Physical activity patterns of primary school children in everyday life

A cross-sectional study among 5th grades in the principality of Liechtenstein and the canton of Schwyz

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Abstract

The purpose of this cross-sectional study was to analyse the activity in daily life (ADL) among 5th grades in two rural regions by regarding selected indicators. The study was conducted in autumn 2012 and included a randomly selected sample of 157 pupils in Liechtenstein (FL: aged 10.4±0.5 years) and 261 pupils in the canton of Schwyz (SZ: aged 10.7±0.7 years). Physical activity (PA) was quantified using a combined methodology (short questionnaire, a diary to assess the commuting to school and a pedometer to determine step counts for four schooldays). The majority of children (FL: 87.8%; SZ: 91%) commuted actively to school and contributed on average 35.5 min. (FL) and 37 min. (SZ) to MVPA/day. The mean steps/day ranged from 14 385 (SZ) to 15 483 (FL) respectively. In both regions mean steps/day were significantly higher in boys than in girls ($p < 0.001$) as well as in sports clubs members than in non members ($p < 0.001$). Following the reference standard of 11 000 (girls) and 13 000 (boys) steps/day 55.4% (SZ) and 63% (FL) of all children achieved this guideline; but only 32.2% (FL) and 25.6% (SZ) met the more strictly BMI-referenced criterion of 12 000 (girls) and 15 000 (boys) steps/day. There was no correlation between the amount of media consumption and mean steps/schoolday.

Zusammenfassung

Im Rahmen dieser überregionalen Querschnittsstudie in Liechtenstein (FL, N = 157) und im Kanton Schwyz (SZ, N = 261) wurde das Bewegungsverhalten von Schulkindern im Alltag anhand ausgewählter Indikatoren untersucht. Die Studie basiert auf zwei repräsentativen Zufallsstichproben der 5. Primarstufe (FL: 10.4±0.5; SZ: 10.7±0.7 Jahre) und wurde im Herbst 2012 realisiert. Als Erhebungsinstrumente dienten ein Kurzfragebogen, ein wöchentliches Schulwegprotokoll sowie eine objektive Aktivitätserfassung mittels Schrittzählern an vier aufeinanderfolgenden Schultagen. In beiden Untersuchungsgebieten legte die Mehrheit der Kinder (FL: 87.8%; SZ: 91%) den Schulweg körperlich-aktiv zurück und trug damit durchschnittlich 35 bzw. 37 Min./Tag zur Erfüllung der offiziellen Bewegungsempfehlungen (> 60 Min./Tag mit mittlerer bis hoher Intensität) bei. Pro Schultag wurden durchschnittlich 14 385 (SZ) bzw. 15 483 Schritte (FL) absolviert, wobei in beiden Regionen Knaben und Sportvereinsmitglieder signifikant höhere Werte als Mädchen ($p < 0.001$) bzw. Kinder ohne Sportvereinsanbindung ($p < 0.001$) erzielten. Unter Bezugnahme des Referenzstandards von 11 000 (Mädchen) und 13 000 (Knaben) Schritten/Tag erreichten insgesamt 55.4% (SZ) und 63% (FL) diese Aktivitätsrichtlinie, jedoch nur 32.2% (FL) bzw. 25.6% die strengere BMI-referenzierte Empfehlung von 12 000 (Mädchen) bzw. 15 000 (Knaben) Schritten/Tag. Zwischen der durchschnittlichen Schrittzahl und Mediennutzung/Tag konnte kein Zusammenhang festgestellt werden.

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Introduction

Due to the significance of physical activity (PA) for children's development and as a long-term health resource, early promoting of an active lifestyle is of primary concern in the global health policy (WHO, 2010). Regular exercise and a sufficient dose of daily PA are associated with several health benefits and help to prevent lifestyle-related risk factors such as obesity and cardiovascular disease (Janssen & LeBlanc, 2010; WHO, 2010). Thereby (due to the dose-response relationship) a greater health benefit can be achieved with a higher degree of daily PA. The childhood is regarded as a key period for health promotion. Both healthy and unhealthy behaviour patterns (e.g. excessive media consumption, mal-

nutrition) are linked with direct health outcomes and with high probability transferred to later periods of life (Hills et al., 2007; Völker et al., 2008; Tremblay et al., 2011). Therefore, the question of how physically active growing children arrange their daily routine is of high relevance.

