# PHYSICAL ACTIVITY OF YOUTH: EVALUATION GUIDELINES FROM THE VIEWPOINT OF HEALTH SUPPORT

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The main goal of this study is to develop guidelines for physical activity (PA hereafter) evaluation from the viewpoint of health support in Czech youth, based on 6 years of monitoring of PA with accelerometers and pedometers. For the guidelines proposal we used data from weekly triangular monitoring of PA (accelerometer Caltrac × pedometer Omron × individual logs = energy expenditure × steps × FITT characteristics of PA) in 1504 females and 1163 males aged 6 to 23. We expressed the guidelines by the means of relative values of active energy expenditure ($kcal \cdot kg^{-1} \cdot day^{-1}$) which enabled us to compare somatic different groups of females and males of different ages. Data analysis shows significant correlation ($r_S = .56 - .75$) between the active energy expenditure from Caltrac ($kcal \cdot kg^{-1} \cdot day^{-1}$) and the steps from Omron ($number \cdot day^{-1}$) in both working and weekend days. The developed guidelines can help to evaluate the level of PA and to create effective interventional PA programs. To express the guidelines in a daily number of steps seems to be a good step towards their larger and more popular use.

*Keywords: Energy expenditure, accelerometer Caltrac, steps, pedometer Omron, age, gender.*

## INTRODUCTION

During recent decades we have been able to observe a dramatic decrease in physical activity (PA hereafter) in children and youth, an increase in their physical inactivity and health related complications as indicated by the rising incidence of children's obesity (Bradley, McMurray, Harrell, & Deng, 2000; Colditz, 1999; Dowda, Ainsworth, Addy, Saunders, & Rinner, 2001; Goran, Reynolds, & Lindquist, 1999; U. S. Department of Health and Human Services, 2000). This unsatisfying development of the present life style of the children and youth population forces many medical, behavioral and other groups of specialists to search for new ways to effectively increase PA in children and youth and to create their healthy relationship to everyday and lifelong performance of PA. Searching for and creating effective ways of increasing PA is based on thorough analysis of present PA, physical inactivity, dietetic behavior and life style. We fall back on recommendations for carrying out PA in view of health support as presented by (Blair et al., 1995; Corbin, Pangrazi, & Welk, 1994; Killoran, Fentem, & Carpensen, 1994; Sallis & Patrick, 1994; Pate et al., 1995; U. S. Department of Health and Human Services, 1996, 2000).

The main goal of this study is to develop guidelines for PA evaluation from the viewpoint of health support in Czech youth, based on 6 years of monitoring of physical activity using accelerometers and pedometers. The design of PA guidelines for health support was preceded by analysis of foreign PA guidelines for adults, youth, and their description, including advantages and hitches of field monitoring methodology and PA evaluation.

## INTERNATIONAL PA GUIDELINES FOR HEALTH SUPPORT – ADULTS

In 1990, a marked change arose in designing these guidelines. Emphasis was placed on PA related to state of health and health in general, not only on fitness and physical performance as we have found in most previous studies (Sallis & Owen, 1999). For that reason, emphasis is placed on moderate PA (4–6 METs) (Corbin & Pangrazi, 1996), which also contributes to the reduction of risk factors for some chronic diseases and is closer to the broad nonsporting population. TABLE 1 shows an overview of chosen surveys dealing with designing PA guidelines for health support in adults.

Although the cited survey and many other surveys refer to and put emphasis on the connection between PA (represented by an optimal combination of duration, intensity, frequency and type of PA) and health and longevity, this relationship is not very often expressed by the value of energy expenditure.

