

THE EFFECT OF INTERVENTIONAL PHYSICAL ACTIVITY OF RESIDENTIAL CAMPS IN NATURE ON THE HABITUAL PHYSICAL ACTIVITY OF FEMALES AND MALES

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Submitted in March, 2004

The main aim of this study is to ascertain the effect of physical activity (hereafter PA) of residential camps in nature on habitual weekly PA and to compare the level of performed PA to health epidemiological recommendations. The effect of females' ($n = 49$) and males' ($n = 27$) PA at residential camps (the experiential camp GO! in Hynčice pod Sušinou, the residential camp in Lipnice nad Sázavou and the school in nature in Volyně) was assessed by comparing it to their habitual weekly PA, performed at a three-week interval after the end of these camps. PA was monitored using the accelerometer Caltrac, the pedometer Omron and individual records. PA was assessed by active energy expenditure (Caltrac), number of steps (Omron) and time of PA (individual record). At every analysed residential camp in nature, the volume of PA meets the epidemiological recommendations for strengthening health. The content and form of PA at residential camps in nature also erases differences between females' and males' PA and weekend and working days. PA performed at the school in nature in Volyně and at the residential camp in Lipnice provided a strong impulse for the development of fitness in males and females. We showed the strong effect of "interventional" PA on habitual weekly PA in both females ($r_p = 0.55$) and males ($r_p = 0.60$) at the school in nature in Volyně and a moderate effect on females ($r_p = 0.39$) at the experiential camp GO!.

Keywords: Active energy expenditure, steps, workday, weekend, Caltrac accelerometer, Omron pedometer.

INTRODUCTION

Characterization of basic paradigms used in this study:

- **Physical activity** – denotes any body movement produced by skeletal muscles and leading to an increase of energy expenditure of the individual (Carpensen, Powell, & Christenson, 1985, 126) "...a complex behavior which generally accounts for 15 to 40% of a person's total energy expenditure" (Bouchard, Shephard, & Stephens, 1994, 9).
- **Active energy expenditure** – is "a consumption of energy sources which is necessary to cover physical activity (without basal metabolism)" (Frömel, Novosad, & Svozil, 1999, 131). It includes the FITT characteristics (frequency, intensity, type and time) of performed PA. In field conditions we use the accelerometer Caltrac to assess active energy expenditure.
- **Health** – "...is an impermanent state of physical, mental and social peace and not only absence of diseases and health defects" (Sharkey, 1990, 4). We lean towards accepting the holistic view of health as a system of "physical", "mental", "social" and "spiritual" health, where any impairment of one single item results in disruption of the whole system. We also understand health as an individual value,

which includes the ability to decide the content of free time.

The most relevant epidemiological recommendations on performing PA in relation to health refer to a week (Biddle, Sallis, & Cavill, 1998; Pangrazi, Corbin, & Welk, 1996; U.S. Department of Health and Human Services, 2000). A week's monitoring and backward recording of PA is a current trend of the objective ascertaining of the level of PA of children, youth and adults (Craig et al., 2003; Trost et al., 2002; Washburn, Jacobsen, Sonko, Hill, & Donnelly, 2003) and, also due to this, it allows comparison between working days and weekend days (Trost, Pate, Freedson, Sallis, & Taylor, 2000). Epidemiological recommendations as to optimal PA in relation to health (Biddle, Sallis, & Cavill, 1998; Pangrazi, Corbin, & Welk, 1996; U.S. Department of Health and Human Services, 2000) are most frequently expressed with frequency and intensity of performing PA:

- Children and youth – PA of moderate intensity for 30–60 minutes daily – Corbin, Pangrazi and Welk (1994), which includes continuous PA at least for 3 days per week for 20 minutes per occasion – Pangrazi, Corbin, and Welk (1996),
- Children and youth – PA of moderate intensity at least for 5 or more days per week for 3 minutes per

occasion. 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 (U.S. Department of Health and Human Services, 2000),

- Adults - increase the proportion of adults who engage regularly, preferably daily, in moderate PA for at least 30 minutes per day. 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 (U.S. Department of Health and Human Services, 2000).