According to international recommendations children and adolescents (aged 5–17 years) should accumulate an average of at least 60 minutes of moderate to vigorous physical activity (MVPA) per day (WHO, 2010; Janssen & LeBlanc, 2010). Another activity guideline refers to the steps/day measured by pedometer.

Following a current review by Tudor Locke et al. (2011) 60 minutes of MVPA/day in school children (aged 6–11 years) appears to be achieved with a daily amount of 11 000–12 000 steps in girls and 13 000–15 000 steps in boys respectively. For children this recommendation is easy to understand. Pedometers are low-cost and have been evaluated as valid tools to assess PA (McNamara et al., 2010; Rowlands & Eston, 2007).

Today representative data of sports behaviour are available for the adult population of Switzerland as well as children and adolscents (Lamprecht et al., 2008a, 2008b); but the current findings about children's activity in daily life are fragmentary and contradictory (BASPO, 2012). Due to the limited applicability and validity of questionnaires (Beneke & Leithäuser, 2008), in school-age the use of objective methods is of high priority in the national research direction (BASPO, 2012). With this background, the purpose of this paper was to investigate the activities in daily life (ADL) among 5th grades in two representative regional samples by regarding selected PA-indicators.

Methods

Participants

After the approval of the school authorities a cluster sampling from the regional basic populations (school statistics), consisting of 10 classes (FL, N = 190) and 15 classes (SZ, N = 292) of 5th grades, was randomly selected. The information of the relevant teachers was carried out in cooperation with the local school administration. The participation of the selected pupils was voluntary, but presupposed a written consent of their parents. Children without parental agreement or who were ill or injured at the time of data collection, have been excluded. The definitive dataset included 157 pupils (80 girls, 77 boys) in Liechtenstein and 261 pupils (139 girls, 122 boys) in the canton of Schwyz, representing a participation rate of 83% and 90% respectively.

Procedures and analysis

The study was carried out in autumn 2012 (during a period of 8 weeks) and followed a standardised schedule. Each class was supervised by a project team member. The introduction and explanation of the survey instruments were realised at the beginning of the week and in presence of the teachers. With these proceedings all the questions could be clarified and an effective information (of approx. 50 min.) be guaranteed. General information about the participants (including socio-demographic items, recreational activities, the sportiness of the children and their family members) were acquired in a short questionnaire. Commuting to and from school (daily duration, frequency and mode of transport) was operationalised by using a weekly diary, which has already been tested in a pilot study (Kühnis et al., 2009). To collect objective data on the duration of commuting we delivered a digital stopwatch (Stoptec) to every child. In addition, the children were asked to draw their personal routes to school on a map-sheet of their school community. The daily PA was determined using the Yamax-SW200 pedometer (Yamax Corporation Tokyo). This type has been well validated and recommended for research (Tudor-Locke et al., 2006; McNamara et al., 2010). Pedometers were worn on the hip for four consecutive schooldays – a period which is regarded as sufficiently representative for a week (Tudor Locke et al., 2002). The children put the pedometer on after waking up and wore it for the whole day (but removing it during swimming or bathing) until they went to bed. Each day of monitoring a member of our staff controlled the pedometers during the first school lesson, recorded and reset the step counts and returned them to the children. To ensure the daily update of the protocol and the wearing of the pedometer several reminders (personal bracelet, poster in the classroom, info sheet for home and a daily note of the teacher) have been used.

