Kinesiologia Slovenica, 25, 2, 44–51 (2019), ISSN 1318-2269

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VALIDITY OF USEFUL ASSESSMENT STRATEGIES OF PHYSICAL ACTIVITY IN ADOLESCENTS

ZANESLJIVOST UPORABNIH STRATEGIJ OCENJEVANJA TELESNE DEJAVNOSTI PRI MLADOSTNIKIH

ABSTRACT

This article aims to provide an overview on specific assessment approaches regarding physical activity in adolescents as well to provide an overview of the validity of physical activity assessment tools such as smart bracelets and questionnaires. A literature search was conducted to retrieve articles from February 2009 to March 2019 using the following databases: PubMed. Web of Science, SportDiscus and Scopus. Articles had to distinguish the validity of physical activity bracelets and questionnaires among adolescents between 12 and 18 years of age. In total, 9 articles was found. Studies using physical activity bracelets for monitoring the physical activity, found higher validity coefficients compared to studies, using physical activity questionnaires.

Keywords: Self-management, Physical activity, Self-monitoring, Social cognitive theory

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IZVLEČEK

Namen prispevka je predstaviti zanesljiva in sprejemljiva orodja za spremljanje telesne dejavnosti pri najstnikih. Izsledki raziskav s področja spremljanja telesne dejavnosti temeljijo na sistematičnem pregledu trenutno razpoložljive literature zadnjih deset let (med februarjem 2009 in marcem 2019), zbrane iz podatkovnih baz PubMed. Web of Science, SportDiscus in Scopus. Zasledili smo 9 študij, ki so se osredotočale na zanesljivost spremljanja telesne dejavnosti z vprašalniki ali pametnimi zapestnicami pri mladostnikih starih med 12 in 18 let. Podatki študij o veljavnosti spremljanja telesne dejavnosti so ugotovile najvišje koeficiente veljavnosti pri uporabi pametnih zapestnic v primerjavi z uporabo vprašalnikov o telesni dejavnosti.

Ključne besede: samo-organiziranje, telesna dejavnost, samonadzor, socialna kognitivna teorija

INTRODUCTION

The health of adolescents worldwide is of growing concern due to the unhealthy patterns of living (Granger et al., 2017). The absence of regular physical activity (PA) is considered as a public health issue (WHO, 2010), therefore PA plays an important role in improving and maintaining health of people (Rogers, Carter, Williams, & Courneya, 2018). Participating in regular PA is indispensable to maintaining a healthy lifestyle due to its continued positive impact on skeletal (Gunter, Almstedt, & Janz, 2012), metabolic (Janssen & LeBlanc, 2010), cardiovascular (Fernhall & Agiovlasitis, 2008) and psychosocial functioning of the human body (Biddle & Asare, 2011). Many health-behaviour-change programs are based on social-cognitive and self-regulation models of behaviour change (Kanfer, 1991; Saelens et al., 2000) in order to teach participants strategies such as self-monitoring (Saelens et al., 2000).

THEORETICAL BACKGROUND

Self-management tools are inter-disciplinary education measures, indispensable for maintaining healthy lifestyle of children and adolescents, which enables individuals to manage their daily tasks in order to live well under certain stress situations and conditions (Barlow, Wright, Sheasby, Turner, & Hainsworth, 2002). However, self-management strategies should help to break the cycle of negative life symptoms such as stress, fatigue and depression (Lorig, 2004) in order to improve health status of individuals. Furthermore, the concept of self-management is broad-based and includes a wide portfolio of actions, such as improving knowledge about different topics and decision-making processes for managing their own health. Social-cognitive theory (Bandura, 1988, 1998, 2001) is widely used as a theoretical framework for health behaviour change interventions (Trost & Hutley, 2015). A key construct within social-cognitive theory is self-efficacy (Lorig, 2004), which is often used as a theoretical scheme for developing self-management programs. Self-efficacy is particularly described as one's perception of his ability to implement a specific behaviour. Consequently, an individual, who have a high level of PA self-efficacy, would more likely pursue PA goals, such as higher levels and enjoyment in PAs (Dishman et al., 2005). The learning of such personal competencies, determined as "life skills", are strongly connected to mentioned self–efficacy processes and are becoming even more important for health promotion. Therefore, a high level of self-efficacy might positively influence PA by self-management strategies.

Teaching adolescents to use cognitive and behavioural self-management strategies such as self-monitoring, time management and reinforcement may be an effective approach to promoting PA (Kanfer & Gaelick, 1986; Kanfer & Gaelick-Buys, 1991; Trost & Hutley, 2015). This change of health behaviour should be learned during early adolescence in order to adapt positive behaviours that enable individuals to deal effectively with the challenges of everyday life (Mangrulkar, Whitman, & Posner, 2001), since PA decreases with age (Riddoch et al., 2004; Roberts et al., 2004). Therefore, in the transitional stage of adolescence the PA, accompanied with self-monitoring, should become a leisure choice of an individual (Dishman et al., 2005). Self-monitoring is a key behavioural strategy to increase PA, where objective self-monitoring is considered the gold standard (Burke, Wang, & Sevick, 2011). Objective measurement of PA provide several positive characteristics, among others simplicity of use, validity and affordability (Goode et al., 2017). The evidence about validity of physical activity bracelets (PAB) are still limited, since the majority of

studies investigate validity of the equipment in laboratories, where the behavioural PA cannot be assessed.