But there are also recommendations expressed with active energy expenditure:

- Children and youth - 6 to 8 kcal·kg⁻¹·day⁻¹ - Corbin, Pangrazi, and Welk (1994)
- Adults - 90 kcal·kg⁻¹·week⁻¹ - Cordian, Gotshall, Eaton and Eaton, III (1998)
- All - "...that an increase of about 150 kcals per day, or 1.000 kcals per week, over sedentary levels, was sufficient to improve health. Vigorous activity was not required for these effects" (Sallis & Owen, 1999).

Besides active energy expenditure from Caltrac, for assessing PA in relation to health and fitness we also take into consideration the number of steps measured by the pedometer Omron, the time of PA and the ratio of active to total energy expenditure. Frömel, Novosad and Svozil (1999) set forth three values (listed below) in order to have basic orientation in assessing the PA of children and youth. Those values respect social, cultural, mental and educational aspects.

- Active energy expenditure should reach at least 9 kcal·kg⁻¹·day⁻¹ in girls (resp. 11 kcal·kg⁻¹·day⁻¹ in boys) for a majority of week days.
- The daily number of steps should approach 11.000 in girls of basic school age (resp. 13.000 in boys) for a majority of week days.
- The daily number of steps should approach 9.000 in girls of secondary school age (resp. 11.000 in boys) for a majority of week days.

Worldwide, weekend days including more free time are paradoxically more critical from the point of view of PA of children and youth than working days (Gavarry, Giacomoni, Bernard, Seymat, & Falgairrette, 2003; Hovell, Sallis, Kolody, & McKenzie, 1999). Although boys are physically more active than girls on school days (Gavarry et al., 2003), on weekend days the differences in volume and content of PA between boys and girls get reduced due to the increase in physical inactivity (Gavarry et al., 2003).

Weekend days, with plenty of free time, provide an appropriate occasion for physical intervention. Okada et al. (2000) confirmed that regular vigorous PA performed only once per week, just at the weekend, markedly decreased the risk of diabetes mellitus type 2 in men (n = 6013) aged 35-60.

Advanced western countries support interventional projects aimed at the increase of daily PA of inhabitants, right eating habits and active lifestyle. The reason is the reality that physical inactivity, with its wide range of health consequences, represents a major avoidable contribution to the costs of illness in the United States and other countries with modern lifestyles that have replaced physical labor with sedentary occupations and motorized transportation (Colditz, 1999). In addition to changes in eating habits and behaviour (Armstrong, Sallis, Hovell, & Hofstetter, 1993; Epstein, Saelens, & O'Brien, 1995; Saelens et al., 2000), health supporting projects are primarily aimed at increase of PA and restriction of physical inactivity (J. K. Ockene, McBride, Sallis, Bonollo, & I. S. Ockene, 1997; Okada et al., 2000; Owens et al., 1999). Multidisciplinary interventional programs, which embrace an increase in PA, dietetical recommendations, motivation for active lifestyle and improvement of knowledge of PA and health, are rated as the most effective interventional programs (Dishman & Buckworth, 1996; Sallis et al., 2000; Simons-Morton, Calfas, Oldenburg, & Burton, 1998).

AIM

The purpose of this study is to find out the effect of physical activity performed at residential camps in nature on habitual weekly PA and to compare the level of performed PA to health recommendations.

METHODS

Characterization of residential camps in nature and monitored participants:

School in nature in Volyně - "interventional" camp designed for pupils of basic school in Chomutov. Morning classes last 3 to 4 hours. The afternoon program was designed to include active spending of free time by PA, while passive relaxation (e. g. reading books, listening to music, watching TV) was not excluded. The school in nature in Volyně offers a well-equipped sports field (sports grounds for football, basketball, volleyball, tennis, baseball, badminton, softtennis, table tennis, balls for all kinds of games, skipping ropes, rackets, darts, and the like) and possibility of hiking and bike trips into surrounding nature. There were 14 girls at the age of 15.17 (M) ± 0.61 (SD) and 12 boys at the age of

15.09 (M) \pm 0.31 who took part in the monitoring. Monitoring of “interventional” and habitual PA took place from the 28th of March to the 4th of April 2000 and from the 25th of April to the 1st of May 2000.