On the base of numerous epidemiological studies using also monitoring by accelerometers Caltrac, Sallis and Owen (1999, 65) conclude that an increase of energy expenditure "...of about 150 kcals per day, or 1000 kcals per week, over the sedentary levels, was

**TABLE 1**
Physical activity guidelines for health support for adults

| Author | Recommendations |
|---|---|
| • Hatano (1993) | • To carry out daily 10000 steps, which equals energy expenditure of 300–400 kcal·day$^{-1}$, creates conditions for maintaining health. |
| • Corbin, Pangrazi, & Welk (1994) | • People who are not involved in PA have higher risk of diseases and death than people regularly involved in PA. The mean daily energy expenditure of 3–4 kcal·kg$^{1}$ (30 minutes of PA equal to brisk walking) is related to the biggest decrease of the risk. Further decrease of the risk is related to increasing amount of carried out PA. |
| • Killoran, Fentem, & Carpensen (1994) | • For 10% reduction of weight in men and women aged 16 to 74 it is necessary to, regularly and for the long-term, carry out moderate PA for at least 30 minutes a week, preferably in a single lesson of 30 minutes of continuous exercising or in two lessons of a minimum of 15 minutes of exercising.<br>• For 15% improvement of the body constitution of women and men aged 16 to 74 it is necessary to, for the long-term, carry out continuous, at least moderate, PA for 30 minutes, at least five times a week, preferably in a single lesson of 30 minutes of continuous exercising or in two lessons of a a minimum of 15 minutes of exercising.<br>• For further improvement of the body constitution of women and men aged 16 to 74, long-term carrying out of vigorous PA, on average for 20 minutes three times a week is necessary. |
| • ACSM (1995) | • For health support in adults it is suitable to carry out PA three to five times a week, continuously for 20 to 60 minutes, at an intensity range of 50–85% of individual maximum. |
| • Blair et al. (1995) | • Adults should strive after a gradual increasing of habitual PA to meet the goal of daily carrying out moderate PA (brisk walking, going up or downstairs, etc.) for 30 minutes. |
| • Pate et al. (1995) | • Every adult American should carry out continuous moderate PA for 30 minutes, preferably every day.<br>• Daily energy expenditure should come to 500 kcal at least. |
| • U. S. Department of Health and<br>• Human Services (1996) | • A significant health benefit can be reached already by a mean amount of PA (30 minutes of brisk walking or raking, 15 minutes of running or 45 minutes of playing volleyball) carried out on most weekdays.<br>• A further health contribution can be reached by carrying out a greater amount of PA. People keeping up a suitable PA routine (long-lasting or more intensive PA) also acquire a higher health benefit. |
| • U. S. Department of Health and Human Services (2000) | • Increase the proportion of adults who engage regularly, preferably daily, in moderate PA for at least 30 minutes per day.<br>• Increase the proportion of adults who engage in vigorous PA that promotes the development and maintenance of cardiorespiratory fitness 3 or more days per week for 20 or more minutes per occasion.<br>• Increase the proportion of adults who perform PA that enhances and maintains muscular strength and endurance and flexibility.<br>• Increase the proportion of trips made by walking and cycling. |

sufficient to improve health... The guiding principle is to do 150 kcals of physical activity every day, and activities can vary from day to day". Máček and Máčková (1999) lean towards more strict criteria for carrying out PA – intensity of 4.5 METs and energy expenditure of 1500 to 2000 kcal per week during brisk walking (that means 24–32 km), after a period of adaptation to reach an intensity of 9 METs and an energy expenditure of more than 2000 kcal. The figure of 6000 kJ per week is the minimum amount of PA recommended by Bunc (1999) for stabilization or minor increase of the fitness of Czech adults. According to him, a significant increase in fitness is noticeable in PA with an energy expenditure of 10000 kJ·week$^{-1}$ and a minimum duration of 5 months. According to ACSM (1995) recommendations Cordian, Gotshall, Eaton and Eaton, III. (1998) calculated, that for a typical clerk, 11 kcal·kg$^{-1}$·day$^{-1}$ is the minimum value of PA energy expenditure sufficient for keeping health intact. As an optimum for health benefit, they, however, present the value of 90 kcal·kg$^{-1}$·week$^{-1}$, that approximately means 12.86 kcal·kg$^{-1}$·day$^{-1}$.

