training times are vital determinants of athletes' competitions scores.

Material and methods

This cross-sectorial study was intended to determine the extent to which the training profiles and training habits of Para Surfers affect their final score in the European Para Surfing Championship.

Participants

Eighteen men and seven women participated in this research (N = 25). Participants were taken from a total sample of twenty-six Para Surfers who were eligible to participate in the 1º European Adaptive Surfing Championship (EASC). Only one Para Surfer decline to participate.

The surfers came from all over Europe, with the majority coming either from France (32.0%), Spain (28.0%), Portugal (16.0%), or Italy (12.0%). Participants averaged 36.5 years of age, with an average of 5.6 years of surfing experience. According to the 2018 ISA Adaptive Surfing Classification (Tab. 1), all athletes participating in the 1º EASC (N = 25) were assessed according to the official ISA Para Surfing International Classifiers. Classifications took place two days before the start of the event, and eligible participants were classified into six adapted classes [18].

Instruments

Data collection was performed using a paper survey administered during the first two competition days, either while athletes were waiting to surf or after the competition had ended for the day. The survey was in English and consisted of three parts: general information, in-water surf training and out-of-water training, and Para Surfing athletes specificities and history. Responses were confidential, taking between five to seven minutes to complete.

The survey was based on one developed for elite bodyboarding competitors in previous research [19,20]. However, to ensure it fit the specifications of the study, the questionnaire was reviewed by a panel of experts. These experts included a former professional bodyboarding athlete and coach from the Portuguese Surfing Federation, two Para Surfing coaches from the Portuguese Surfing Federation, three surfing experts and coaches from the Surfing Viana High-Performance

Tab. 1. International Surf Association Para Surfing classification and sample distribution according to categorization

	ISA Classification	Sample
AS-1 (N = 5)	Surfers who ride waves in a standing position	**20.0%** (male 22.2%; female 14.3%)
AS-2 (N = 4)	Surfers who ride waves in a standing or kneeling position;	**16.0%** (male 16.7%; female 14.3%)
AS-3 (N = 0)	Surfers who ride waves in a seated position;	No athletes evaluated
AS-4 (N = 6)	Surfers who ride waves in a prone position;	**24.0%** (male 27.8%; female 14.3%)
AS-5 (N = 5)	Surfers who ride waves in any non-standing position and need assistance to paddle into waves and while in the water	**20.0%** (male 16.7%; female 28.6%)
AS-VI (N = 5)	Surfers who have a visual impairment	**20.0%** (male 16.7 %; female 28.6%)

ISA – International Surf Association; adapted from ISA Adaptive Surfing Rulebook (2018).

Center, a physical therapist, and an occupational therapist with experience in the eligibility and classification of Para Surfing.

The questionnaire was revised until the panel agreed that the questions were appropriate for the study and objectively corrected according to its main purposes. The changes to the original questionnaire are related to the suitability of Para Surfing specificities per the ISA classification plan and practice conditions. After the panel of experts validated the questionnaire, a pre-test was carried out on four Para Surfing athletes, each belonging to one of the following categories: AS-VI; AS-5; AS-4; AS-1. There was no need to adjust any section, and the average data collection time was estimated to vary between five and seven minutes.

Procedures

All team managers who were present during competition days were contacted and informed about the primary purpose of the research. Then, all participants were individually invited to participate and informed of the purpose of the study. The potential risks and benefits of their participation were also explained to them. Those who agreed to participate signed an informed consent form following the ethical standards for the study in humans as suggested by the Declaration of Helsinki. If participants could not read the informed consent form, it was read by the researcher, verbal agreement was provided, and signatures were obtained from the participants. Any participants who were unable to complete the questionnaire independently were helped by their Para Surfing coach/guide.

At the end of the competition, the EASC final scores were attained from the ISA judges panel's final report.

The study was approved by the local scientific council with the code CTC-ESDL-CE001-2019.