The classification of pedometer data was based on two step-defined cut points *(table 1a),* established from Vincent & Pangranzi (2002) and Tudor-Locke et al. (2004). Both reference criteria are frequently used in pedometer studies (Tudor-Locke et al., 2011). The routes to school were digitised by using a geographical information system (ArcGIS 9.3). Statistical analysis only included complete data and were performed using SPSS (version 21) and non-parametric tests, drawn at a significant level of $p < 0.05$.

Results

The main findings and descriptive data, stratified by sex and study areas are summarised in *tables 1a/b and figures 1a/b.*

Membership in sports clubs

The majority of the observed children (FL: 74%; SZ: 70%) participated in sports clubs with no gender difference in Liechtenstein, but a significantly higher proportion in boys in the canton of Schwyz ($p < 0.05$). In Liechtenstein 61.2% of all members were active in one and 38.8% in two or more sports clubs; in the canton of Schwyz this proportion included 71.6 and 28.4%. No significant group differences between the two regions were observed.

Active commuting to school (ACS)

Overall the proportion of children who actively commuted to school (walk, bike, kickboard or similar) was 87.8% (FL) and 91% (SZ) respectively. Thereby 70.5% (FL) and 67.1% (SZ) walked to school, 15.1% (FL) and 11.1% (SZ) used a bike and only 12.2% (FL) and 9% (SZ) commuted motorised or partially motorised (such as a combination of walking and bus). In both study areas active commuters on average contributed 35.5 min. (FL) and 37 min. (SZ) to MVPA/day, i.e. they achieved approximately 60–62% of the official WHO-recommendations; each 10th child even achieved the guideline. Neither within nor in comparison between the two study areas significant gender differences could be detected.

Pedometer-measured daily activity

In Liechtenstein pedometers were worn on average 12.57 hours/day and in the canton of Schwyz 12.54 hours/day respectively. There were no statistical differences between boys and girls or study areas. On average *(table 1a),* boys achieved significantly more steps/day than girls in both regions ($p < 0.001$). Using the Vincent & Pangrazi (2002) reference of 11 000 (girls) and 13 000 (boys) steps/day, 63% of the 5th grades in Liechtenstein and 55.4% in the canton of Schwyz were able to meet this criterion over all monitored days. 4.1% (FL) and 5% (SZ) never met these cut points. No significant group differences within or between the regions were observed. Only 32.2% (FL) and 25.6% (SZ) of all participants achieved the more strictly BMI-referenced cut points (Tudor-Locke et al., 2004); thereby in the canton of Schwyz the proportion was significantly higher in girls than in boys ($p < 0.05$). 5% (FL) and 12.8% (SZ) never met these BMI-referenced cut points. Not surprisingly, the mean steps on schooldays were significantly higher among sports clubs members than non-members (FL and SZ, $p = .000$). On average, members of sports clubs attained approx. 2500 (FL) and 2000 (SZ) more steps/day. According to this 69.1% (FL) and 63.4% (SZ) of all members met the guideline1; 35.5% (FL) and 27.9% (SZ) the guideline2. The proportion of non-members achieving guideline1 was only 44.4% (FL) and 35.7% (SZ); regarding guideline 2 even only 22.2% (FL) and 20% (SZ) respectively.

Daily media consumption

On schooldays *(table 1b)* children on average spent 1.37 hours (FL) and 1.52 hours (SZ) in front of screens (TV, computer and game console), whereby 40.8% of 5th grades in Liechtenstein and 36.7% in the canton of Schwyz engaged daily up to 1 hour with electronic media. For 11.5% (FL) and 14.3% (SZ) the media use included > 3 hours per day. In both regions significant gender differences and an increasing media use (mainly television) at weekends could be identified *(table 1b, figure 1a)*. On school and weekend days boys invested significantly more time in media use than girls. In the cross-regional comparison no significant differences in the total time of media use could be detected; but boys in the canton of Schwyz spent significantly more time with computers on schooldays ($p < .01$) and weekend days ($p < .01$) than peers in Liechtenstein. A comparison with national findings of the HBSC-study (Kuntsche & Delgrande Jordan, 2012) is illustrated in *figure 1a*.