**TABLE 2**
Physical activity guidelines for health support for children and youth

| Author | Recommendations |
|---|---|
| • Corbin, Pangrazi, & Welk (1994) | • Children – daily 60 minutes of PA = energy expenditure of 6–8 kcal·kg$^{-1}$. |
| • Sallis & Patrick (1994) | • Adolescents aged 11 to 21 should be physically active every day or nearly every day.<br>• Adolescents should carry out moderate or vigorous PA for 20 or more minutes three or more times per week. |
| • American College of Sports Medicine (1995) | • Children should be generally more physically active than adults and keep up an adequate level of fitness.<br>• Healthy children should be, considering their accelerated psychosomatic evolution, lead to and involved in adequate PA. |
| • Pangrazi, Corbin, & Welk (1996) | • Vigorous PA is not recommended for children.<br>• Moderate PA for 30 to 60 minutes per day is suitable.<br>• Of the 30 to 60 minutes of daily PA, at least 20 minutes three times a week should be carried out continuously.<br>• Children should carry out a greater volume of PA, but only moderate PA. Such PA can be carried out in the course of everyday playing.<br>• To place emphasis on the convenience of usual acts of motion (walking to school, household work).<br>• Children may acquire and develop skills and knowledge which lead towards an active life style.<br>• Step by step children shall manage individualization of the level of carried out PA: duration, intensity and type. |
| • Biddle, Sallis, & Cavill (1998) | • All young people should daily carry out, at least, moderate PA for 60 minutes.<br>• Young people, usually and regularly carrying out undemanding activity, should daily carry out, at least, moderate PA for 90 minutes.<br>• At least twice a week, PA should be performed which leads to the enhancement and maintainence of muscular strength, flexibility and bone health. |
| | |
| • U. S. Department of Health and Human Services (2000) | • Increase the proportion of adolescents who engage in moderate PA for at least 30 minutes on 5 or more of the previous 7 days.<br>• Increase the proportion of adolescents who engage in vigorous PA that promotes cardiorespiratory fitness 3 or more days per week for 20 or more minutes per occasion.<br>• Increase the proportion of adolescents who participate in daily school physical education.<br>• Increase the proportion of adolescents who spend at least 50% of school physical education class time being physically active.<br>• Increase the proportion of adolescents who view television for 2 or fewer hours on a school day.<br>• Increase the proportion of trips made by walking and cycling. |
| | |
| • President's Council on Physical Fitness and Sports (2001) | • For health support of children, it is recommended to reach a daily number of 11000 steps, at least five days a week. |

## INTERNATIONAL PA GUIDELINES FOR HEALTH SUPPORT – YOUTH

Orientation to PA in childhood and adolescence is a key factor in the prediction of active physical behavior in adulthood. A positive relationship between performing PA in childhood and in the future closely following thereafter was positively proved in both shorter (3 to 5 years) and longer (more than 10 years) intervals (Barnekow-Bergkvist, Hedberg, Janlert, & Jansson, 1996; Kraut, Melamed, Gofer, & Froom, 2003; Pate, Baranowski, Dowda, & Trost, 1996; Pate et al., 1999; Telama, Yang, Laakso, & Viikari, 1997). According to Kraut et al. (2003), the predictive relationship between attending organized PA in one's school period and PA in adulthood is invariable in different groups from the standpoint of age, body mass index, family status, change of occupation and faith. Similarly to the previous authors, Corbin (2002), Daley (2002) and Stone, McKenzie, Welk and Booth (1998) found, that PA of moderate and vigorous intensity carried out in school physical education positively influences PA in adulthood. In general, we can state, that physically active children will become physically active adults.

PA guidelines for health support in youth were, at first, inferred from the criteria for adults, for the reason that there were no distinguished studies on solving this problems in youth. Therefore, the criteria for minimal or optimal PA were, at first, very similar to the recommendations for adults (Sallis & Patrick, 1994). Lately, however, there are marked changes in requirements for PA in youth (TABLE 2) considering their worsening health state and accelerated psychosomatic development (American College of Sports Medicine, 1995).