Experiential camp GO! in Hynčice pod Sušinou (Margagata 2001) – the aim of the camp was a meeting of participants (pupils) and their class teacher and to create informal relationships and social relations in the newly formed class “team”. The camp was drawn up as a voyage (margagata in Sanskrit) from the land of the “basic school” to the land of “Gymnazion” (secondary grammar school) where the participants would be supposed to spend the next part of their life. Opening of the camp represented boarding a sailboat “Margagata” and setting sail towards “Gymnazion”. The camp took place from the 2nd of August to the 8th of August 2001. Habitual PA was monitored from the 29th of August to the 5th of September 2001. There were 18 females (at the age of 15.39 \pm 0.27 years) and 5 males (at the age of 15.45 \pm 0.87 years) who participated in this monitoring of PA.

Residential camp in Lipnice nad Sázavou (Polis Lipnae) – as the main goal of this camp students of recreology (FTK UP Olomouc) got acquainted with methods and possibilities of “experience pedagogy”. This camp was composed as an example of a camp of this type. The stay at the camp was brought into line with the life in polis of ancient Greece – “Polis Lipnae”. 17 females (at the age of 20.15 \pm 1.62 years) and 10 males (at the age of 20.83 \pm 1.62 years) participated in the monitoring of PA at the camp from the 16th of June to the 22nd of June and habitual PA from the 13th of July to the 19th of July 2001.

Monitoring of PA

Monitoring is based on the triangulation approach to the measurement of PA by the accelerometer Caltrac (active energy expenditure), the pedometer Omron (number of steps) and the individual record (time of duration, type and frequency of PA and physical inactivity), (Frömel, Novosad, & Svozil, 1999). For precise monitoring of PA it is recommended to use a combination of various approaches and methods, such as accelerometers and questionnaires, multifunctional motion sensors, direct observation and accelerometers or pedometers, questionnaires and heart rate sensors (Baranowski & de Moor, 2000; Basset, 2000; Lamonte & Ainsworth, 2001).

In field conditions, accelerometers are suitable devices for the monitoring of the physical behaviour of a mid-sized group of children and youth (Janz, Witt, & Mahoney, 1995; Ott, Pate, Trost, Ward, & Saunders, 2000), particularly for several days', week's or even longer monitoring (Freedson & Miller, 2000; Janz, Witt,

& Mahoney, 1995; Trost, Pate, Freedson, Sallis, & Taylor, 2000; Welk, Corbin, & Dale, 2000).

For assessment of active energy expenditure in field conditions, the accelerometer Caltrac was validated by comparison with a heart rate sensor (Montoye, Kemper, Saris, & Washburn, 1996) which was also done by a week's monitoring of Czech adolescents (Frömel, Novosad, & Svozil, 1999). Active energy expenditure from Caltrac significantly correlates with the number of steps from the pedometer Omron ($r_p = 0.62$, $p < 0.0000$) and time of duration of PA from the individual record ($r_p = 0.48$, $p < 0.0000$) by all-day field monitoring of PA of 190 boys and girls at the age of 11–12 (Sigmund, 2000).

According to individual data (weight, height, age and sex; length of step and weight respectively), the accelerometer Caltrac (the pedometer Omron respectively) were set up for measuring active energy expenditure in kilocalories or number of steps.

Every proband was intimately instructed how to “wear” the accelerometer Caltrac and the pedometer Omron and how to write down data about PA into the individual record sheet. An elastic belt strongly and exactly fixed the devices over the right hip during the all-day monitoring, except for sleeping, lying in bed, personal hygiene and swimming. Every morning and evening probands put down times, active energy expenditure and steps during PA into their record sheet. Before going to bed they also put down types, times of duration and intensity of PA. The number of wrong or incomplete individual records was lower than 5 %, thanks to schooled students of the Faculty of Physical Culture Palacký University, who supervised the rightness of monitoring at outdoor camps as well as during monitoring of habitual weekly PA. For comparison of PA at residential camps in nature and habitual weekly PA we select only those probands who had completed both monitoring issues.

Statistical processing

The effect of PA performed at residential camps in nature on habitual weekly PA was assessed by r_p – Pearson's correlation coefficient of relative variable – active energy expenditure ($\text{kcal}\cdot\text{kg}^{-1}\cdot\text{day}^{-1}$). Dishman and Buckworth's (1996) classification of r_p , small ($r_p = 0.10$), moderate ($r_p = 0.30$) and large ($r_p = 0.50$) effect. The coefficient of determination (r_p^2) expresses the percentual effect of PA at residential camps in nature on habitual weekly PA of monitored females and males.