Statistical analyses

Descriptive statistics (mean ± standard deviation (SD)) and 95% confidence intervals (CI) and percentage distribution (when applicable) provided a profile for each variable. After applying the Shapiro-Wilk test in conjunction with a histogram, it was verified that the sample distribution was not normal, and the non-parametric Mann-Whitney U test was applied to compare male and female. The effect size was obtained through dividing z per the square root of N, where N is the total sample and the value of z that is reported after applying the Mann-Whitney U test. The classification of effect size was obtained by using of the follow criteria: very small ($r < 0.1$); small effect ($0.1 \leq r < 0.3$); medium effect ($0.3 \leq r < 0.5$); and large effect ($r \geq 0.5$). Concerning the sample distribution and the type of variables being tested, the Spearmen correlation was applied, adopting the correlation scale: trivial ($\_ < 0.1$); small ($0.1 \leq \_ < 0.3$); moderate ($0.3 \leq \_ < 0.5$); large ($0.5 \leq \_ < 0.7$); very large ($0.7 \leq \_ < 0.9$); and nearly perfect (≥ 0.9). The tests were executed using the Statistical Package for Social Sciences (SPSS, Version 25.0, Chicago, IL) for a statistical significance at 0.05.

Tab.2. Sample description with mean and (standard deviation)

Variable		Total (n = 25)	Male (n = 18)	Female (n = 7)
Age (years old)		36.5 (9.0)	39.1 (6.6)*	29.7 (11.1)
Height (cm)		172.0 (8.7)	175.4 (6.9)*	163.9 (7.3)
Weight (kg)		65.7 (11.8)	70.1 (8.9)*	54.3 (11.3)
Para Surfing experience in years		5.6 (5.2)	6.5 (5.6)	3.2 (3.1)
Para Surfing competition in years		2.2 (2.0)	2.7 (2.1)	0.8 (0.8)
1º Adaptive Surfing Competition final score		12.8 (4.0)	12.7 (4.2)	13.2 (3.3)
Surfing time per month (days)		9.4 (7.5)	10.0 (7.2)	8.2 (8.5)
Disability time (years)		12.9 (7.3)	12.4 (6.4)	15.3 (12.2)
Prior disability surfing experience (years)		10.7 (8.3)	11,6 (8.2)	2.0 (0.0)
1º Adaptive Surfing Competition final score considering prior disability surfing experience	Yes	14.58 (3.7)	14.11 (3.6)	18.83 (0.0)
	No	10.41 (4.2)	9.46 (4.6)	12.28 (0.5)
Congenital condition	Yes	28.0%	16.7%	57.1%
	No	72.0%	83.3%	42.9%
Surfing before disability	Yes	55.6%	60.0%	33.3%
	No	44.4%	40.0%	66.7%

* $p < 0.05$.

Results

Ninety-five per cent of the participants in the 1º EASC were included for analyses. A comparison between males and females revealed statistically significant differences between age, height and weight, with males having higher values for all three variables (Tab. 2).

The majority of participants (72.0%) perceived that their disability was not a consequence of a congenital condition. However, when analysed separated by gender, this congenital condition was perceived by 57.1% of females. Males and females also differed significantly in terms of average time spent in Para Surfing competitions, as well as in surfing competitions before becoming disabled (Table 2).

Participants' final competition scores were significantly influenced by prior Para Surfing experience ($p = 0.026$; $r = 0.444$; medium effect). Significant differences were also verified for males ($p = 0.034$; $r = 0.514$; large effect) but not for females ($p = 0.221$; $r = 0.433$; medium effect).

All female participants reported having a surfing coach, yielding a significant difference when compared with males ($p = 0.006$; $r = 0.501$; medium effect). In general, surfing coaches were primarily involved in in-water training (71.4%). For females, surfing coaches were never just on the beach - this condition was less frequent for both sexes (Tab. 3).

Males and females spend an average of 9.4 days per month surfing. 27.8% of males spent two to three hours in the water per surf session, while no females reported spending this much time in the water in a single session (Tab. 3). During surf sessions, half of the surfers were usually helped by one person. When analysed by gender, female and male were also predominantly helped by one person, with females presenting a higher percentage (71.4%).

More than 80% of males described performing complementary training sessions (one to two hours per session). Strength training and cardio training were the most frequent types of complementary training (Tab. 3).

An analysis of all athletes revealed that final competition scores were significantly correlated with average days per month spent surfing ($r = 0.436$; $p = 0.033$; 95%CI [0.049 to 0.709]; positive and medium) and prior Para Surfing experience (in years) ($r = 0.578$; $p = 0.012$; 95%CI [0.237 to 0.792]; positive and large).