Relationship between PA and media use

Of further interest in this study was also the question whether there are any differences in the reported amount of daily media use in relation to the selected variables of PA behaviour. While members of sports clubs in Liechtenstein showed a significant lower daily media consumption than non-members on school days (mean 1.27 vs. 2.05 hrs., $p < 0.001$) and

Table 1a: Summary analysis of participation in sports clubs and daily physical activity

	Liechtenstein (FL, N = 146)			Canton of Schwyz (SZ, N = 250)		
Variables	All	girls	boys	All	girls	boys
Membership in sports clubs	73.9%	71.3%	76.6%	70.1%	64.7%	76.2%*
Commuting to school						
Active commuting (HPM)[d]	87.8%	88.9%	86.6%	91.0%	88.5%	93.8%
Daily HPM (min.)	35.5 ± 16.1	38.3 ± 15.4	33.0 ± 16.3	37.0 ± 18.5	36.1 ± 19.5	37.4 ± 17.4
Pedometer data						
Daily step count[a]	15 483 ± 3664	14 268 ± 2848	16 733 ± 3994***	14 385 ± 3609	13 604 ± 3272	15 293 ± 3781**
Meeting guideline1[b]	63.0%	68.9%	56.9%	55.4%	56.9%	53.6%
Meeting guideline2[c]	32.2%	36.5%	27.8%	25.6%	32.3%*	17.9%

[a] Data are means (±sd); significant gender differences (Mann-Whitney-U-Test): * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[b] Cut points (Vincent & Pangrazi, 2002): 11 000 (girls), 13 000 (boys) steps/day; no significant gender differences (Chi-Square-Test), $p > 0.05$
[c] BMI-referenced cut points (Tudor-Locke et al., 2004): 12 000 (girls), 15 000 (boys) steps/day; significant gender differences (Chi-Square-Test): * $p < 0.05$
[d] Human powered mobility = any mode of active commuting (walking, biking, kickboard or similar)

Table 1b: Amount of daily media consumption (TV, computer and game console)

	Liechtenstein (FL, N = 157)			Canton of Schwyz (SZ, N = 258)		
Variables	All	girls	boys	All	girls	boys
schoolday[a]						
Total time/day (hrs.)	1.37 ± 1.1	1.18 ± 0.5	1.57 ± 1.2**	1.52 ± 1.3	1.23 ± 1.0	2.26 ± 1.4***
television (min.)	55 ± 40.1	48 ± 35.9	63 ± 43.1*	61 ± 54.1	51 ± 44.8	72 ± 61.2**
computer (min.)[b]	22 ± 25.5	19 ± 20.2	25 ± 30.0	32 ± 34.0	25 ± 29.8	39 ± 36.9***
game console (min.)	21 ± 32.8	11 ± 22.4	31 ± 38.6***	20 ± 34.9	7 ± 15.2	35 ± 44.0***
weekendday						
Total time/day (hrs.)	2.53 ± 2.1	2.21 ± 1.5	3.27 ± 2.4**	3.13 ± 2.3	2.29 ± 1.5	4.03 ± 2.5***
television (min.)	101 ± 77.8	85.3 ± 65.2	117 ± 86.6*	110 ± 85.7	96.7 ± 71.3	124.2 ± 97.8*
computer (min.)[c]	36.7 ± 45.1	35.4 ± 43.3	38.1 ± 47.2	48.6 ± 58.1	40.1 ± 57.7	58.2 ± 57.3***
game console (min.)	37.6 ± 52.1	21.1 ± 33.1	55 ± 62.1***	35.4 ± 55.1	13.1 ± 22.0	60.6 ± 68.9***

[a] Data are shown as mean (±sd); significant gender differences within study areas (Mann-Whitney-U-Test): * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[b] Significant differences between study areas ($p < 0.01$): girls (n.s.); boys ($p < 0.01$)
[c] Significant differences between study areas ($p < 0.05$): girls (n.s.); boys ($p < 0.01$)