However, in our specific case, high school students are nowadays under high pressure due to a large number of external influences, which are reducing the optimal personal and professional development of each individual. The time schedule of a high school student is often overloaded and do not foreseen sport activities in a regular manner, what could have a negative impact on their health status and well-being. The main purpose of present study is to examine the validity of potential measures of assessment strategies for PA such as smart bracelets and questionnaires in adolescents with following aims: i) to provide summary information to guide and monitor self-management strategies of adolescents ; ii) to found PA measure which is easy to use and applicable in school systems.

METHODS

Data source

From February 2009 to March 2019, PubMed. Web of Science, SportDiscus and Scopus were searched to identify relevant articles on self-management on PA of secondary school children or adolescents. The search string included self-management methods predefined as a self-control tool of secondary school children in terms of managing their PA. PA monitors such as Bodymedia SesnseWear, ActiGraph and ActivPal and others are fairly expensive and difficult to access the PA data, therefore our search based only on PAQs and PABs, since adolescents can afford this type of PA self-assessment tools (Ridgers et al., 2018). Abstracts were therefore screened using following search string: physical activity AND (questionnaire OR bracelet OR tracker) AND (children OR adolescents) AND validity. The validity of a test is generally considered as one of the most important topics in psychological and educational testing (Popham, 2008).

Study inclusion and exclusion criteria

The primary objective of present review is to distinguish the evidence of assessment tools in secondary schools. Studies had to be published as articles with focus on healthy secondary school-aged children. Secondary schools typically follow on from primary school where its attendance is mostly compulsory in all countries for students between the ages 12 and 18, therefore we included adolescents between 12 and 18 years of age. Included articles needed to include an obvious measure of PA and their level of validity. Validity was compared to gold standard for assessing PA (accelerometers or doubly-labelled water) (Westerterp, 2009). Results with $p < 0.05$ were considered statistically significant. Studies meeting all eligibility criteria are presented in Table 1.

RESULTS

All studies that met all eligibility criteria for present systematic review was nine (Table 1). Altogether 3777 adolescents participated, what corresponds to 629.5 participants/study in average. Mean age of included participants was 13.29 + 0.82 years. Search string found only 2 validation studies on secondary school children using self-management techniques such as PAB. In PAB validation studies 272 adolescents, aged 13.14 + 0.89 years participated. In PAQ validations studies altogether 3505 adolescents (corresponding to 500.7 participants/study) participated. Mean

Table 1. Studies included in review.

	Name of study/ PAQs	Measuring time/ recall period of PAQs	Age (sample size)	Scores of PA assessed	Validity
PAB	Validation of the Fitbit Zip for monitoring physical activity among free-living adolescents (Schneider & Chau, 2016)	Last 7 days	first cohort 12.76 + 0.72 (25), the second cohort 11.15 + 0.43 (35), the third cohort 12.74 + 0.52 (27)	Number of steps, MVPA	Pearson r for steps = (0.72, 0.92, 0.96); Pearson r for MVPA = (0.67, 0.79, 0.94)
PAB	Validity of Garmin Vívofit 1 and Garmin Vívofit 3 for School-Based Physical Activity Monitoring (Šimůnek et al., 2019)	Last 7 days	15.9 + 1.9 (185)	Before school PA, in school PA, after school PA	Pearson r = 0.95; Pearson r = 0.96; Pearson r = 0.95; Pearson r = 0.95
PAQ	Computer Delivered Physical Activity Questionnaire - CDPAQ (Ridley et al., 2001)	Previous day	11.96 ± 0.53 years (30)	Typical activities (MET, WBF score)	Pearson r = 0.41 (P < 0.05)
PAQ	International Physical Activity Questionnaire (modified for Adolescents) – IPAQ-A (Hagströmer et al., 2008)	last 7 days	15 – 17 years old (188)	Sedentary, leisure, household, occupation, transportation	Spearman r = 0.20 (P < 0.01)
PAQ	Multimedia Activity Recall for Children and Adolescents – MARCA (Ridley et al., 2006)	Previous day	11.8 + 0.8 (32)	sedentary, household, transport, sport	Spearman r = 0.45 (P < 0.01)
PAQ	Oxford Physical Activity Questionnaire – OPAQ (Scott et al., 2015)	Last 7 days	14.7 + 0.5 (123)	Moderate – to vigorous PA	Spearman r=0.44 (0.001)
PAQ	Self-Administered Physical Activity Checklist (modified version) – SAPAC (Affuso et al., 2011)	Last 3 days	12.6 ± 1.1 years (128)	sedentary	Pearson r (95 % CI) = 0.18 (0.07;0.28), Spearman r (95 % CI) = 0.14 (0.05;0.23)
PAQ	School Health Action, Planning Evaluation System – SHAPES (Wong et al., 2006)	Last 7 days	Grade 9 – 12 (2812)	sedentary, moderate, vigorous physical activity	Spearman r = 0.25 (P = 0.07)
PAQ	Youth Media Campaign Longitudinal Survey – YMCLS (Welk et al., 2007)	Last 7 days	9 – 13 years old (192)	physical activity, outside activity, organised activity	Spearman r (95 % CI) = 0.23 (−0.09;0.51); Spearman r (95 % CI) = 0.27 (−0.05;0.54); Pearson r = 0.52 (P < 0.001)