These changes are supported by recommendations by Biddle, Sallis and Cavill (1998), who, unlike the criteria of the early 90's, put emphasis on repeated performing of PA to enhance and maintain muscular strength, and flexibility and bone health. Also recommendations for vigorous PA in youth are very simplified, in case duration and type of PA is not respected.

## METHODOLOGY OF FIELD MONITORING AND EVALUATION OF PHYSICAL ACTIVITY

One week monitoring or retroactive monitoring of PA is a present day trend in the objective investigation of the level of PA in youth and adults (Craig et al., 2003; Trost et al., 2002; Washburn, Jacobsen, Sonko, Hill, & Donnelly, 2003) considering the possibility of comparing working and weekend days (Gavarry, Giacomoni, Bernard, Seymat, & Falgairette, 2003; Trost, Pate, Freedson, Sallis, & Taylor, 2000). In view of strongly lower PA on weekend days than on working days (Gavarry, Giacomoni, Bernard, Seymat, & Falgairette, 2003; Goran, Reynolds, & Lindquist, 1999; Hovell, Sallis, Kolody, & McKenzie, 1999), this kind of comparison becomes more and more topical and relevant.

We used evaluation of PA based on seven day long continual field monitoring of PA using the accelerometer Caltrac, pedometer Omron and individual logs (Frömel, Novosad, & Svozil, 1999; Sigmund, 2000). Using an appropriate triangulation mechanism (accelerometer Caltrac × pedometer Omron × individual logs = energy expenditure × steps × FITT characteristics of PA) we eliminated wrong or skewed data and enhanced the plausibility of the obtained results. Although, among these three techniques of monitoring PA, the individual log is most affected by the "subjectivity" of the proband (veracity, thoroughness), we use the duration and intensity of PA for correction of active energy expenditure from Caltrac according to Compendium of PA (Ainsworth et al., 1993, 2000), above all in such types of PA (static strengthening, swimming, skiing, skating, cycling and the like), which can not be accurately measured by accelerometer. Compendia of PA (Ainsworth et al., 1993, 2000) are, according to Harrell et al. (2005), more accurate for assessing energy expenditure in youth aged 8 to 18 than in adults.

For the guidelines proposal we used data from weekly triangular monitoring of PA (accelerometer Caltrac × pedometer Omron × individual logs = energy expenditure × steps × FITT characteristics of PA) in 1504 females and 1163 males aged 6 to 23.

Every participant got the information about manipulation with the accelerometer Caltrac (the pedometer Omron respectively) and filling in the individual log. The accelerometer Caltrac (the pedometer Omron respectively) was set on individual values (body height and weight, calendar age and gender; length of step and body weight respectively) to assess energy expenditure during PA (active energy expenditure) in kilocalories (number of steps respectively). All participants wore Caltrac and Omron continuously for one week except while sleeping, bathing, showering and swimming. Precise and tight-fitting placement on the right (left respectively) hip was provided by an elastic belt with a pocket for Caltrac, Omron, pencil and individual log.

Every morning after waking up and every evening before going to bed, participants recorded the time and values of energy expenditure (total and active energy expenditure) from Caltrac and the number of steps from Omron into their individual log. On working days of the school week, they also recorded energy expenditure and number of steps at the beginning of schooling, at the beginning and end of physical education lesson and at the end of schooling. In case of taking part in a training or exercise lesson they, as well, recorded time, energy expenditure and number of steps at its beginning and end. Every evening before going to bed, participants wrote down into their individual logs type, duration, and intensity (moderate or vigorous) of everyday PA and duration and type of physical inactivity.