RESULTS

The volume of PA at each of the monitored residential camps in nature fulfils epidemiological recommen-

dations for strengthening health (Fig. 1, 2). Although all camps were not primarily aimed at progress of fitness, PA at school in nature in Volyně and at the residential camp in Lipnice nad Sázavou even provides conditions for fitness progression in both females and males.

The highest effect of “interventional” PA on habitual weekly PA was registered at the school in nature. Active energy expenditure ($\text{kcal}\cdot\text{kg}^{-1}\cdot\text{day}^{-1}$) at the school in nature in Volyně influenced the active energy expenditure in the habitual week by 36 % or 30 % in males or females. The school in nature in Volyně was, above the other camps, most aimed at performing PA and fitness.

Habitual weekly PA, monitored during a habitual week in girls who took part in the experiential camp GO!, was influenced by 15% by the PA performed at the experiential camp GO! in Hynčice pod Sušinou, we consider it a moderate effect of “interventional” PA. Only a few males ($n = 5$) took part in the experiential camp GO! and successive monitoring of habitual weekly PA, therefore we will not speculate on the effect of “interventional” PA.

While previous cases deal with assessment of the effect of “interventional” PA on habitual PA in a habitual week, the case of the residential camp in Lipnice nad Sázavou is different. Students of recreology at FTK UP form a highly selective group and monitoring of habitual weekly PA took place in the period of the summer holidays, when we found considerable variance in active energy expenditure, number of steps and time of duration of PA. In this case we are not able to speak about the effect of PA at the residential camp in Lipnice nad Sázavou on habitual PA (females $r_p = 0.09$, males $r_p = 0.06$).

DISCUSSION

Environment is a strong motivation factor for PA. The environment of the school in nature in Volyně is furnished with sports fields (sports grounds for football, basketball, volleyball, tennis, baseball, badminton, soft-tennis) and sport equipment (tables for ping-pong, balls for all kinds of games, skipping ropes, rackets, darts, and the like). To make use of the glamorous nature environment is a priority of the residential camp in Lipnice nad Sázavou and the experiential camp GO! in Hynčice pod Sušinou.

Females and males of all camps positively evaluated and took advantage of the possibility of deciding on their free time PA. Even in their habitual daily schedule participants placed emphasis on the possibility of arranging their free time themselves. Free time spent in this way is mostly evaluated as better used than time organized by someone else. In the case of pupils of the school in nature in Volyně, it is in harmony with the

level of their mental development, which is manifested by criticalness and nonobjectivity.

Content was a common positively evaluated character of all three camps. More than 75% of the respondents, without any significant differences between females and males, emphasize compounded content – well-known and uncustomary movement and sports games, the possibility of their individual or team realization and the atmosphere of friendship, which dominated over the spirit of “competition” and “comparison”. More than $\frac{2}{3}$ of participants declared that an experiential camp is a strong motivation impulse for the further performance of PA – above all after-school PA.

An informal interview showed that 79% of females and 84% of males at the school in nature in Volyně are first of all interested in sports and PA. This finding is confirmed by the first-rank popularity of PE lessons. Watching TV was the second most often performed activity, but pupils’ interest in sports was more than two times higher. Other popular activities are: spending time with friends, working with the computer, music and minimally reading or fine arts.

In both females and males of all camps, walking comprises a dominant part of habitual weekly PA (females: 7.8–11.1 hour-week⁻¹, males: 6.1–9.3 hour-week⁻¹). Walking is followed by sports and other movement games and such types of PA, which can be more easily performed outdoors, in free time, after school, but in the frame of an altered school schedule as well. The preservation of a traditional “walking” environment and the development of a “cycling” environment are economically and ecologically the least demanding of ways of supporting everyday kinetic health prevention in children, youth and adults. Even though an increasing living standard is attended with an increase in physical inactivity and “motorization” (Colditz, 1999), it is very necessary to preserve and support this “walking behaviour” (Eyler, Brownson, Bacak, & Housemann, 2003). Especially support of walking and other types of PA of moderate intensity can reduce the aged-related decline of PA in young females (Leslie, Fotheringham, Owen, & Bauman, 2001).