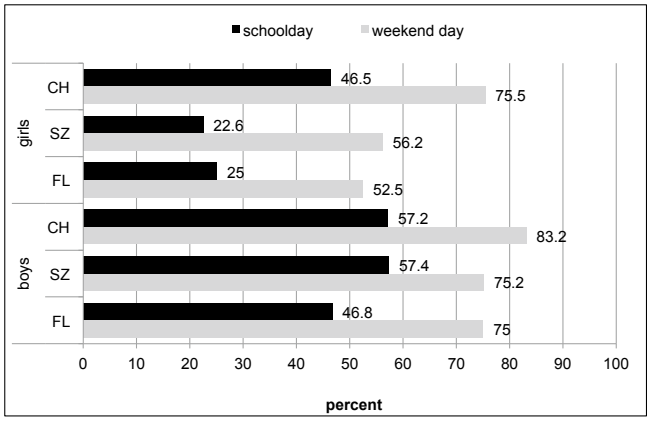

Figure 1a: Proportion of 5th grades (%) with a media consumption (TV, computer, game console) > 2 hrs/day compared with national findings (Kuntsche & Delgrande Jordan, 2012).

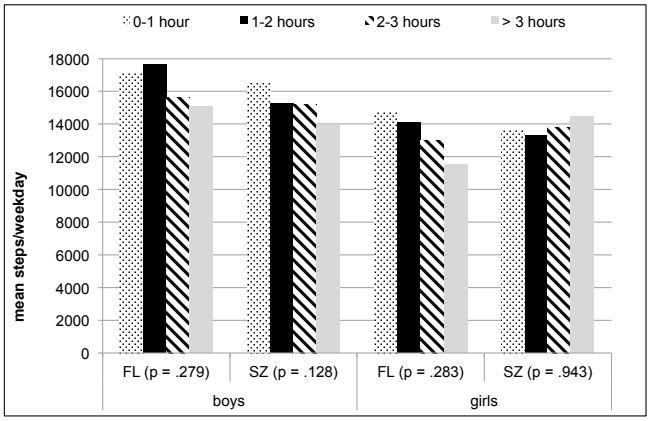

Figure 1b: Pedometer-based mean steps/day by children's reported daily amount of media consumption (TV, computer and game console) on weekdays (Kruskal-Wallis-Test).

weekend days (mean 2.39 vs. 3.39 hrs., $p < 0.05$), there were no group differences detectable among children in the canton of Schwyz (schooldays: mean 1.51 vs. 156 hrs.; weekend days: mean 3.11 vs. 3.18 hrs.). In both study areas there was no statistical difference in the amount of daily media use between children with active and motorised or partly motorised commuting to school. Furthermore, between the pedometer-determined mean steps/schooldays and the amount of daily media use no statistical relevant relationship could be detected. The bivariate correlations (Spearman-Rho) separated by study areas (FL: r = –.104, p = .210; SZ: r = –.018, p = .784) as well as the analysis by gender (Kruskal-Wallis test, *figure 1b)* showed no significant results.

Discussion

From the perspective of health promotion PA (especially due to the possible tracking effects) is regarded as a key factor for children's health (Janssen & LeBlanc, 2010; WHO, 2010). With the present study some concrete insight into selected indicators of daily PA of 5th grades in Liechtenstein and the canton of Schwyz was made possible for the first time.

The membership in sports clubs is a frequently captured indicator to document the general interest and activity in sports. In correspondence with other studies, sports clubs played an important role in children's recreational activities. According to the findings of a nationwide study in Switzerland in 2007, the participation rate of 10- and 11-year-old children was 61% and 63%, respectively (Lamprecht et al., 2008b). Moses et al. (2007) found an overall rate of 63% among 5th grades in the cantons of Aargau and Baselland. In comparison to these reference studies an obvious higher participation could be determined in the present study *(table 1a)*. In addition, a trend analysis for 5th grades in Liechtenstein illustrates that the current proportion has remained on a constant level in comparison with the last survey in 2008 and a quote of 74.1% (Kühnis, 2012).