For increasing the exactness of field monitoring of PA, it is recommended to use a combination of different approaches and techniques (Baranowski & de Moor, 2000), such as accelerometer + questionnaire, multifunctional kinetic sensors, dual heart rate sensors and kinetic sensors, direct observation + accelerometer or pedometer, self-evaluation techniques + direct observation and heart rate sensors or accelerometer (Baranowski & de Moor, 2000; Bassett, 2000; Lamonte & Ainsworth, 2001; Stone, McKenzie, Welk, & Booth, 1998). Although the sensitivity of accelerometers is lower for monitoring of static activities, cycling, skiing, wrestling and other activities, they provide a valid measurement of active energy expenditure and can be used to differentiate sedentary activities and PA of low, moderate and vigorous intensity (Puyau et al., 2004), by means of all day, all week or long term monitoring (Freedson & Miller, 2000; Janz, Witt, & Mahoney, 1995;

Trost, Pate, Freedson, Sallis, & Taylor, 2000; Welk, Corbin, & Dale, 2000; Westerterp, 1999).

The active energy expenditure from Caltrac represents the value of energy expenditure by PA that means the total energy expenditure minus the basal metabolism, which was individually settled according to age, gender, body height and weight (Puyau et al., 2004). It is recommended to express the active energy expenditure in relative value ($kcal \cdot kg^{-1} \cdot day^{-1}$) for comparison between somaticly different groups of boys and girls of different age categories (Puyau et al., 2004). Most validation studies in youth have used the accelerometer Caltrac solely as an activity monitor with energy expenditure given in "activity counts". However, valid caloric expenditure values obtained from the accelerometer Caltrac could provide a more meaningful estimation of PA patterns in children than activity counts alone (Bray, Morrow, Pivarnik, & Bricker, 1992).

In recent years, field monitoring of PA by pedometers has become more and more popular (Crouter, Schneider, Karabulut, & Bassett, 2003; Le Masurier, Lee, & Tudor-Locke, 2004; Ozdoba, Corbin, & Le Masurier, 2004; Schneider, Crouter, & Bassett, 2004; Tudor-Locke et al., 2004; Vincent & Pangrazi, 2002). The increasing popularity of pedometers is supported not only by improving their measure of precision in comparison to the past (Bassett, Ainsworth, Leggett, Mathien, Main, Hunter, & Duncan, 1996; Montoye, Saris, Kemper, & Washburn, 1996), but also by the fact, that walking is the dominant everyday PA of youth (Bassett, Cureton, & Ainsworth, 2000; Frömel, Novosad, & Svozil, 1999; Leslie, Fotheringham, Owen, & Bauman, 2001; Sigmund, 2000; Tudor-Locke & Myers, 2001). The mechanism of the pedometer is a spring-suspended horizontal lever arm responding to vertical moves of the centre of gravity. The lever arm opens and closes an electric circuit with each step (Bassett, 2000). Steps and hops are recorded and shown on the display of the device. In the past, pedometers were very inaccurate and therefore were not widely used in research, but, thanks to new technological advances, the present types of pedometers have a sufficient degree of validity and reliability (Bassett et al., 1996). After setting up (for length of step, body weight, age and gender respectively), pedometers can be used not only for counting steps, but also for the assessment of traveled distance and active energy expenditure. Recount to other units can cause a decreasing exactness of their measurement. Pedometers are most accurate for assessing steps, while less accurate for assessing traveled distance and even less accurate for assessing active energy expenditure (Bassett et al., 1996; Crouter, Schneider, Karabulut, & Bassett, 2003; Hendelman et al., 2000; Welk, Corbin, & Dale, 2000). Based on this finding Rowlands, Eston and Ingledew (1999) and Tudor-Locke and Myers (2000) recommend accepting a number of steps per time unit for a standard unit of assessing, judging and interpreting data.