LIMITATION

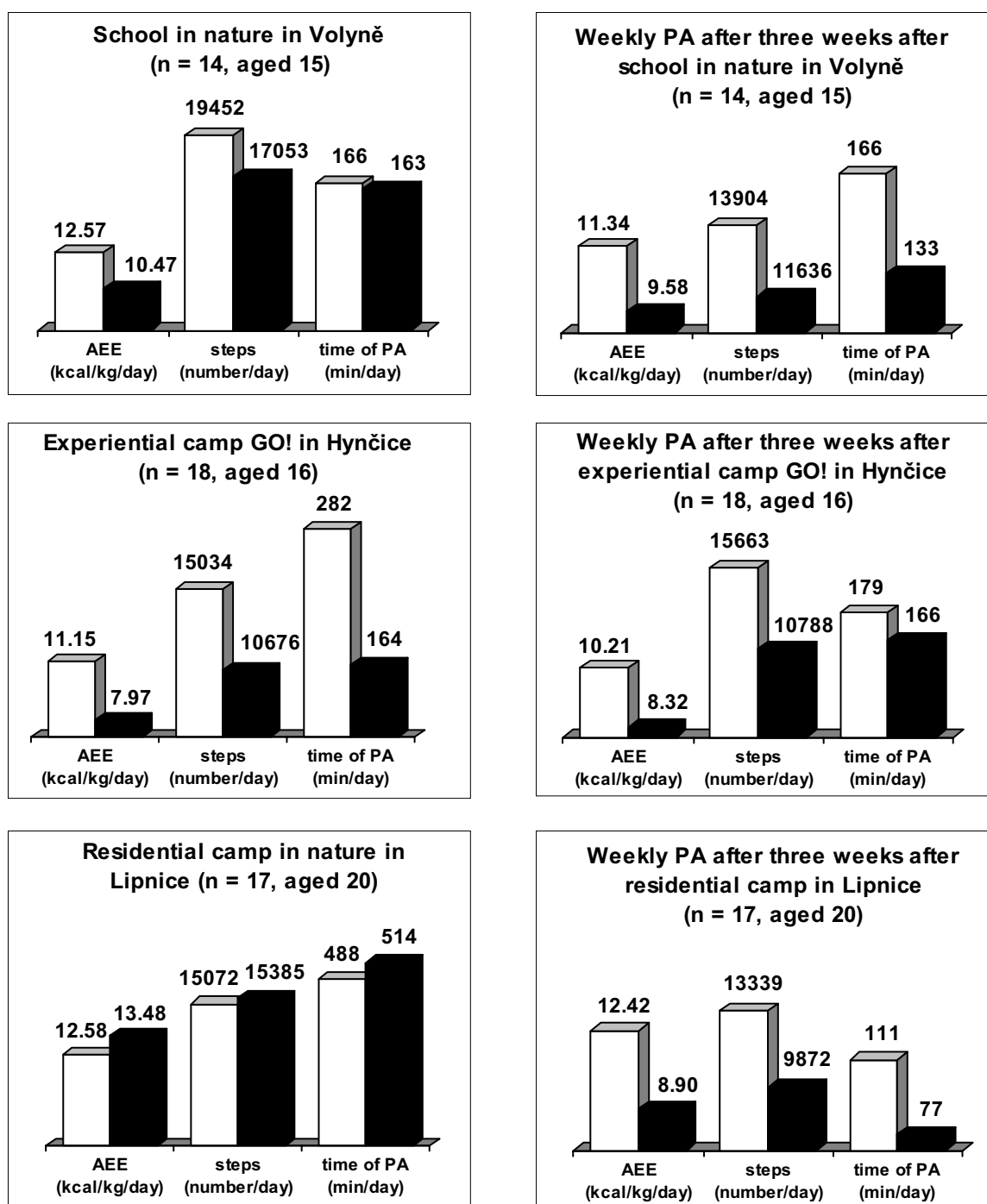
One of the limits was that we monitored the effect of “interventional” PA at residential camps in nature only once – within three weeks after the camp finished. For future studies we recommend carrying out long-term monitoring of the duration of the effect of “interventional” PA on habitual PA. An effect of „interventional“ PA was confirmed in healthy adolescents, whose attitude towards PA is positive. A world-wide question is how to motivate people, who are not inclined toward PA,

to enhance their PA. There was a seasonal influence – the monitoring of PA took place in the months with better climatic conditions for everyday performance of outdoor PA (Pivarnik, Reeves, & Rafferty, 2003; Pratt, Macera, & Blanton, 1999). From the standpoint of year-

long PA, it is convenient to put “interventional” PA also into the time period November–March, which includes months with decreased PA, due to the worse climatic conditions (Pivarnik, Reeves, & Rafferty, 2003; Pratt, Macera, & Blanton, 1999).