A similar analysis separated by gender indicated that females' final scores were significantly correlated

Tab. 3. Frequencies to survey answer

Variable		Total (n = 25)	Male (n = 18)	Female (n = 7)
Time on the water per surf session	One hour	8.0%	11.1%	0.0%
	One to two hours	72%	61.1%	100%
	Two to three hours	20.0%	27.8%	0.0%
Surf Coach	Yes	56.0%	38.9%	100%
	No	44.0%	61.1%	0.0%
Surf Coach during Training	On the beach	7.1%	14.3%	0.0%
	On the water	71.4%	57.1%	85.7%
	On the beach and water	21.4%	28.6%	14.3%
Number of persons supporting during surf sessions	Zero	32.0%	38.9%	14.3%
	One	56.0%	50.0%	71.4%
	Two	12.0%	11.1%	14.3%
Complementary Training	Yes	80.0%	83.3%	71.4%
	No	20.0%	16.7%	28.6%
Time spend in complementary training	One hour	35.0%	40.0%	20.0%
	One to two hours	65.0%	60.0%	80.0%
Type of complementary training	Strength	64.0%	61.1%	71.4%
	Cardio	60.0%	61.1%	57.1%
	Swimming	56.0%	44.4%	42.9%
	Other	60.0%	50.0%	28.6%
Strength	Zero to two	18.8%	27.3%	0.0%
	Three to four	25.0%	18.2%	40.0%
	Five to seven	18.8%	18.2%	20.0%
	More than eight	47.5%	36.4%	40.0%
Cardio	Zero to two	13.3%	18.2%	0.0%
	Three to four	40.0%	36.4%	50.0%
	Five to seven	13.3%	18.2%	0.0%
	More than eight	33.3%	27.3%	50.0%
Swimming	Zero to two	21.4%	27.3%	0.0%
	Three to four	28.6%	27.3%	33.3%
	Five to seven	21.4%	18.2%	33.3%
	More than eight	28.6%	27.3%	33.3%
Other	Zero to two	20.0%	12.5%	50.0%
	Three to four	30.0%	25.0%	50.0%
	Five to seven	0.0%	0.0%	0.0%
	More than eight	50.0%	62.5%	0.0%

with swimming time per month (r = 1.000; p = 0.01; positive and perfect) and disability duration (in years) (r = –1.000; p = 0.01; negative and perfect). Meanwhile, for males, the final scores were significantly correlated with prior Para Surfing experience (in years) (r = 0.753; p = 0.001; 95%CI [0.427 to 0.906] positive and very large).

Discussion

To the best of our knowledge, this study represents the first attempt to characterise the training profiles of European Para Surfing athletes and to determine the effects of training profiles on competition scores. As expected, males and females exhibited significant differences in terms of height (medium effect size), weight (large effect size), and age (medium effect size), with males presenting higher values for all three parameters.

Males and females were also significantly different regarding their surfing experience before becoming disabled, as well as regarding their Para Surfing experience. The differences in their surfing experience before becoming disabled are explained by the fact that four in seven females reported a congenital disability. Although, differences in Para Surfing experience could be partially due to the access and feasibility of Para Surfing practice, as congenital condition was reported by only 16.7% of males but 57.1% of females and previous disability surfing experience may lead to pursuing Para Surfing after becoming disable.

Moreover, 100% of females reported having a surfing coach, which might also be explained by gender difference in Para Surfing competitions years and Para Surfing experience. These less experience in surfing and higher prevalence of disability due to birth condition for female might also lead that coaches were never just on the beach (this condition was less frequent for both sexes) but mainly on the water or on the beach and on the water.

Another noteworthy difference was that females reported spending no more than two hours per surfing sessions, while several males reported spending up to three hours surfing. Time spent surfing was a decisive determining factor of surfing performance [11,21] and Para Surfing performance. As expected, the final score for the 1º EASC were significantly influenced by the number of days spent surfing per month. On average, Para Surfers spend approximately ten days surfing each month, remaining in the water for one to two hours per session. However, athletes spend only 3 to 8% of their training time riding waves [9,11]. Moreover, self-paced surfing training sessions do not provide adequate conditioning to fully prepare for competitive events [11]. Therefore, it seems that the number of sessions per month should be higher than reported in this study.