Although to express the amount of PA for health support in a daily number of steps is not so frequent as the duration of PA or active energy expenditure, it is clearly popular for a wide range of people – from children up to elderly individuals. A daily walking minimum of 10000 steps is considered to be a "universal" standard for health support (Hatano, 1993; Yamanochi et al., 1995). According to Le Masurier, Sidman and Corbin (2003) and Tudor-Locke (2002), this standard is not based on an adequate empirical base. The number of 10000 steps a day is practically attainable for healthy adults, but unattainable for, particularly, older and ill people and too low for youth (Le Masurier, Sidman, & Corbin, 2003; Tudor-Locke, 2002; Welk, Corbin, & Dale, 2000). According to Hatano (1993), the number of 10000 steps is equal to an energy expenditure of about 300–400 $kcal \cdot day^{-1}$, which more than doubly exceeds the recommended health benefit level of 150 $kcal \cdot day^{-1}$ (Sallis & Owen, 1999; U. S. Department of Health and Human Services, 1996). For health support in children, the President's Council on Physical Fitness and Sports (2001) recommends reaching the daily number of 11000 steps, at least five days a week. Tudor-Locke (2002) found that people carrying out daily more than 9000 steps have more often normal body weight, while the number of 5000 and less steps is closely related to obesity. Leermakers, Dunn and Blair (2000) assert that reaching at least 15000 steps a day is necessary for reducing body weight.

## EVALUATION GUIDELINES OF THE PHYSICAL ACTIVITY OF YOUTH FROM THE VIEWPOINT OF HEALTH SUPPORT

Based on six years of monitoring of PA by accelerometers and pedometers, we suggest the following evaluation guidelines for the PA level of Czech youth from the standpoint of health support, derived from active energy expenditure (Fig. 1) and daily number of steps (Fig. 2).

For the guidelines proposal we used data from a one week monitoring of habitual PA in 1504 females and 1163 males aged 6 to 23. Habitual weekly PA is considered as commonly organized and performed PA, including that done in leisure time, in one habitual week. The dates of monitoring were chosen in agreement with a common (habitual) week (weeks without festivals, holidays, school trips, all-day sport competitions and tournaments, weeks without stress at school, e. g. before final marking, etc.). Only the data of individuals, who completed the whole continual seven days monitoring and did not fall ill, were included in the analysis. Data

**Fig. 1**
Classification of active energy expenditure (kcal·kg$^{-1}$·day$^{-1}$) from the accelerometer Caltrac from the viewpoint of health support