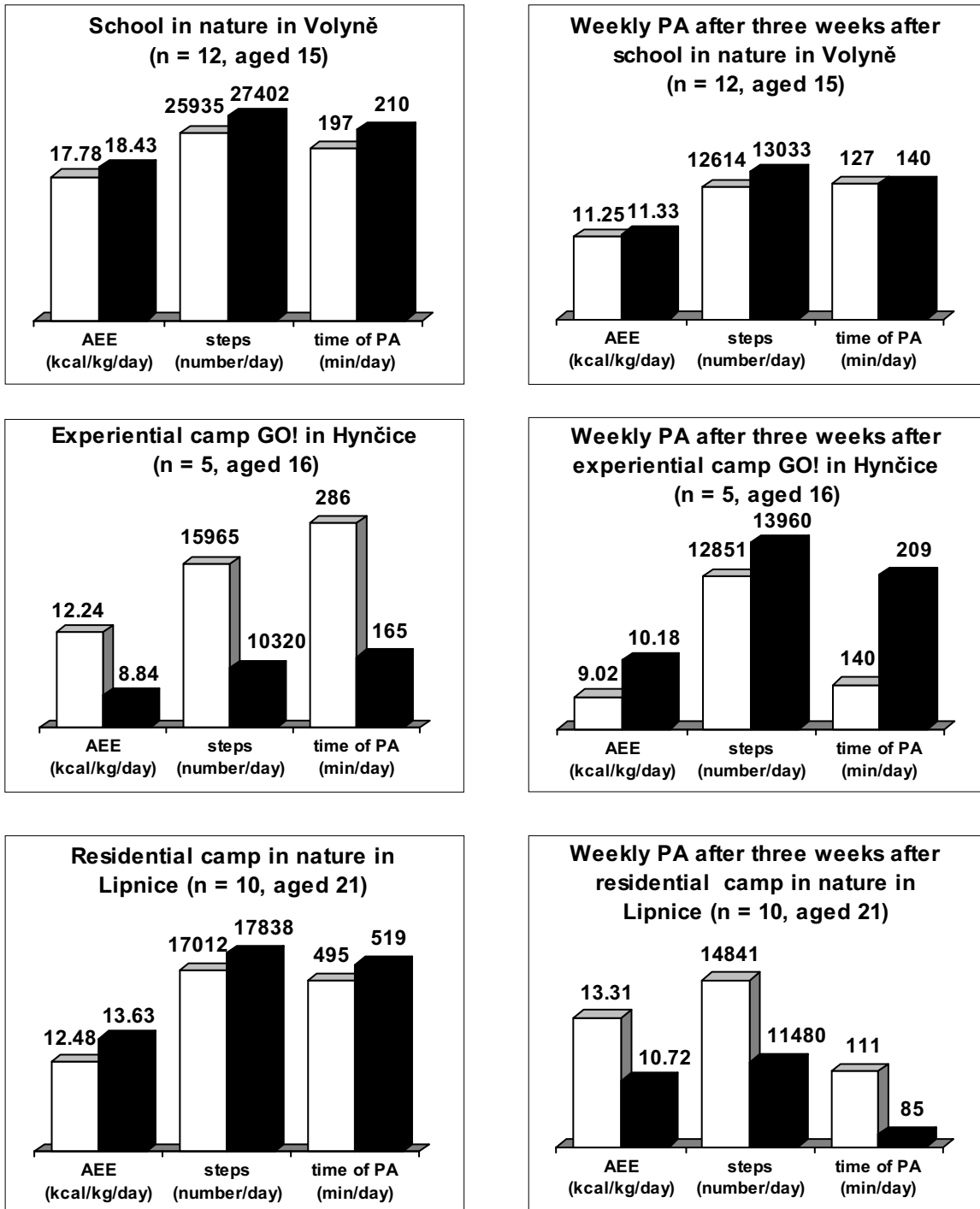
Fig. 1

Comparison of females PA on residential camps in nature and weekly routine



Notes: □ workdays, ■ weekends, AEE - active energy expenditure, PA - physical activity