In both regions the majority of children commuted actively to school and contributed on average 35.5 min. (FL) and 37 min. (SZ) to MVPA/day, i.e., they achieved approximately 60–62% of the WHO-recommendations. This central finding underlines the high relevance of the way to school as a daily source of activity and a setting for interventions.

In total, the determined mean steps on weekdays were 15 483 (FL) and 14 385 (SZ) respectively *(table 1a)*. In comparison with other studies and focusing only on the age groups of 10- and 11-year-olds our findings for 5th grades can be summarised as follows: In both study areas girls and boys achieved higher mean steps/weekday than 10- and 11-year-old children from the U.S., Australia and Greece (Vincent et al. 2003; Michalopoulou et al., 2011). In comparison with Swedish children, in both age groups the mean steps/day taken by boys were higher than the ones of our boys; Swedish girls showed a higher PA level in 10-year-olds, but a lower level in 11-year-olds. As expected, children with participation in sports clubs achieved higher mean steps/day and higher rates of meeting the pedometer-determined activity guidelines than non-members.

Comparing the two pedometer standards used, the proportion of children, who meet these cut points and thereby achieved the recommended minimum of MVPA/day varied considerably. Following the Vincent & Pangrazi (2002) guideline of 11 000 (girls) and 13 000 (boys) steps/day between 55.4 (SZ) and 63% (FL) all children achieved these cut points; following the more strictly BMI-referenced standard (Tudor-Locke et al. 2004) the proportion was only 32.2% and 25.6%. In other words, depending on the reference standard used more than half of the observed children or only every 3rd/4th child respectively achieved the guidelines. The choice of the reference standard therefore is an essential factor for the classification of the step-based PA as well as for the comparability with other studies too.

Another health relevant lifestyle indicator of the today's young generation represents the electronic media use, because it's generally implemented as sedentary activity during leisure time (Tremblay et al., 2011). In accordance with findings from the national HBSC-study (Kuntsche & Delgrande Jordan, 2012) gender differences in the media consumption (boys invested more time than girls) as well as an increase from schooldays to weekend days could be identified in both study areas *(table 1b and figure 1a);* but in comparison with 5th grades in Switzerland our participants (especially girls) showed a lower daily use. In accordance with other studies (Biddle et al. 2004; Bünemann 2008) our results also seem to indicate that the frequently expressed hypothesis of a displacement of PA by the time spent with media cannot be simply generalised: The analysis of the daily media consumption in relation to the mean steps/day showed no group differences at all *(figure 1b)*.

Major strengths of this study are the use of a combined methodology (including objective measures) by regarding

relevant PA indicators as well as the high participation rates, even though participation was voluntary. Due to the anonymous collection of data it can only be speculated about the reasons for the non-participation of 17% (SZ) and 10% (FL), respectively. The standardised proceedings in the classroom and the instruments experienced a good acceptance and proved to be practicable. Especially the use of a weekly diary and a stop watch to document the daily commuting to school resulted in exact data. In contrast to a one-off questioning and a usually rounded estimation of the length and duration of school ways, this procedure provides realistic information.

This study has several limitations: Our findings are based on data of two typical rural regions and therefore they cannot be generalised for other regions. Furthermore no causal interpretation is possible because of the cross-sectional design. Although pedometers are suitable for children, they're unable to measure the intensity or the energy effort of an activity. Furthermore there's a possibility of reactive behaviour because of the monitoring situation and also the fact that these small devices are motivating for children in general. Because of this possible bias and in order to minimise the risk of data resets pedometers can be sealed. In this study we didn't, because according to findings from McNamara et al. (2010) and Rowlands & Eston (2007) valid measures can also be obtained from unsealed pedometers.

Conclusions

For the focused regions this study represents the first of its kind to examine children's everday activities in a broad perspective. This analysis provides useful baseline information, but to improve the informative value of data and to estimate development trends a regional monitoring (e.g. in a cycle of 2–3 years) would be desirable.

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