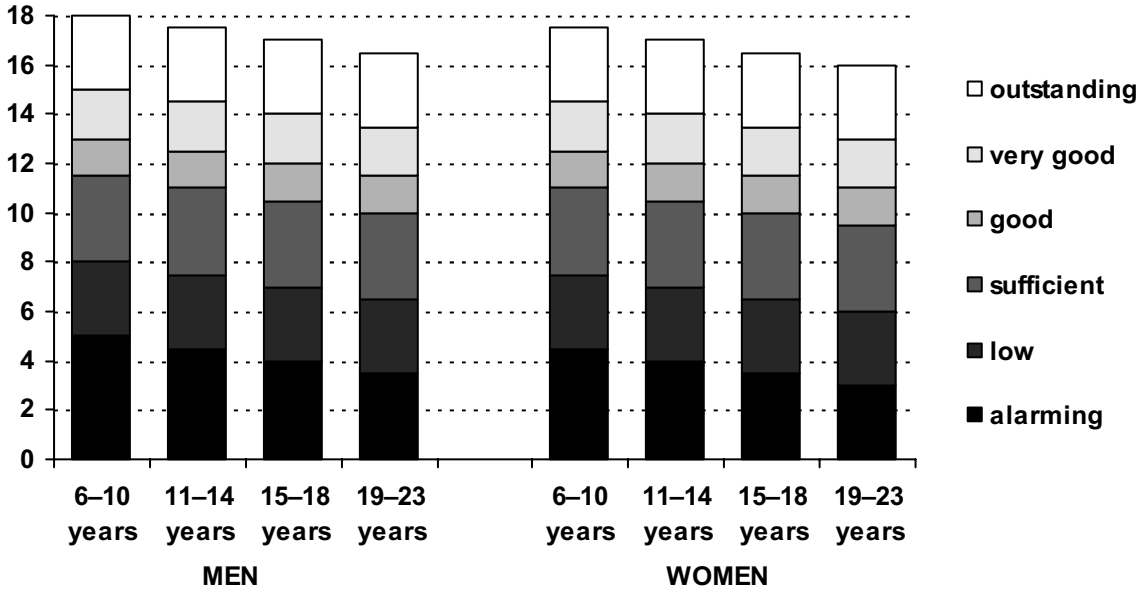
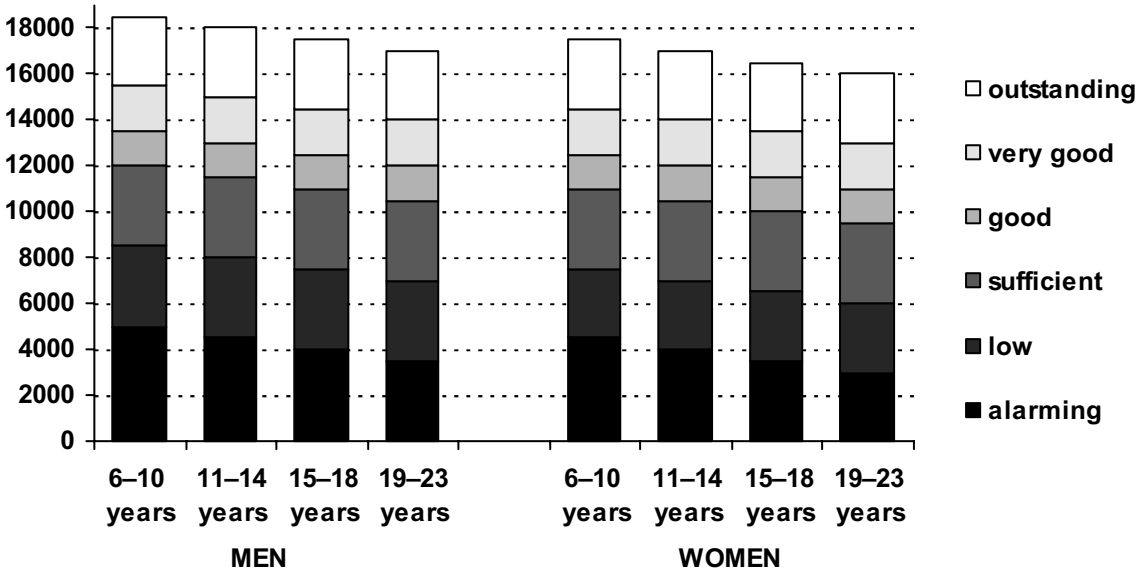



**Fig. 2**
Classification of number of steps (number·per day$^{-1}$) from the pedometer Omron from the viewpoint of health support




from monitoring "extreme" PA (sport summer camps and workshops, skiing courses, weeks for youth from special sports classes in different periods of conditioning, weeks of Christmas, spring and summer holidays) provided support for the suggestion of PA guidelines according to health benefits.

Selecting of the number of classification levels was done with regard to frequency histograms and with the necessity of avoiding inaccurate three levels of sorting (under average, average, above average). As an "alarming" level of PA (< 5 kcal·kg$^{-1}$·day$^{-1}$) we understand, in accordance with our methods, to be a whole day's stay at home. This activity is characterized by walking between the refrigerator, TV, toilet, bathroom and bed. A "low" level of PA category presents an increase in the performance of household chores (cooking, sweeping, gardening, cleaning, and watering) or walking to and from school (employment) in comparison to the "alarm-

ing" level. A "sufficient" level of PA includes more walking (> 45 minutes) or jogging, cycling or sport activity (basketball, volleyball, football, floorball, etc.) for more than 20 minutes at a time. Partial experiments show positive correlations between active energy expenditure in habitual and "extreme" PA and fitness level ($r_S$ = = 0.32–0.68) in females and males as a "very good" or "outstanding" level of PA. Physiotherapeutic exams done in age groups 12–14 and 19–23 uncovered most inaccurate physical activity stereotypes and dysbalances in females and males at the level of "alarming" and at a "low" level of PA.