Fig. 2
Comparison of males PA on residential camps in nature and weekly routine



Notes: □ workdays, ■ weekends, AEE - active energy expenditure, PA - physical activity

CONCLUSIONS

- Physical activity performed at all analysed residential camps in nature provides not only conditions for health preservation, but by means of its engaging content and form it also erases differences in physical activity between females and males and between weekend and working days.
- Physical activity performed at the school in nature in Volyně and at the residential camp in Lipnice nad Sázavou provided a strong impulse for the development of their fitness in both females and males.
- The highest effect of “interventional” physical activity on habitual weekly physical activity was proved in males ($r_p = 0.60$) and females ($r_p = 0.55$) at the school in nature in Volyně and moderate effect in females ($r_p = 0.39$) at the experiential camp GO! in Hynčice pod Sušinou.
- Residential camps in nature provide suitable conditions for acquiring and fixating movement skills and for acquiring motion experience by means of well-known and uncustomary, team or individual movement and sports games.
- Field monitoring of physical activity based on the triangulation approach to the measurement of physical activity (active energy expenditure – the accelerometer Caltrac, number of steps – the pedometer Omron and time of duration, type and frequency of physical activity and physical inactivity – the individual record) is an appropriate means for assessing physical activity in relation to health recommendations.

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VLIV INTERVENČNÍ POHYBOVÉ AKTIVITY POBYTOVÝCH KURZŮ V PŘÍRODĚ NA HABITUÁLNÍ POHYBOVOU AKTIVITU ŽEN A MUŽŮ

(Souhrn anglického textu)

Hlavním cílem této studie je posoudit vliv pohybové aktivity (dále PA) pobytových kurzů v přírodě na habituální týdenní PA a srovnat úroveň její realizace se zdravotními epidemiologickými doporučeními. Efekt PA pobytových kurzů v přírodě (adaptační kurz GO! v Hynčicích pod Sušinou, kurz pobytu v letní přírodě v Lipnici nad Sázavou a škola v přírodě ve Volyni) byl u žen (n = 49) a mužů (n = 27) posuzován srovnáním s jejich habituální týdenní PA realizovanou tři týdny po skončení pobytových kurzů v přírodě. PA byla monitorována prostřednictvím akcelerometru Caltrac, pedometru Omron a individuálního záznamu. PA byla hodnocena podle aktivního energetického výdeje (Caltrac), počtu kroků (Omron) a doby trvání PA (individuální záznam). Na všech analyzovaných pobytových kurzech v přírodě

splňuje objem PA epidemiologická doporučení k upevnění zdraví. Svým obsahem a formami její provádění také smazává rozdíly mezi PA děvčat a chlapců a PA ve víkendových a pracovních dnech. PA ve škole v přírodě ve Volyni a na kurzu pobytu v letní přírodě v Lipnici nad Sázavou je navíc u děvčat i chlapců výrazným stimulem pro rozvoj tělesné zdatnosti. Výrazný vliv „intervenční“ PA na habituální PA byl prokázán u děvčat ($r_p = 0.55$) i chlapců ($r_p = 0.60$) ze školy v přírodě ve Volyni a střední efekt ($r_p = 0.39$) u děvčat z adaptačního kurzu GO!

Klíčová slova: aktivní energetický výdej, kroky, pracovní dny, víkendy, akcelerometr Caltrac, pedometr Omron.

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1997–1992 Palacký University in Olomouc, Faculty of Physical Culture, Mgr. (Magister – Master of Arts) specialization – high school teacher, State examination (Mathematics – Physical Education).

Foreign study visits – at the high school “Högskolan i Halmstad”, Halmstad, Sweden in May, 1999 (Dr. Ewa Wirdheim) and at San Diego State University in September of 2003 (Prof. James F. Sallis).

Scientific-explorational activity in the field of kinanthropology oriented to organised and leisure physical activity, sports preferences and methodology of the monitoring of physical activity and inactivity.

First line publications

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