Note: PAB – physical activity bracelet; PAQ – physical activity questionnaire

age of adolescents in PAW study was 13.37 + 0.73 years. Six studies assessed PA for previous week or last 7-days (Hagströmer et al., 2008; Schneider & Chau, 2016; Scott, Morgan, Plotnikoff, & Lubans, 2015; Šimůnek et al., 2019; Welk et al., 2007; Wong, Leatherdale, & Manske, 2006), one study for last 3 days (Affuso et al., 2011) and two studies for previous day (Ridley, Dollman, & Olds, 2001; Ridley, Olds, & Hill, 2006). The best validity results are presented in CDPAQ (Ridley et al., 2001) and MARCA (Ridley et al., 2006) PAQs, both with correlation coefficients higher than 0.4. Nevertheless, the highest validity of PAQs (Ridley et al., 2001, 2006), those questionnaires are using recall period for last day. PA assessment for only one day can be critical, since it is dependent on weather and health conditions, therefore those results (Ridley et al., 2001, 2006) are not presenting the clear picture of adolescents PA activities workload. Highest level of validity showed Garmin Vivofit 1 and Vivofit 3 bracelet (Šimůnek et al., 2019) for assessing PA with mean correlation of r=0.95.

There are also methodological limitations to be considered in present review: i) different sample size of included studies; ii) subjective assessment of PA. Major limitations regarding subjective assessment of PA is inadequate length of assessment and over-reporting of PA (Warnecke et al., 1997); iii) the desire for a particular outcome and cultural differences, where PAQ was validated (Argiropoulou, Michalopoulou, Aggeloussis, & Avgerinos, 2004); iv) children knew they were monitored with PAB (Dencker & Andersen, 2011), therefore they did not measure their habitual PA; v) different measures of validity (Pearson and Spearman coefficient).

DISCUSSION AND CONCLUSION

The aim of the current study was to provide an overview about the validity of potential measures such as smart bracelets and questionnaires for assessing PA in adolescents. In general, the results indicated that several different approaches of assessment strategies (Scott et al, 2015; Šimůnek et al., 2019, Schneider & Chau, 2016, Welk et al., 2007) with relatively higher levels of validity could be useful to identify the lack of PA in adolescents and to teach students healthy life style behaviors (Dishman et al, 2005).

The study has highlighted some striking aspects of different monitoring approaches regarding PA at high school level. It is interesting to note that the approach of Šimůnek et al., (2019) showed one of the highest test validities by using bracelets for school-based PA. The use of bracelets seems to be a useful and valid instrument in sense of a pure self-monitoring method (Baskett, 2001; Kanfer & Gaelick-Buys, 1991; Karoly & Kanfer, 1982), which improves individuals' awareness of PA behavior (Nelson, Smith, Young, & Dodd, 1991). Furthermore, this mentioned measure might have the prevalent influence on the individuals' self-efficacy level (Lorig, 2004) in sense of the social-cognitive theory (Bandura, 1988, 1998, 2001). Social-cognitive variables are therefore putative influences of self-initiated change in health behaviour (Dishman et al., 2005). A large number of social-cognitive correlates of PA have been identified among adolescents (Sallis, Prochaska, Taylor, Hill, & Geraci, 1999), simply indicating self-management as bridge between the concept of life-management in terms of healthy living and the concept of time-management, which is jointly related to the concept of self-management (Barlow et al., 2002; Hardeman & Michie, 2009).

This practical measure of using PA bracelets appeals directly to individual's awareness how much PA the individual has done. Additionally, this specific learning process throughout self-observation of PA workload could have an impact on encouraging and motivating the individual

for further PA (Baskett, 2001). Self-monitoring is a key behavioural strategy to increase PA, where objective self-monitoring is considered the gold standard (Burke, Wang, & Sevick, 2011). It seems clear, that theory leads to practice (ie. doing and measuring PA), could enable a high school student to learn needed skills and get confidence for everyday actions in order to be able to pursue a healthy lifestyle. However, an appropriate technical support (bracelet), which is easy to use and applicable in school classes, seems to be much more effective than the simple use of a questionnaire in order to implement behavioral changes.

Present review study supports the use of assessment tools for PA, which have an appropriate level of applicability and practicability in order to increase the awareness of the importance of PAs in high school students. The effect of self-management programs with pure self-monitoring measures (PA bracelets) could also have an over-time input. This findings needs more specific ongoing longitudinal research to confirm this assumptions.

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