Even though each of the used instruments (Caltrac × Omron = active energy expenditure × steps) rate a different aspect of PA, a more complex view of the described PA can be obtained by their combination. The rightness of a more complex view of the described PA and proposal for PA guidelines according to health benefits are supported by high correlation coefficients ($r_S$ = .56 – .75) between active energy expenditure from Caltrac ($kcal \cdot kg^{-1} \cdot day^{-1}$) and the daily number of steps from Omron.

With regard to significant correlations we express indicators of PA level for health support at the end of day amount of steps (Fig. 1). This expression allows for the lay public's general health orientation at the level of performed PA. A whole day's stay at home where the only activity is walking between the refrigerator, TV, toilet, bathroom and bed is characterized with less than 5000 steps. A daily amount of steps less than 8000 includes a stay at home with household chores or walking to and from school (employment). Vigorous training, such as soccer or a floorball match in the gym with an average game time of 60–75 minutes represents 8000–10000 steps.

## CONCLUSION

The suggested evaluation guidelines of PA level, with a respect to gender and age, shall not be considered to be definitive and dogmatic. Time, socio-cultural, politic, economic, environmental and other factors will always determine their definition. The level of PA carried out must be evaluated individually with an account of the FITT characteristics (frequency, intensity, type and duration) of PA, the current state of health, weekly routine (school × holiday), days in the week (working or school × weekend or out of school), season, weather and the like. Expressing the guidelines for PA evaluation from the viewpoint of health support by the means of relative values of active energy expenditure ($kcal \cdot kg^{-1} \cdot day^{-1}$) enables us to compare somatic different groups of females and males of different age. The developed guidelines can help to evaluate the level of PA and to create effective interventional PA programs. The expression of the guidelines in a daily number of steps seems to be a good step towards their larger and more popular use.

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## POHYBOVÁ AKTIVITA DĚTÍ A MLÁDEŽE: UKAZATELE K HODNOCENÍ Z HLEDISKA PODPORY ZDRAVÍ

(Souhrn anglického textu)

Hlavním cílem této studie je na základě 6letého monitorování pohybové aktivity (dále PA) pomocí akcelerometrů a pedometrů stanovit ukazatele k hodnocení úrovně PA z hlediska podpory zdraví u českých dětí a mládeže. Pro návrh kritérií byla použita data z triangulačního týdenního monitorování PA (akcelerometr Caltrac × pedometr Omron × individuální záznam = energetický výdej × kroky × FITT charakteristiky PA) od 1504 děvčat a 1163 chlapců ve věku 6–23 let. Vyjádření ukazatelů k hodnocení PA z hlediska podpory zdraví pomocí relativních hodnot aktivního energetického výdeje ($kcal \cdot kg^{-1} \cdot den^{-1}$) umožňují srovnávat somaticky odlišné skupin děvčat a chlapců v různých věkových kategoriích. Při analýze dat zjišťujeme v pracovních i víkendových dnech výrazné korelační závislosti ($r_S = 0{,}56–0{,}75$) mezi aktivním energetickým výdejem z Caltracu ($kcal \cdot kg^{-1} \cdot den^{-1}$) a denním počtem kroků z Omronu. Stanovené ukazatele mohou přispět k posuzování stávající úrovně PA a k tvorbě efektivních intervenčních pohybových programů. Příslibem širšího, „populárnějšího“ využití navržených ukazatelů je jejich vyjádření prostřednictvím denního počtu kroků.

*Klíčová slova: energetický výdej, akcelerometr Caltrac, kroky, pedometr Omron, věk, pohlaví.*

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Explorational activity in the field of kinanthropology with an orientation to organised and leisure physical activity, sports preferences and methodology of monitoring of physical activity and inactivity.

***First-line publications***

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