Final 1º EASC score were also positively correlated with prior Para Surfing experience in years. Engagement in physical activity improves athletes' motor skills and various aspects of physical fitness [22]. These factors are linked directly via neuromuscular function, as well as indirectly via participation in physical activity [23]. These findings are consistent in males but not in females, possibly because they are mediated by i) sample size, ii) number of females per group, iii) differences in condition (more than 57% of the females had a congenital disability, while only 16.7% of males did), iv) prior Para Surfing experience, and v) differences in motor skills and motor experiences between males and females (females presented a perfect negative correlation between final 1º EASC score and disability duration (in years) and a perfect positive correlation with swimming training).

Disregarding whether the disability was a consequence of a congenital condition and years of surfing experience, surfing experience before becoming disabled impacted the performance of Para Surfing athletes, particularly when males and females were analysed separately. This evidence indicates that long-term surfers who became disabled for any reason have an advantage when competing against Para Surfers with no surfing experience before becoming disabled.

Nevertheless, because research in this area is lacking, this subject requires more research and, particularly regarding specific divisions like AS-VI (visually impaired athletes). Furthermore, the qualification process of Para Surfing might also be an essential factor for coaches and athletes to considerer when choosing a training method and designing training sessions, with ISA changing the classification criteria after this championship.

More than 80% of the athletes in the present study reported performing complementary training sessions of one to two hours each – strength training and cardio training were the most frequent among these. An analysis of training type separated by sexes showed that swimming time per month was perfectly positively associated with final 1º EASC scores for females. However, no such association was detected for males.

These results might have been mediated by the sample distribution (just three females reported swimming) and the fact that the type of training was categorised only into four divisions, potentially generating much variability between training types. Nonetheless, several other studies report a strong association between physical

variables and surfing performance [13,15,21,24,25]. We suppose that physical fitness enhances Para Surfing performance, although further research is needed to elucidate which types of training are the most effective depending on the surfer's disability and motor competencies. Nevertheless, it was promising to observe that 80% of the athletes in the present study performed some kind of complementary training.

Training research on Paralympic elite sports is scarce, and most such research focuses on individuals or the personal experiences of coaches, athletes, and scientists [26], making it impossible to compare the present results with those derived from similar methodologies. This situation emphasises the importance of these findings considering Para Surfing in particular and Paralympic sports in general.

This retrospective cross-sectorial research used a self-reported survey, a convenient sample and a limited number of participants, making it impossible to generalise the results. However, most of the best European Para Surfing athletes were included in this study. Thus, it provides important indicators for Para Surfers and their coaches concerning how surfing and training habits affect performance in competitions.

Conclusion

Competitive European male and female Para Surfing athletes present significant differences in terms of surfing experiences before becoming disabled and years of competition experience. These differences might be due to the access and feasibility of Para Surfing practice. Time spent surfing and previous surfing experience are key factors for achieving better performance in Para Surfing competitions. Final scores in the Para Surfing European Championship were positively influenced by the number of days spent surfing per month and overall surfing experience before becoming disabled.

Para surfing is more than a recreational or therapeutic sport, and more knowledge is needed regarding sports-specific technical and physical demands and conditioning. Such knowledge would allow athletes to compete at a higher level.

Acknowledgements: The authors would like to thank the Portuguese Surfing Federation, the panel of Surfing Sports Experts that review the survey and all athletes that participated in this research.

Funding
This research received no external funding.

Conflicts of interest
The authors declare no conflict of interest.

References

1. Lopes JT, Masdemont M, Cruz G. Adaptive surfing: leisure, competition or therapy? Brazilian J Educ Technol Soc. 2018; 11. doi: 10.14571/brajets.v11.n1.148-159.
2. Clapham E, Armitano-Lago C, Lamont L, Audette J. The ocean as a unique therapeutic environment: developing a surfing program. J Phys Educ Recreat Danc. 2014; 85: 8–14.
3. Méndez-Villanueva A, Perez-Landaluce J, Bishop D, Fernandez-García B, Ortolano R, Leibar X, et al. Upper body aerobic fitness comparison between two groups of competitive surfboard riders. J Sci Med Sport. 2005; 8: 43–51.
4. Silva B, Cruz G, Bentes R. Surfing in Blind Athletes: A Case Study. Sport Phys Act All. 2020; 6.
5. Moore AM, Clapham ED, Deeney TA. Parents' Perspectives on Surf Therapy for Children with Disabilities. Int J Disabil Dev Educ 2018; 65: 304–17.
6. Clapham ED, Lamont LS, Shim M, Lateef S, Armitano CN. Effectiveness of surf therapy for children with disabilities. Disabil Health J. 2020; 13: 100828.
7. Caddick N, Smith B, Phoenix C. The effects of surfing and the natural environment on the well-being of combat veterans. Qual Health Res. 2015; 25: 76–86.
8. Mendez-Villanueva A, Bishop D. Physiological aspects of surfboard riding performance. Sport Med. 2005; 35: 55–70.
9. Farley ORL, Harris NK, Kilding AE. Physiological demands of competitive surfing. J Strength Cond Res. 2012; 26: 1887–96.
10. Mendez-Villanueva A, Bishop D, Hamer P. Activity Profile of World-Class Professional Surfers During Competition: A Case Study. J Strength Cond Res. 2006; 20: 477.
11. Secomb JL, Sheppard JM, Dascombe BJ. Time-motion analysis of a 2-hour surfing training session. Int J Sports Physiol Perform. 2015; 10: 17–22.
12. Peirão R, dos Santos SG. Critérios de julgamento em campeonatos internacionais de surfe profissional. Rev Bras Cineantropometria e Desempenho Hum. 2012; 14: 439–49.
13. Farley, Abbiss CR., Sheppard JM. Performance analysis of surfing: A review. J Strength Cond Res. 2017; 31: 260–70.
14. Farley ORL, Secomb JL, Parsonage JR, Lundgren LE, Abbiss CR, Sheppard JM. Five Weeks of Sprint and High-Intensity Interval Training Improves Paddling Performance in Adolescent Surfers. J Strength Cond Res. 2016; 30: 2446–52.
15. Tran TT, Lundgren L, Secomb J, Farley ORL, Haff GG, Seitz LB, et al. Comparison of physical capacities between nonselected and selected elite male

competitive surfers for the national junior team. Int J Sports Physiol Perform. 2015; 10: 178–82. doi: 10.1123/ijspp.2014-0222.
16. Silva B, Clemente FM. Physical performance characteristics between male and female youth surfing athletes. J Sports Med Phys Fitness. 2019; 59: 171–8.
17. Moreira M, Clemens H, Peixoto C. Profile of training habits of world class professional surfers. 18th Annu. Congr. Eur. Coll. Sport. Sci., Barcelona: 2013.
18. International Surf Association. ISA Adaptive Surfing Rulebook. La Jolla: 2018.
19. Silva B, Cruz G. Training profile and performance in elite bodyboarders. In: Pereira J, Clemente FM, Brandão A, Silva F, Varela JG, Quaresma L, et al., editors. Int. Congr. Adventure Tour. Outdoor Sport., Melgaço: Escola Superior de Desporto e Lazer de Melgaço do Instituto Politécnico de Viana do Castelo; 2018, p. 34.
20. Silva B, Cruz G. Training profile and performance in elite bodyboarders. Rev Euroam Ciencias Del Deport Sport TK. 2019; 9: 27–31.
21. Silva B, Cruz G, Rocha-Rodrigues S, Clemente FM. Monitoring physical performance and training load in young surf athletes. J Hum Sport Exerc. Accept Pap Press 2020. doi: 10.14198/jhse.2021.162.03.
22. Stodden DF, Goodway JD, Langendorfer SJ, Roberton MA, Rudisill ME, Garcia C, et al. A Developmental Perspective on the Role of Motor Skill Competence in Physical Activity: An Emergent Relationship: EBSCOhost. Quest 2008; 60: 290–306.
23. Cattuzzo MT, dos Santos Henrique R, Ré AHN, de Oliveira IS, Melo BM, de Sousa Moura M, et al. Motor competence and health related physical fitness in youth: A systematic review. J Sci Med Sport. 2016; 19: 123–9.
24. Lundgren L, Tran T, Farley O, Secomb J, Nimphius S, Newton R, et al. Ankle range of motion among surfing athletes. Aust Strength Cond Assoc. 2013; 21: 121–4.
25. Silva B, Clemente FM. Physical performance characteristics between male and female youth surfing athletes. J Sports Med Phys Fitness. 2017; 59: 171–8.
26. Perret C. Elite-adapted wheelchair sports performance: a systematic review. Disabil Rehabil. 2017; 39: 164–72.